Study providing analytical support for the financial instruments and programmes to facilitate investment in the energy sector: the Recovery and Resilience Facility

Final Report No. ENER/A4/2021-350/SI2.863857

Written by Ecorys, Ramboll and VIS Economic & Energy Consultants
December – 2022

EUROPEAN COMMISSION

Directorate-General for Energy
Directorate Energy Policy — Strategy and Coordination
Unit A.4 — Economic Analysis, Foresight and Recovery

Contact: Julian DIELER

E-mail: Julian.DIELER@*ec.europa.eu*

European Commission
B-1049 Brussels

Study providing analytical support for the financial instruments and programmes to facilitate investment in the energy sector: the Recovery and Resilience Facility

Final Report No. ENER/A4/2021-350/SI2.863857

Directorate-General for Energy

2022

Directorate-General for Energy

2022

Manuscript completed in December 2022

LEGAL NOTICE

PDF ISBN: 978-92-68-00226-1 doi: 10.2833/069988 Catalogue number: MJ-04-23-152-EN-N

Luxembourg: Publications Office of the European Union, 2023

TABLE OF CONTENTS

Table of Figures and Tables

Table of Abbreviations

ADEME	French Environment and Energy Management Agency
BAU	Business-As-Usual
CCfD	Carbon Capture for Difference
CEF	Connecting European Facility
CGE	Computable General Equilibrium
CO2	Carbon dioxide
CoR	European Committee of the Regions
DG ENER	Directorate-General for Energy
DG REFORM	Directorate-General for Structural Reform Support
DNSH	Do No Significant Harm
EBRD	European Bank for Reconstruction and Development
EIB	European Investment Bank
EIF	European Investment Fund
ERDF	European Regional Development Fund
ESIF	European Structural and Investment Fund
EU	European Union
EV	Electric Vehicle
FMFIB	Fund Manager of Financial Instruments in Bulgaria
GHG	Greenhouse Gas
MFF	Multiannual Financial Framework
NECP	National Energy and Climate Plan
NGEU	Next Generation EU
NRRP	National Recovery and Resilience Plan
RES	Renewable Energy Sources
RRF	Recovery and Resilience Facility
RRP	Recovery and Resilience Plan
SME	Small and Medium-Sized Enterprise
SG RECOVER	The Recovery and Resilience Task Force - Secretariat General
SO	Specific Objective
TEN-E	Trans-European Networks for Energy
TEN-T	Trans-European Transport Network

Executive summary

This is the final report of the "Study providing analytical support for the financial instruments and programmes to facilitate investment in the energy sector: the Recovery and Resilience Facility (RRF)". The study aims to assess the expected impact of the RRF, through the energy-related measures included in Member States' Recovery and Resilience Plans (RRPs), on supporting the clean energy transition and on the development of suitable financing solutions for projects in the energy sector. By doing so, this study gathers and provides evidence to help the European Commission identify and mitigate the challenges that hinder the effective implementation of the energy-related measures in the RRPs to maximise their positive impacts on EU Member States, foster the decarbonisation of countries' economies, and achieve the European Green Deal's objectives.

To achieve these objectives, the study relied on a step-by-step approach. First, we performed an extensive review of the most relevant literature exploring the impacts of the RRF, including qualitative and quantitative analyses, on the 2030 renewable energy targets, energy efficiency targets and greenhouse gas (GHG) emissions as well as on the development and use of financial instruments for energy projects. Then, a detailed analysis of the National Recovery and Resilience Plans (NRRPs) and the National Energy and Climate Plans (NECPs) of the 27 EU Member States was carried out to assess and compare the possible additional impact on energy and climate targets of the energy-related measures included in the NRRPs. The planned investments and reforms as reported in the NECPs served as a business-as-usual (BAU) scenario. However, it should be noted that such a BAU scenario does not factor in the fact that, due to the crisis, the investments and reforms included in the "business-as-usual" scenario may not have taken place given fiscal constraints. The comparison of this BAU scenario with the measures planned under NRRPs was done by category of energy projects, covering the whole energy sector from energy efficiency in buildings and industry to renewable energy production, energy infrastructure, hydrogen, and sustainable transport.

In parallel, we analysed the impact of the RRF on the use and development of financial instruments for projects in the energy sector, examining the instruments developed by Member States, assessing the synergies between the RRF funding and other sources of funding, and identifying good practices favouring complementarity with alternative financing solutions. The findings from the desk research were complemented by insights gained from interviews with Member States' representatives, which proved to be essential in filling in gaps and complementing the information collected from available sources. Finally, we developed policy recommendations aimed at addressing existing obstacles regarding the design and coverage of energy measures in the RRF and their contribution to the achievement of MS energy targets. The policy recommendations and findings of the study were discussed and elaborated in a workshop with experts and practitioners from academia, think tanks, and European and other international institutions with expertise on EU funding instruments, including the RRF .

The detailed review of the literature and the analysis of the NRRPs and NECPs revealed that **most of the proposed energy-related investments and reforms primarily help achieve existing energy and climate targets, which is in line with the overall ambition of the RRF,** in the context of the post-pandemic economic crisis. The majority of Member States indeed did not increase their ambitions in their national energy transition strategies to meet the EU climate targets, rather they invested in projects that were already planned to achieve existing targets as set in their NECPs. This was also confirmed by Member States' representatives, as some Member States used the RRF funding to expand the volume or the timeline of existing support schemes to minimise the associated administrative burden and achieve effective climate action in the short timeline available. Conversely, while in other cases **new measures were identified in the NRRPs, the estimated impacts of these interventions were assessed to be limited**. Specifically, in 16 of the 27 NRRPs, the proposed measures were

found to have a high likelihood of leading to somewhat higher climate targets in at least one of the energy categories.

The analysis of the categories of energy projects covered by the investments and reforms presented in the NRRPs revealed that **more than half of the investments and almost half of the reforms included in the NRRPs of EU Member States target Sustainable transport and Energy efficiency in buildings**. This is well depicted in the distribution of funds across energy-related categories, with 34.4% and 30.2% of the RRF funds being allocated to the former and the latter, respectively. Conversely, Hydrogen and Energy infrastructure received significantly less RRF funding across most EU Member States.

The review of the financial instruments for energy-related projects proposed in the NRRPs highlighted that **eight out of 27 Member States planned to use or develop at least one financial instrument related to energy projects**, with some instruments being based on previously existing ones. For 15 Member States, no energy-related financial instruments were identified, however, several NRRPs mentioned financial instruments but did not specify them further (i.e., proposed a preparatory study to define them, proposed them in a mix of measures without clarifying the specific amounts allocated to the financial instrument or the link to energy projects was unclear) or mentioned them as part of a reform. Lack of time, lack of private capital markets and worries about duplicating existing financial instruments were cited by Member State authorities as reasons for not including more. Financial instruments were not mandatory, however the Commission suggested their use but also recommended to the Member States to rely on existing structures as the timeline of the RRF would make it difficult to develop new structures. Likely also, for this reason, only limited guidance on financial instruments was provided initially, and only the revised guidance following REPowerEU provided more information on their benefits and use.

The limited interest in financial instruments can also be explained by the fact that the RRF grants offer 100% financing and do not require any national co-financing. This does not apply to the RRF loan compartment, which however was only used by a few Member States that were also more likely to include financial instruments in their NRRPs. Member States can still apply for RRF loans until 31 August 2023 providing some room to develop further financial instruments. Nevertheless, there **could have been scope to further develop financial instruments for energy projects**. However, the unprecedented crisis and short timeline did not allow for much room to do so. Therefore, considerations should be made to develop off-the-shelf guidance and good practices for financial instruments such as those already provided by the fi-compass platform and that can be easily adapted and used by Member States. In addition, recognising the existing obstacles of financial instruments, for example, the administrative complexity and coordinating issues, some Member States have already put in place mechanisms to overcome these barriers that could represent replicable good practices in other Member States (e.g., setting up of a central investment platform, and the use of technical assistance as well as European financial institutions to support the design and implementation of financial instruments).

Similarly to what we identified when assessing the measures and funding across categories of energy-related projects, **the majority of financial instruments were used for energy efficiency interventions in industry and buildings** (in particular the former), while other types of projects did not receive much attention. Reasons for this may include the low maturity of technologies, which applies to hydrogen and potentially some renewable energy technologies, but also the large-scale and often public nature in the case of energy infrastructure and sustainable transport projects, which have a relatively high need for concessionality to address external costs. In the case of renewable energy technologies, there is also a higher availability of grants and state aid, which is generally preferred by project promoters and would compete with any new financial instruments. In terms of the type of financial instruments proposed, the **most common types were loans**, followed by guarantees

and equity; but on several occasions, the measures in the NRRPs combined two or more types of financial instruments.

Finally, the **analysis of the effects of RRF financial instruments in the energy sector pointed out that the Member States expect significant multiplier effects** stemming from the proposed financial instruments, although with some differences and, most importantly, acknowledging that it is not possible to provide accurate values at this stage as most instruments are not yet in place. Additionally, due to limited information, it was not possible to draw any conclusions regarding the degree of complementarity between some financial instruments included in the NRRPs and other funding sources as well as regarding the creation of additional funding volume or replacement of national investments. While a few stakeholders shared concerns that the publicly-backed financial instruments had a negative impact on the development of private instruments, Member States shared their expectations that the financial instruments could address existing investment gaps in their economies caused by economic uncertainties and thereby unlock private investments.

1. Introduction

1.1. Overview of this study

This is the final report of the project "Study providing analytical support for the financial instruments and programmes to facilitate investment in the energy sector: the Recovery and Resilience Facility". The project, running from April 2022 to December 2022, was commissioned by the European Commission (DG ENER) and performed by a consortium consisting of Ecorys, Ramboll, and VIS Consultants.

In the context of the unprecedented COVID-19 pandemic that started in 2020, the European Union (EU) established the NextGenerationEU (NGEU) recovery package to shape the future of Europe recovering from the economic and public health crisis as well as fostering the ongoing efforts to mitigate and adapt to climate change.

As part of these efforts, the RRF is the key instrument to help the EU and its Member States emerge more robust and resilient from the crisis, face the challenges, and reap the opportunities brought by the green and digital transitions. The RRF made EUR 723.8 billion in loans and grants available to the Member States[1], but to access the funding each Member State was asked to develop a National Recovery and Resilience Plan outlining the intended reforms and public investment projects, as per the requirements set in the RRF Regulation[2] and guidelines published by the EU Commission.

The RRF has now become one of the key instruments to support the decarbonisation efforts of the EU Member States, with a substantial amount of funding allocated towards investments and reforms in the energy sector, for example, to improve energy efficiency in buildings, industry, and to promote the uptake of renewable energy and hydrogen.

Given the unprecedented financial support provided by the RRF on energy-related measures, this recovery instrument will also likely impact the use and development of sustainable financing solutions aimed at supporting projects in the energy sector, with potential synergies arising between the RRF funding and other sources of funding.

With the aim of better understanding the potential impacts of the RRF in the energy sector, this study assessed the energy-related measures included in the Member States' NRRPs, on supporting the clean energy transition, and on the development of suitable financing solutions for projects in the energy sector. Specifically, the study had the following two objectives:

- Assess the expected impact of the energy-related measures included in the NRRPs on supporting the implementation of the NECPs;
- Assess the potential impact of financing solutions for projects in the energy sector. included in the NRRPs.

Based on the findings in these two areas, policy recommendations for the consideration of the European Commission were developed to highlight how to better support the green transition and the European Green Deal objectives as well as the energy targets enshrined in the NECPs through the NRRPs.

[1] EUR 385.8 billion in loans and EUR 338 billion in grants

[2] Regulation (EU) 2021/241 of the European Parliament and of the Council of 12 February 2021 establishing the Recovery and Resilience Facility

1.2. Overview of this report

This report is organised into the following chapters:

- **Executive summary**
- **Chapter 1**. *Introduction*
- **Chapter 2**. *Methodological approach*. Summary of the applied methodology.
- **Chapter 3**. *Impact of the RRF on reaching energy and climate targets*. Analysis based on the review of the NRRPs and NECPs and complementary interviews with experts.
- **Chapter 4**. *Impact of the RRF on the use of financial instruments for energy projects*. Analysis based on the review of NRRPs, interviews with experts and the review of the literature.
- **Chapter 5**. *Discussion and policy recommendations*. Presents the policy recommendations suggested to support investments in the energy sector in the framework of the RRF.
- **Annex A**. *List of financial instruments*.
- **Annex B**. *Country fiches of the NRRPs of the 27 Member States* (a separate document).
- **Annex C**. *Detailed assessment of the energy measures in the RRPs and the NECPs* (a separate document).
- **Annex D**. *Detailed assessment of the identified financial instruments* (a separate document).

2. Methodological approach

This chapter presents a summary of the methodology adopted for the analysis in line with the objectives mentioned above.

The first step of the work was to identify and classify the energy-related measures presented in the NRRPs and NECPs, to facilitate the analysis in the subsequent steps and present the findings in a coherent and well-organised manner.

The study covered the following six categories of energy projects as presented in Table 1. The focus on measures with an explicit impact on the energy transition differs from the definitions used for specifying intervention areas for climate and environmental tracking in Annex VI of the RRF Regulation. Notably, interventions related to the circular economy, land use, or adaptation to climate change were only included if an impact on one of the energy categories was intended or obvious, for example involving waste to energy in a circular economy initiative.

Table 1. Definition of energy categories

Energy category	Description
Energy efficiency in buildings (renovation)	Projects related to more efficient use of energy in buildings. For example, energy renovation and the installation of heat pumps.
Energy efficiency in industry and other	Projects related to more efficient use of energy in industry or other fields. For example, research and development of new processes and technologies, or enabling a change to renewable energy sources.
Renewable energy production	Projects linked to the deployment of renewable energy sources. For example, new solar and wind generation capacity.
Hydrogen	Activities associated with the use of renewable hydrogen as an alternative source of energy (except in the transport/mobility sector). For example, new hydrogen production capacity, transport terminals, or the development of hydrogen-based technologies in the industry.
Energy infrastructure	Projects aimed at expanding/improving the network of energy infrastructure except infrastructure targeted at supporting electric/hydrogen vehicles. For example, energy storage capacity, smart grid development, electricity grid reinforcements, etc.
Sustainable transport	Projects linked to the low-carbon transition of the transport sector. This category covers all modes of transport and all types of measures aimed at decarbonising the transport sector, including the promotion of low- or zero-carbon technological solutions, the promotion of a modal shift and infrastructure development, and the reduction in the demand for transportation. For example improvement of the rail network, public transport, or Electric Vehicle (EV) charging stations,

The NRRPs are strategic documents structured in a coherent way to present the priorities of the governments of the different Member States to help their economies recover from the crisis caused by the COVID-19 pandemic. In most cases, these documents report the following information in this order: (i) a description of the main characteristics of the plan and its key objectives, (ii) a description of the reforms and investments by mission/pillar and components

of the plan, (iii) complementarity with other initiatives and implementation of the plan, and finally (iv) presentation of the expected macroeconomic and social impacts of the plan.

While the NRRPs follow a similar structure, the review of the measures included in each Member State revealed a high degree of heterogeneity in terms of the measures and policies proposed within each key mission/pillar and component, including the climate and energy-related ones. In many cases, the analysis also identified measures belonging to one or more energy categories or with other objectives[3], but containing an energy-related dimension (e.g., centred around digitalisation or focusing on the promotion of the circular economy in industrial sectors and agriculture). In these cases, an additional effort was put into deciding whether or not to include such measures in our assessment, and the analysis targeted the investments and reforms which intend to produce an effect in terms of decarbonisation of the energy system or reduction of energy consumption.

Despite the vast assortment of measures and policies, no additional categories of energy projects were identified from the review of the NRRPs and NECPs, and all collected measures were classified into the original six categories. Yet, the scope of the original category Electric mobility was broadened to include all measures related to Sustainable transport. The analysis, therefore, included measures aimed at promoting the electrification of not only road transport but also railways and air and marine transport, as well as measures supporting the modal shift to low-carbon means of transport and promoting more climate-friendly mobility alternatives. In fact, in their NRRPs, numerous Member States included a package of measures including reforms with long-term effects and investments aimed at reducing emissions in the transport sector not only via electrification, but also through the implementation of policies to reduce transport demand and (or) to shift demand towards less carbon-intensive transport options[4].

The categories were then used as a basis for the analysis in the literature review, in assessing the energy-related measures in the NRRPs, and finally in assessing the financial instruments reported in the national plans.

2.1. Literature review

Starting from the definition of the energy categories and running throughout the project, a literature review was performed to collect and assess any existing qualitative and quantitative analyses on the impact of the RRF on the 2030 renewable energy targets, energy efficiency targets and GHG emissions, as well as on the impact of the RRF on the development and use of financial instruments for energy projects. The focus was mainly on policy reports, academic papers, articles, white papers and other media. Given that the RRF is a relatively new funding facility designed in 2020 and coming into effect in 2021, the review was limited to literature published since 1 January 2020. The list of reviewed sources was updated with the progress of the study as more literature was published on this subject matter.

A list of key words was defined in two categories to collect and shortlist relevant sources:

- *Overarching key words*: These key words were included in every search and used in every combination with fine-tuning key words. Acronyms were also used where relevant.

[3] In their NRRPs, Member States describe the reforms and investments that they plan to implement with the support of the RRF to address all the country-specific recommendations (CSRs) and advance the green and digital transitions.

[4] Member States such as Portugal or Denmark introduced a more generic 'Sustainable mobility' component in their NRRPs to decarbonise transport via implementation of policies targeting the three pillars of sustainable mobility: Avoid, Shift, and Improve, as well as to include the adoption of alternatives to the electrification such as biofuels.

- *Fine-tuning keywords:* These keywords were applied in conjunction with the overarching keywords, sometimes with each other, but not without the overarching keywords.

The complete list of the used keywords is provided in Table 2.

Table 2. List of keywords used in the literature search

Overarching keywords	
• Recovery and Resilience Fund (RRF) • Recovery and Resilience Plan (RRP)	• Energy (projects) • Names of Member States
Fine-tuning keywords	
• Financial instruments • Financial mechanisms • Project funding • Energy projects • Blended instruments • Grants • Loans • Financing • Next Generation EU (NGEU) • Economics • Public-private partnership • Additionality • Complementarity	• Multiplier • Effectiveness • Best practices • Value added • Coherence • Energy efficiency • Renewable energy sources (RES) • GHG emissions • E-mobility • Climate tagging • NECP • Hydrogen • Climate targets.

The resulting body of reviewed literature consisted of 57 documents. These were catalogued in a Member State Excel database that captured the key information from each document (Title, Author, Year, Organisation, Subject) and reviewed to collect their relevant inputs in relation to the objectives of this study.

2.2. Analysis of the impacts of NRRPs on reaching energy and climate targets

Following the initial literature review, the focus of the research switched to the analysis of the NRRPs of the 27 EU Member States concerning the expected impact on energy-related measures. To assess the impact, the relevant measures (investments and reforms) of the NRRPs were reviewed and compared to the measures and instruments foreseen in the most recent NECPs published prior to the RRF. The objective was to provide a detailed understanding of the impacts and benefits stemming from the implementation of the NRRPs in comparison to the previously planned measures as entailed in the NECPs (i.e., the business-as-usual scenario). Hence, the objective was to understand if the measures in the NRRPs were aligned with the targets in the NECPs, if they possibly went beyond the targets in some areas, or if the focus of the NRRPs was different from the needs defined in the NECPs.

The analysis consisted of the following activities:

- desk research and **analysis of the NRRPs** to identify the policy measures in the considered categories of energy projects (Energy efficiency in buildings and

renovation, Energy efficiency in industry and other, Renewable energy production, Hydrogen, Energy infrastructure, Sustainable transport);

- desk research and **analysis of the NECPs** and contextual documents to compare the impact of NRRPs with the business-as-usual scenario of investments and reforms previously included in the NECPs and other national strategies and plans adopted or planned before the publication of the RRF;
- **expert interviews** to fill research gaps and add further insights on the expected impacts of the RRF in reaching climate and energy targets, as well as on the use of financial instruments; and
- **cross-analysis and reporting** of the gathered information and data to produce a summary (i.e., country fiche) per Member State and in an aggregate manner at EU-level.

The qualitative analysis of the NRRP and NECP of each Member State has been organised to provide a thematic assessment for each category of energy project. This is presented in Section 3 where the findings from the assessments of the NRRPs and their comparison with the NECPs are presented, as well as in the country fiches in Annex B which provide a deep dive into the plans of each Member State.

It should be noted that the NRRPs differ in terms of structure and content since they are tailored to the specific needs of Member States. While the overarching assessment framework was developed to provide a rigorous analysis that can inform how the RRF performs at the aggregate EU level, in practice, the important differences between NRRPs impact the analyses at the level of individual Member States. The results are also presented in detail in the country fiches in Annex B.

2.3. Analysis of the expected impacts of the RRF on the use and development of financial instruments

The goal of the second area of attention was to conduct a qualitative and, where sufficient data availability allowed, quantitative analysis of the impact of the RRF on the use of financial instruments in the energy sector. More specifically, the analysis aimed to (a) address the impact of the RRF on the development of financial instruments in the energy market, and (b) investigate the synergies between the RRF and existing financing solutions for energy projects.

This analysis consisted of two activities:

- A **data collection** based primarily on an in-depth analysis of the energy-related financial instruments described in NRRPs as well as interviews with relevant experts; and
- an **additional literature review** focused specifically on how similar issues have been dealt with in previous funding exercises;

Together, these activities address the following four specific objectives (SO):

- SO1: Assessing the impact of the RRF on the use and type of financial instruments for supporting energy projects;
- SO2: Assessing the impact of the RRF on the uptake of private financing solutions for energy measures;

- SO3: Assessing the impact of the RRF on the multiplier effect of public funding for energy measures;
- SO4: Assessing the potential for complementarity or substitution between RRF funding and other sources of funding for energy measures.

The activities for this analysis were conducted jointly and in parallel with the analysis of energy measures described in Section 2.2 following an assessment template. Findings on the financial instruments for energy projects identified in individual Member States are also summarised in the country fiches (see Annex B).

Lack of concrete information was a challenge as so far only one energy-related financial instrument has met its first milestones and others are yet to be implemented. Descriptions of the foreseen financial instruments also vary greatly in detail across different Member States. We, therefore, had to complement the review with qualitative information from interviews with Member State representatives and the workshop with experts. In addition, due to the funds being disbursed on an ongoing basis, the assessment base was updated regularly during the project. Regular consultation of new disbursements, as well as interviews at different points in time, were critical in ensuring relevant new insights were accounted for. Identifying potential instances for complementing or substituting other funding was a key consideration for this task; however. this was difficult to assess due to a lack of evidence.

Finally, due to the unprecedented nature of the RRF and that financial instruments were not a mandatory requirement for Member States, only a few studies focus explicitly on the role of financial instruments in the RRF. Therefore, apart from the review of the NRRPs, interviews with Member State authorities and the workshop with experts, insights were drawn also from more general literature on the use of financial instruments in the energy sector, corresponding to alternative funding programmes.

2.4. Development of policy recommendations

The last part of the study was dedicated to developing and assessing policy recommendations based on the analysis performed under the previous activities. The developed recommendations aim to provide the European Commission with suggestions on how to address the possible obstacles hindering the implementation of NRRPs, what complementary measures would be needed to have a long-lasting impact on supporting the green transition and the European Green Deal, and how to asses such impacts. Furthermore, possible avenues to further develop and broaden the analysis were identified to expand the longer-term added value to the study.

This part of the analysis consisted of the following activities:

- **Collection of relevant inputs** from all previous activities, including relevant literature review, analyses performed on NRRPs and use of financial instruments;
- **Assessment of conducted interviews**, which included forward-looking questions and provided insights into the drafting, implementing, and monitoring of NRRPs;
- **Shortlisting of most relevant preliminary recommendation**s obtained from previous activities. This included an internal workshop with the complete research team, and further desk research to substantiate and finetune selected recommendations.
- Finally, a **validation session** was conducted with academics and policy experts to discuss the findings of the study in general and the proposed policy recommendations specifically. The inputs received were integrated with the finalisation of the proposed policy recommendations.

As mentioned above, the key consideration in developing the policy recommendations was to build on the findings of the previous activities based on the analysis of the NRRPs, NECPs, and interviews with experts from the different Member States. The heterogeneity of the NRRPs, however, increased the difficulties to generalise the policy recommendations that could initially be inspired by trends affecting only a few Member States.

Additionally, the current lack of literature, especially on quantitative studies on the impact of the RRF on energy and climate targets, was continuously monitored. While only a limited number of quantitative studies analysing the impact of the energy-related measures included in the NRRPs were identified, possible avenues for future research were established to fill the gap in available studies (see Section 5.2). This included both quantitative and qualitative avenues of future research, for example, using modelling techniques such as Computable General Equilibrium (CGE) models to assess the investments in energy projects included in the RRF and analyse their impact on reaching energy and climate targets by comparing them against a “current policy” scenario that excludes the RRF.

3. Impact of the RRF on reaching energy and climate targets: Analysis of the NRRPs and NECPs

In this chapter, we **present the findings of the analysis of the impacts of the RRF on reaching energy and climate targets**. These findings are based on the review of the **National Recovery and Resilience Plans** and **National Energy and Climate Plans** provided by the Member States and complemented by interviews with experts and a literature review. The analysis and comparison of the NRRP and NECP of each EU Member State have been organised to provide a thematic assessment for each category of energy project. This is well represented in the following sections and the country fiches providing a deep dive into each Member State. As introduced in the previous section, energy-related measures have been classified into six categories of energy projects which cover the full range of project initiatives in the energy sector.

Our review of the energy and climate investments and reforms proposed in the NRRPs is based on an analysis of the NRRPs of all 27 EU Member States in their latest, publicly available version, as well as additional publications and data sources. At the time of writing (November 2022), all NRRPs except the one for Hungary, have been endorsed by the EU Commission and approved by the Council of the European Union.

As stated in Chapter 2, **the focus of this study is on energy-related measures in the NRRPs**. The following analysis includes reforms and investments with an *explicit* impact on the energy transition, applying a narrower measure mapping compared to the climate tracking methodology defined in Annex VI of the RRF Regulation, since this study focused on measures with an *explicit* impact on the energy transition

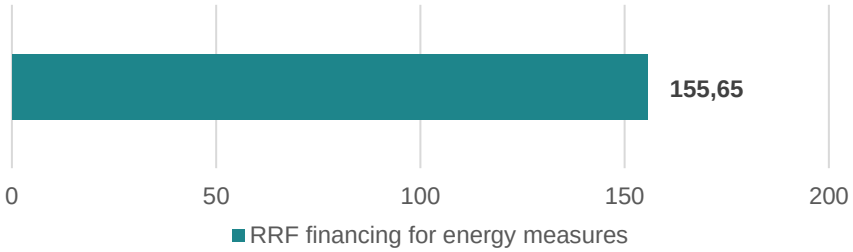
3.1. Overview of energy-related investments and reforms in the Member States NRRPs

In total, **512 individual measures in these categories are included across the 27 NRRPs**: 376 (73.4%) of these measures are investments, 133 (26.0%) are reforms and three (0.6%) are combined reforms and investments.

As shown in Figure 1, the **total RRF financing dedicated to energy measures amounts to EUR 155.65 billion**.[5] In addition to this, Member States plan to supplement the RRF financing with additional means from national budgets or through financial instruments. Thus, the total financing volume mobilised by the RRF for energy measures is higher than the figure presented. However, reliably quantifying this number is not possible as the specificity of NRRPs on the issue varies across Member States.

[5] It should be noted that this amount includes only measures with an explicit impact on the energy transition, a narrower sub-set of measures compared to the climate tracking methodology. Therefore, there may be differences between the amounts listed in this report and other analyses of the RRF.

Figure 1. Financing volume of NRRP energy measures (in billion EUR)



The analysis reveals that **all NRRPs include at least one reform or investment in the fields of energy efficiency in buildings and sustainable transport.** This stems notably from the constraints introduced in the RRF Regulation of a minimum share (37%) of climate-related investments, as a prerequisite for the positive assessment of NRRPs by the European Commission. However, few Member States have included measures targeting energy efficiency in industry and other sectors and renewable energy production, which are listed in 22 NRRPs. On the contrary, investments and reforms targeting hydrogen and energy infrastructure are reported in 16 and 18 NRRPs, respectively. These findings are illustrated in Table 3, which provides an overview of the Member States' NRRPs and, specifically, indicates which categories of energy-related investments and reforms can be identified in each plan.

Out of the reviewed 27 Member States, Czechia, Luxembourg and Sweden did not include in their NRRPs any measures in three out of the six energy-related categories. While some NRRPs do not report initiatives in all energy categories, it might be that all categories, including hydrogen and energy infrastructure, are mentioned in the plan without, however, any specifically related investment or reform. This comparison also has to consider the different financing volumes made available to different Member States, as countries with smaller plans received smaller shares of the overall RRF volume.

Table 3. Categories of energy-related investments and reforms identified in the NRRPs

MS	Energy efficiency in buildings (renovation)	Energy efficiency in industry and other	Renewable energy production	Hydrogen	Energy infrastructure	Sustainable transport
AT	X	X	X	X		X
BE	X	X		X	X	X
BG	X	X	X	X	X	X
HR	X	X	X	X	X	X
CY	X	X	X		X	X
CZ	X		X			X
DK	X	X		X	X	X
EE	X	X	X	X	X	X
FI	X	X	X	X	X	X
FR	X	X		X	X	X
DE	X	X		X		X
EL	X	X	X		X	X
HU	X		X		X	X

MS	Energy efficiency in buildings (renovation)	Energy efficiency in industry and other	Renewable energy production	Hydrogen	Energy infrastructure	Sustainable transport
IE	X	X	X			X
IT	X	X	X	X	X	X
LV	X	X	X		X	X
LT	X		X	X	X	X
LU	X					X
MT	X	X	X			X
NL	X	X	X	X		X
PL	X	X	X	X	X	X
PT	X	X	X	X		X
RO	X	X	X	X	X	X
SK	X	X	X	X	X	X
SI	X	X	X		X	X
ES	X		X	X	X	X
SE	X	X				X
SUM	**26**	**22**	**21**	**18**	**18**	**27**

Assessing these findings in more detail, Table 4 below provides an overview of the number and distribution of the 512 energy-related investments and reforms across the energy categories. The numbers in Table 4 are slightly higher than the 512 individual measures reported previously because some measures fall into more than one energy category. For instance, substantial overlaps are found between renewable energy production and energy infrastructure as well as between energy efficiency in industry and hydrogen. In these cases, they are strongly related or even depend on each other, which results in a combination of categories.

The distribution of measures varies widely within the different energy categories, with investments being much more common than reforms. Whilst it is hard to infer strong conclusions from a comparison of the number of investments compared to reforms, the prevalence of investment measures may be explained by the easier decision-making process that investments entail compared to reforms. In addition, since the RRF is a funding instrument, Member States are also incentivised to include more investment measures to make use of their funds. Member States authorities highlighted the short timeline for developing the plans and risks of reduced RRF financing if NRRP reforms are not implemented as a potential explanation, which did not allow for extensive national political negotiations and prioritisation of less complex measures. However, the financial support provided by the RRF played an important role in balancing budget implications of these reforms and therefore gave Member States the means to continue implementing these measures, which are required for achieving previously defined targets.

When looking at the countries listing the highest number of measures per energy category, France, Italy and Spain stand out in many categories, which is in line with their significant shares of total RRF funding. Other countries that proposed numerous investments and reforms in comparison to other Member States include Bulgaria, Czechia, and Belgium.

As shown in Table 4, hard-to-abate sectors (transport, buildings, and industry) account for the majority of measures. The majority of investments and reforms are directed towards

sustainable transport (33% and 28% of the total investments and reforms, respectively), followed by energy efficiency in buildings (renovation) and renewable energy production. When looking at the absolute numbers, it becomes obvious how **significantly more investment measures and, to a certain extent reforms, targeting transport and buildings** have been included in the NRRPs of EU Member States **compared to those targeting hydrogen and energy infrastructure**.

As a result, planned measures will increase demand for clean electricity (e.g., programmes that encourage the purchase of heat pumps and electric vehicles), but there are fewer measures aimed at increasing the production of green electricity (e.g., projects in clean electricity generation). The measures on energy efficiency in buildings and industry will help to limit the overall energy demand. This focus on demand-side action addresses the challenges in market financing for decentralised investments by households and public institutions. Supply and infrastructure projects are needed to match demand, but these can be more easily financed by the private sector. This also explains why the RRF funds fewer of this type of projects.

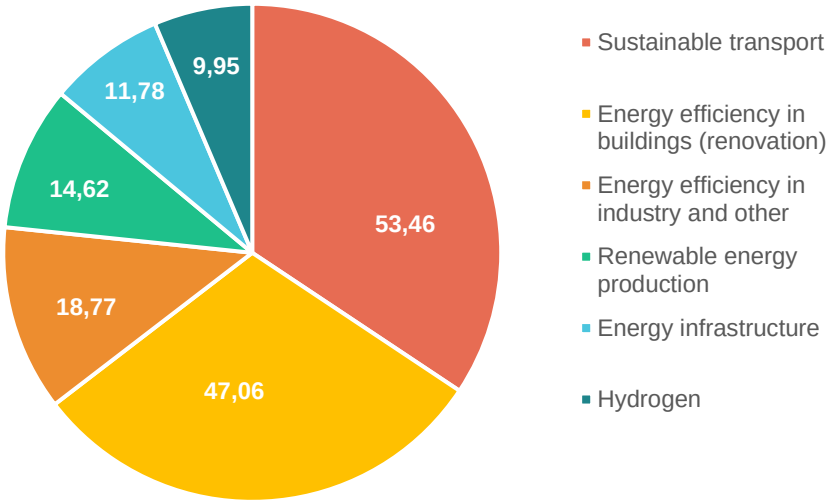
Table 4. Overview of energy-related investments and reforms in the NRRPs

Energy category	Investments		Reforms		MS with the most investments and reforms per category
	No.	**%**	**No.**	**%**	
Energy efficiency in buildings (renovation)	107	26%	29	19%	BE, CZ, FR, IT, ES
Energy efficiency in industry and other	59	14%	24	16%	DK, FR, IT, SI
Renewable energy production	48	12%	35	23%	BG, IT, LT, ES
Hydrogen	24	6%	9	6%	BE, IT, RO
Energy infrastructure	37	9%	11	7%	BG, IT, ES
Sustainable transport	133	33%	43	28%	BE, HR, CZ, FR, ES
SUM	**408**	**100%**	**151**	**100%**	

Based on the in-depth review of the NRRPs energy measures, the share of energy-related investments across the energy categories is illustrated in Figure 2 below. The distribution across the categories corresponds to that of the number of investments and reforms as presented in Table 4. **Most of the funds have been directed towards sustainable transport (34.4%), followed by energy efficiency in buildings (30.2%).** The rest of the categories constitute the remaining 35.5 % of the total investment. Within this, energy efficiency in industry and renewable energy production accumulate the largest amounts of investment.

Almost all Member States have a distribution of financing across categories that is similar to the overall one. The five biggest GHG emitters in the EU (Germany, France, Spain, Italy and Poland), have used even more of their high-impact climate investments in these sectors but also placed substantial attention on hydrogen.

Figure 2. RRF energy-related investment by category (in billion EUR)



3.2. Expected impact of the energy-related investments and reforms in the NRRPs

This section summarises the qualitative comparison of the NRRPs and NECPs of the EU Member States and presents the results of the assessment of the additional impacts of the measures in the NRRPs compared to a business-as-usual scenario of previously planned investments and reforms. Specifically, we summarise the results across Member States at the aggregate level for the considered energy categories; a more detailed assessment for each country's NRRP is available in the separate Annex B containing all the country fiches.

The NRRPs and NECPs are significantly different documents in terms of purpose, structure and content, with very different levels of detail regarding the planned investments, reforms, and targets within the energy and climate spheres. The NECPs represent mid- to long-terms strategies containing measures that are not necessarily funded. Therefore to address financing gaps and as laid out in the RRF regulation to "*enable a swift delivery of the targets, objectives and contributions set out in NECPs*", the NRRPs should be "*consistent*" with NECPs to be eligible (art. 17). This bridging of the financing gaps in NECPs was especially needed during the crisis and while recommended, there was no ambition to go with the NRRPs beyond NECPs targets.

Additionally, the objectives and priorities of the RRF relate to economic recovery rather than specific decarbonisation or energy targets. Therefore, in the development of the NRRPs, a standardised methodology for the assessment of the impacts on energy consumption, RES share, or GHG emissions was not provided or required. This limits the depth of their comparison with NECPs quantitative objectives and the analysis that can be performed to assess their impacts. The overall quantified assessment of the energy and climate impacts of measures can only be found in the countries' NECPs. As stated, NECPs are non-binding, high-level strategy documents that do not consistently present details about the implementation and funding of initiatives, which makes the identification of overlap difficult and potentially ambiguous. When information on the planned measures and their expected impacts was missing or was not complete, we relied on the available information on the overall targets by energy category.

Relying on this information, we were able to do a comparison between the expected impacts of the measures included in the NRRPs with the targets and measures presented in the NECPs. For each energy category, we assessed to which extent the RRPs contributed to the implementation of the NECPs and the likelihood of reaching even higher energy and climate targets considering the impacts of the investments and reforms included in the NRRPs. To complement this comparison, we also made use of the information reported in additional national strategies and plans, for example, the national hydrogen strategies and climate action plans.

The results of the comparison have been characterised under five different categories, and a traffic light system has been introduced to simplify the interpretation and allow better understanding. The five categories represent the assessed likelihood for the NRRPs' energy measures of reaching higher energy and climate targets compared to the NECPs. The five categories are the following:

- high (highlighted in **green**);
- medium (highlighted in **orange**);
- low (highlighted in **red**); and
- not assessable, where the level of detail in the NRRP or NECP was insufficient to make a comparison; and
- no measures, where an NRRP did not include any measures in that category.

The detailed comparison between the energy measures in the NRRPs and the NECPs of all EU Member States has been categorised and summarised using matrixes in MS Excel. These documents are reported in Annex C.

Results of the comparison between NRRPs and NECPs

Table 5 summarises the results of the qualitative comparison of the energy-related investments and reforms included in the NRRPs and NECPs by Member State and energy category.

The first element that emerged from the analysis was the **encountered difficulty in achieving a clear and definite conclusion on the effective likelihood** of NRRPs measures on reaching higher energy and climate targets compared to the measures in the NECPs. This was due to, in some cases, missing qualitative or quantitative information on the expected impacts of such measures in terms of, for example, GHG emission reductions, reduction in energy consumption, or additional installation of renewable energy capacity. Another issue that in certain instances limited the assessment was the difficulty in verifying whether certain measures were included in both the NRRPs and the NECPs; this difficulty was produced by the differences between the two documents discussed above. Nevertheless, these issues were partially mitigated following further rounds of assessments of the plans, a review of additional literature, and insights from the interviews with experts.

Given the limitations in comparability and the early stage of implementation of the NRRPs, a consistent assessment for all Member States against a scenario without the RRF is impossible, and the likelihood assessed at the moment of writing may develop over time with the progress in implementation. When the information was sufficient to perform the comparison, the analysis highlighted that **across all Member States and categories, the investments and reforms listed in the NRRPs will make a contribution to reaching the targets in the NECPs**. The limited impact is mostly linked to the fact that some of the investments and reforms presented in the NRRPs were already among the measures listed in the NECPs. However, the RRF Regulation outlined this option as RRF financing can ensure the implementation of measures that otherwise may have had to be stopped or postponed in the context of the COVID-19 crisis and its economic and budgetary implications. Therefore, even in those cases where the NRRP

do not include measures exceeding the targets set out in he NECPs, the comparison to a no-RRF scenario would likely still suggest that the NRRP contribute to a higher likelihood of reaching the NECP targets.

Table 5. Overview of the assessed likelihood of reaching higher energy targets of NRRPs' measures

MS	Energy efficiency in buildings (renovation)	Energy efficiency in industry and other	Renewable energy production	Hydrogen	Energy infrastructure	Sustainable transport
AT	Low	Low	Low	Not assessable	No measures	Low
BE	High	Low	No measures	High	High	High
BG	Low	Medium	Medium	Low	Low	Not assessable
HR	Medium	Low	Low	High	Medium	High
CY	Low	Low	Medium	Not assessable	Medium	Medium
CZ	Low	No measures	Low	No measures	No measures	Medium
DK	High	High	No measures	Medium	Not assessable	High
EE	Medium	Not assessable	Low	Not assessable	Low	Low
FI	High	High	Low	Not assessable	Not assessable	High
FR	High	High	No measures	Medium	Medium	High
DE	Medium	High	No measures	High	Low	Medium
EL	Low	Not assessable	Not assessable	Low	Low	Low
HU	Medium	No measures	Low	No measures	Medium	Low
IE	Medium	Not assessable	Low	No measures	No measures	Not assessable
IT	High	Low	Medium	Not assessable	Low	Low
LV	Low	Low	Low	No measures	Low	Low
LT	Low	No measures	Low	Not assessable	Not assessable	Low
LU	Not assessable	No measures	No measures	No measures	No measures	Not assessable

MS	Energy efficiency in buildings (renovation)	Energy efficiency in industry and other	Renewable energy production	Hydrogen	Energy infrastructure	Sustainable transport
MT	Not assessable	Low	Low	No measures	No measures	High
NL	Low	Medium	High	High	No measures	High
PL	High	Low	Low	High	Not assessable	Medium
PT	Medium	Medium	Medium	High	No measures	High
RO	Low	Not assessable	High	High	Low	Not assessable
SK	Low	Medium	Low	Medium	High	Medium
SI	Medium	Medium	High	No measures	Medium	High
ES	Not assessable	No measures	Medium	High	Medium	Medium
SE	High	High	No measures	No measures	No measures	Medium

In 16 of the 27 NRRPs, the proposed measures were found to have a high likelihood of leading to higher climate targets in at least one of the energy categories. In many other categories and the remaining 11 Member States, this was not the case. Yet, even in these latter cases the RRF provided an additional financing source to relieve the stress on national budgets. These points were also confirmed by many of the interviewed experts who clearly outlined that some Member States introduced in their NRRPs measures to help achieve previously enacted energy and climate commitments rather than achieving more ambitious targets.

The assessment by energy category reveals that the strongest increase in ambition can be observed in sustainable transport. For nine NRRPs, it is assessed that the additional measures will very likely help Member States in achieving higher decarbonisation targets. In seven cases, the analysis suggests that the probability of achieving higher targets in this category is low. A substantial portion of the investments in the transport sector are in road transport infrastructure, and a significant portion was dedicated to the automotive industry to support the uptake of private low-carbon vehicles such as electric vehicles (EVs). Therefore, some plans have been criticised for missing the opportunity for a comprehensive green transformation of the transport sector, including a modal shift to public transport, which would substantially lower the GHG emissions of the sector[6].

Regarding other energy categories, in eight NRRPs we assessed that the measures will likely help to achieve more ambitious targets in terms of hydrogen deployment, and in seven in energy efficiency in buildings, while few assessments were deemed as highly ambitious for energy efficiency in industry and renewable energy production. Lastly, only the NRRPs of

[6] See for example: https://foes.de/publikationen/2021/2021-04_FOES_DARP.pdf

Belgium and Slovakia have been judged as ambitious enough to deliver higher targets in the energy infrastructure category. In Belgium, this originates from investments in an energy island to connect future offshore wind turbines. In Slovakia, the most impactful measure is the investment in the flexibility of electricity systems to accommodate more RES generation.

Cross-validation with Member State authorities

Following the analysis of the NRRPs and NECPs, a series of interviews allowed us to discuss these findings with the national representatives in charge of the development and administration of their respective NRRP. One objective of these interviews was to validate findings and close remaining gaps in the understanding of the RRP measures. However, they also delivered additional insights into the development process and decisions that led to the formulation of the NRPPs as they are today. This section presents the key takeaways from the discussions.

Overall, the analysis of the contributions gained via interviews with the national representatives revealed two main considerations regarding the design of the RRP investment measures.

One the one hand, **some Member States employed a high degree of selection and planning to ensure optimal additionality** to currently existing measures, plans and funding programmes. This design was described as driven by an aim for targeted impacts in energy areas, regions or stakeholders that were previously less supported. Therefore, the measures can be very specific and addressed to pre-identified projects or beneficiaries. In this way, overlaps with existing programmes such as funding from the Cohesion Fund can be minimised. This approach often led to the introduction of new measures that were not included in the NECPs.

On the other hand, **some Member States decided to expand the volume or timeline of existing support schemes** and described this as their leading principle. In these cases, relying on existing mechanisms enabled a more rapid and less burdensome implementation for both authorities and beneficiaries. The expansion of funding measures that use competitive calls to select the supported projects was mentioned as one promising way to achieve fast and effective climate action. However, the short timeline and demanding reporting requirements for the NRRP development were described as additional important drivers in the decision for an expansion of existing measures. As a result of this approach, the measures of the NRRPs overlapped to a large extent with the ones defined in the NECPs or other national strategy documents.

The challenges in the comparison between the two plans were also described by the interviewees. In particular, the quantified impact assessment differs for measures in the NECPs and the NRRPs. The former focuses on GHG emission reduction, renewable energy and energy efficiency, while the latter does not have this explicit dimension as part of its assessment. As a standardised assessment and reporting of GHG emissions reduction was not part of the NRRPs' development, such information was not always available and could not necessarily be compared to the NECPs. The measures in the NRRPs are also often more granular than actions in the NECPs.

Additionally, Member States across Europe confirmed the mentioned **need for RRF funding and the NRRP measures to achieve energy and climate targets as defined in previous commitments** to the EU. The COVID-19 pandemic amplified the challenges of fundamental changes to societal and economic mechanisms required for the energy transition. This limited the formulation of more ambitious targets in a period of high uncertainty.

The potential of energy and climate impacts coming from reforms was also considered by Member States when drafting their NRRPs. The analysis of NRRPs and the discussions with Member States' representatives highlighted that several reforms had already been agreed upon at the national level.. Several reforms were planned already before the introduction of

the RRF and the NRRP, or follow from changes in EU legislation (e.g., Energy Efficiency Directive). As mentioned above, interviewees pointed to the challenges in timing and political risks to reach agreements on new reforms as a main cause for the conservative approach. However, the impact of the reforms was also described as broader and longer-lasting than investments. Especially tax reforms for energy use from fossil fuels compared to renewable energy sources were described as impactful measures which are expected to lead to higher GHG reductions by applying to a large part of the economy. Another example of impactful reforms according to the interviewees was the improved permitting systems that lead to faster uptake for RES projects. Selecting such reforms as part of the NRRP further increases the pressure and incentives to implement them, and can therefore have relevant impacts on the climate and energy targets.

The financial support by the RRF ensures that these reforms, which are required for achieving previously defined targets, remain possible by balancing budgetary restrictions and maintaining political focus on these priorities. This is the case also for reforms that may have been already agreed or planned before the introduction of the RRF.

Analysis of the existence of substitution effects caused by RRF financing

In this analysis, the effects of RRF financing need to be considered in light of possible substitution effects on other forms of financing for the energy transition from national budgets or with an impact on the debt position of a Member State. A clear and quantified analysis of this issue is not possible as such impacts were not described in the plans. However, in line with the findings above, the results of the comparison between NECPs and NRRPs as well as some existing studies point to the potential replacement of financing between the proposed and existing measures when these were similar in terms of design[7]. Indirectly and at a more general level, this was also mentioned by Member State interviewees who explained the preference for grant allocations over loans due to advantageous budget implications and reduced stress on national budgets which ensured the continuation of implementing initiatives for achieving energy efficiency, RES increase and GHG emission reduction. Literature cautions also that RRF investments could substitute Cohesion Policy programmes considering the RRFs lower administrative burden and higher priority combined with the limited absorption capacity in Member States[8].

Potential synergies, for example between the RRF and Cohesion Policy due to their common themes and the potential of the RRF making use of well-established structures of Cohesion Policy, are highlighted as well in literature[9]. This was also confirmed in our discussions with Member States who highlighted the experience within their respective Ministries in managing EU funds as beneficial in implementing the RRF. However, concerns were also raised about the unprecedented nature of the RRF and its large scope that required the involvement of parts of the administration less familiar with EU funding.

With the currently available data, positive nor negative consequences of substitution or continuation cannot be confirmed or quantified for specific Member States or the overall RRF. An ex-post assessment after the completion of the RRF timeline could be useful to understand the impacts of substituting public investments. For private investments and financial instruments, further analysis and discussion is presented in Chapter 4.2.2.

---

[7] See for example: https://foes.de/publikationen/2021/2021-04_FOES_DARP.pdf

[8] J. Barbero, A. Conte, et al. (2022) The impact of the recovery fund on EU regions: a spatial general equilibrium analysis, Regional Studies.

[9] Ibid.

3.3. Conclusions

Overall, it is not possible to assess how the situation would have been across the 27 Member States if the RRF had not been created. The unprecedented crisis caused by the COVID-19 pandemic and the current early implementation stage of the NRRPs means that consistent values for assessment and comparison are not available. However, this analysis has led to some key findings.

Across the Member States, sustainable transport and energy efficiency in buildings are the focus areas for investments and reforms. This applies to the number of NRRPs with measures in these areas, the overall number of measures across NRRPs, and the financing volume dedicated to these measures. Additionally, sustainable transport was also the topic on which the highest number of Member States (9) are likely to have created a higher level of ambition.

The numbers were more limited for the other energy categories following the easier access to private financing for large commercial projects compared to decentral projects on household side. Yet, hydrogen stands out with eight Member States likely to achieve higher ambition. This is due to the increased attention placed on hydrogen as a fuel substitute in its development and pre-commercialisation stage compared to the time of adoption of the NECPs.

Investments outnumber reforms in all of the plans and all of the energy categories. Whilst it is difficult to draw clear conclusions from a simple comparison between the number of investments compared to the number of reforms, this may be explained by the focus on economic recovery from a crisis, which sparked unprecedented funding but also by the short timeline for developing NRRPs. This led to a preference in national governments to include investments rather than reforms. However, some reforms may prove vital and highly impactful for the systemic and long-term decarbonisation of energy systems.

Combining the findings from the literature review, the comparison of NRRPs with NECPs and the interviews with Member States' representatives, it is concluded that **the proposed measures primarily help achieve existing energy and climate targets, as defined by the EU, in the context of the post-pandemic economic crisis (compared to an alternative scenario without the RRF)**.This is not surprising given that the RRF Regulation and the NRRPs were not conceived as means to increase NECPs ambition but to help implement them. In addition sixteen Member States use the NRRPs to increase their ambition in at least one energy category. In many other countries, the instruments were needed to ensure continuity in reaching targets, at a time when healthcare, medical supply chains and economic pressures required the utmost political attention and could have diverted resources from those targets.

4. Impact of the RRF on the use of financial instruments for energy projects

In this chapter, we present the findings on the impact of the RRF on the use of financial instruments for energy projects. These findings are based on the review of the NRRPs provided by the Member States and complemented by interviews and a literature review. It should be noted that currently, only one financial instrument has fulfilled its first milestones, so our assessment is based mainly on what is described in the NRRPs[10]. We start by first defining financial instruments and presenting some general findings from the literature before presenting an overview of the financial instruments identified in the NRRPs and conclusions on how the RRF affected the use of financial instruments for energy projects.

The specifications for this study identify loans, guarantees, equity, quasi-equity, and (green) bonds as possible financial instruments. Financial instruments differ from grants as they are repayable forms of financing, while grants are non-repayable[11]. The text box below further defines the types of financial instruments.

Definition of types of financial instruments

- **Loan:** An agreement which obliges the lender to make available to the borrower an agreed sum of money for an agreed time and under which the borrower is obliged to repay that amount within the agreed time.
- **Guarantee:** A written commitment to assume responsibility for all or part of a third party's debt or obligation or for the successful performance by that third party of its obligations if an event occurs that triggers such guarantee, such as a loan default.
- **Equity**: Provision of capital to a firm, invested directly or indirectly in return for total or partial ownership of that firm and where the equity investor may assume some management control of the firm and may share the firm's profits.
- **Quasi-equity:** A type of financing that ranks between equity and debt, having a higher risk than senior debt and a lower risk than common equity. Quasi-equity investments can be structured as debt, typically unsecured and subordinated and in some cases, convertible into equity, or as preferred equity.
- **(Green) bonds:** Bonds are financial instruments that finance projects and provide investors with regular or fixed-income payments. A green bond is specifically earmarked to raise money for climate and environmental projects.
- **Risk sharing instrument:** A financial instrument which allows for the sharing of a defined risk between two or more entities, where appropriate, in exchange for an agreed remuneration.
- **Fund of funds**: A fund set up to contribute support from a programme or programmes to several financial instruments. Where financial instruments are implemented through a fund of funds, the body implementing it shall be considered to be the only beneficiary.

[10] The Greek Loan Facility has fulfilled its first milestones by launching its call among commercial banks. For more information on milestones, see: https://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/index.html?lang=enhttps://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/index.html?lang=en.

[11] It should be noted however that there are also forms of repayable grants, which are for example used in EU Cohesion Policy.

Source: European Commission (2015) Guidance for the Member States on Financial Instruments – Glossary and World Bank Group (2021) What you need to know about IFC's Green Bonds.

While considered private instruments, in the context of public funding programmes such as the RRF, financial instruments like the ones described above, are a form of public intervention. In general, public interventions are justified when they support investments that would otherwise not be undertaken because of their low viability, but which are considered to be in the wider public interest. Additionally, the private sector may be unwilling to carry out a certain project for reasons which do not relate to the viability of the project itself. This is the case when confidence in the overall performance of the economy is low. In such a scenario, a project may not successfully attract investment. In this regard, the RRF aims to stimulate investment after the COVID-19 crisis.

Concerning energy projects, a central issue is that projects in renewable energy, energy efficiency and energy infrastructure require large upfront investments which can complicate their commercial viability even under normal economic circumstances. In addition, projects in energy efficiency (and also smaller residential renewable energy projects) face the challenge of being very decentralised and split into many small projects. Given these barriers, energy efficiency and renewable energy are two of the sectors that can benefit the most from the use of publicly supported financial instruments[12]. Government funding is essential for the development of these sectors. Consequently, the role of financial instruments is only feasible when the investment is income-generating or cost-saving[13].

It might seem that financial instruments are not attractive for beneficiaries when there are grants available, but financial instruments have some advantages with respect to grants[14]:

- Financial instruments are more sustainable because funds are normally repaid, allowing the possibility of reinvestment;
- Similarly, financial instruments can make more cost-effective use of public funds partly because funds may be recycled, but also because of their potential to attract private funds. [15] In doing so, publicly backed financial instruments might also support the development of new private financial markets.
- Financial instruments can improve project quality since the obligation to repay can act as a performance incentive.

Publicly backed financial instruments generally are distributed through intermediaries such as national or European development and promotional banks, financial institutions as well as investment and business agencies. These institutions then manage the funds and further distribute them to commercial banks. A novel aspect of the RRF is the enhanced role it gives to such financial institutions.[16] When assessing the energy-related financial instruments within the RRPs, we found that four Member States (Bulgaria, Croatia, Greece and Romania) involved the European Investment Bank (EIB), the European Investment Fund (EIF) or the

[12] The Clean Energy Ministerial (CEM). High Upfront Costs, available at:https://www.cleanenergyministerial.org/resources-cesc/finance/barriers/high-upfront-costs/

[13] EPRC (2017) Improving the take-up and effectiveness of financial instruments, available at: https://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/improve_effective_fei_en.pdf

[14] Faiña, A. et al. (2012), "Expert evaluation network delivering policy analysis on the performance of Cohesion Policy 2007-2013. Task 1: Financial engineering"

[15] In 2016, an evaluation of financial instruments in cohesion funding found however limited evidence of the capacity of public financial instruments to draw in private capital with many ESIF co-funded instruments using public capital alone (See: Whishblade, F. (2017) Improving the take-up and effectiveness of financial instrument). More recently, an uptake of financial instruments can however be observed under the EIF and InvestEU.

[16] A. Bartzokas, Giacon, R. and Macchiarelli, C. (2022) Exogenous Shocks and Proactive Resilience in the EU: The Case of the Recovery and Resilience Facility. Available at: https://www.lse.ac.uk/european-institute/Assets/Documents/LEQS-Discussion-Papers/EIQPaper177.pdf.

European Bank for Reconstruction and Development (EBRD) in their proposed financial instruments. Others mention also national development or investment banks.

Financial instruments in other EU programmes

Financial instruments relevant to the energy transition can be found in various EU programmes. For example, the European Regional Development Fund (ERDF) provides loans and guarantees for projects contributing to climate neutrality. Similarly, the Connecting Europe Facility (CEF), while mainly using grants, provides also guarantees, performance-based grants, co-financing structures and project bonds through CEF Energy to help project promoters to access the necessary financing for energy-related projects. Finally, the EIB also offers a full range of financial instruments. These are provided directly or through national development banks or private banks and include equity finance, mezzanine finance, and loans and guarantees. As such the EIB is also in charge of implementing 75% of the InvestEU programme, which brings together EU financial instruments, and the EIF, which supports SMEs

Source: Agora Energiewende (2022) Matching money with green ideas. A guide to the 2021–2027 EU budget.

4.1. Overview of the use of financial instruments for energy projects in the NRRPs

This section presents the results of our review of the financial instruments related to energy projects proposed in the NRRPs of the EU 27 Member States. Table 6 and Table 7 provide an overview of the number of financial instruments per Member State and energy category. Further details are provided in Annex A.

Table 6 shows that 8 out of 27 Member States had a total of 12 financial instruments to support energy projects.[17] Some of the planned instruments were created specifically for the NRRPs. However, some of them are based on existing or previous financial instruments. For 16 Member States[18], no financial instruments were identified, and several NRRPs mentioned financial instruments but did not specify them further (i.e., did not specify their RRF funding in case of mixed measures) or mentioned them as part of a reform. A list of unspecified instruments can be found in Annex A.

[17] It should be noted that the Commission Notice published after REPowerEU identified 15 RRPs that include a total of 53 financial instruments with a volume of EUR 22.4 billion (EUR 19.9 billion financed with RRF loans). This disparity is due to our research taking a more focused view and focusing only on funded instruments and those instruments that can clearly be associated with energy-related projects. See: Commission Notice (2022) Guidance on Recovery and Resilience Plans in the context of REPowerEU.

[18] The following Member States did not include any financial instruments in their NRRPs: Austria, Belgium, Czech Republic, Denmark, Finland, Hungary, Ireland, Italy, Latvia, Malta, Netherlands, Portugal, Slovakia, Slovenia, Spain and Sweden. The Czech NRRP mentions that part of the RRF funds could be implemented through voluntary financial instruments at the national level and that priority investments could receive strategic co-financing with loans and capital contributions from the EBRD. However, this does not constitute the creation of financial instruments under the RRF and was therefore disregarded.

Table 6. Number of financial instruments per Member State

Member State	Financial instruments	Description
BG	2	Two specified financial instruments under the Economic Transformation Programme are relevant to energy projects, Fund 2. Green Transition and Circular Economy, and Fund 3. Investment in Climate Neutrality and Digital Transformation. EUR 75 and 30 million of RRF funding has been dedicated to the financial instrument elements, guarantee and equity, of these funds.
EE	1	One financial instrument, Green Fund, is a green technology investment program. It consists of direct investment and investments through venture capital, and it is managed by a public company SmartCap. EUR 100 million of RRF funding has been dedicated to the financial instrument.
FR	1	One financial instrument that has EUR 250 million RRF funding allocated in, The Recovery Participatory Loans, provides loans and state guarantees to companies, to fund energy transition operations, for example. It is specifically tailored for the RRP.
DE	1	One concept for a pilot project for a financial instrument is to introduce carbon contracts for difference (CCfDs), dedicated EUR 550 million of RRF funding.
EL	1	One financial instrument, the RRP Loan Facility, makes use of different distribution channels (international financial institutions, commercial banks, Member State compartment of InvestEU) to provide corporate bond purchases or syndicated loans. As a broad instrument, it covers categories of energy efficiency in industry, renewable energy production as well as energy infrastructure.
LV	2	Two instruments, one for energy efficiency of multi-apartment buildings (loans and grants) and the other for increasing energy efficiency in business (loans and capital rebates). They are provided by state-owned development finance institution Altum and have been dedicated EUR 74.8 million and EUR 120.6 million from the RRF.
PL	1	One instrument, a fund providing equity, loans or combined investments, aims to support low- and zero-emission solutions in the field of sustainable mobility.
RO	3	All three financial instruments target energy efficiency in the industry (Portfolio guarantee for climate action and Fund funds for digitalisation, climate action) and for buildings (Financial instrument for investments in energy efficiency in the residential and buildings sector). Provided through the European Investment Bank and the European Bank for Reconstruction and Development. A portfolio guarantee for investments in energy efficiency and renewable energy is partly covered by InvestEU, and complementarity from InvestEU is possible for the Fund of funds for digitalisation, and climate action.
Total	**12**	

Note: In addition to the listed instruments, we observed 8 mentions of other financial instruments. Due to a lack of information and/or the early stage of developing these instruments, they were not included in the analysis. Annex A presents the full list of unspecified FIs.

Our analysis revealed that **financial instruments were most commonly used to support energy efficiency in industry**, both in terms of RRF funding and the number of instruments. These instruments were aimed in particular at providing guarantees or loans to companies to implement energy efficiency investments. Apart from financial instruments targeting energy

efficiency in industry, we found **two financial instruments targeting energy efficiency in buildings**. The cost savings generated by such energy efficiency projects enable the beneficiary to pay back the respective loan(s), which is a factor driving the use of financial instruments in this area. However, as experts pointed out in the workshop, the long repayment periods represent a challenge, often requiring co-financing and complementarity with grants to make these investments attractive for project promoters[19]. Furthermore, for energy efficiency in housing, one-stop shops are needed to simplify processes and make them accessible and reduce the lack of awareness of the benefits of investing in energy efficiency. Our review of NRRPs found several examples of investment or reform measures in Member States that aimed to set up such one-stop shops.[20] Other obstacles that have been highlighted include the decision-making process and financing for energy efficiency renovations in multi-apartment buildings and the limited capacity of financial intermediaries to provide financing based on the expected savings following the implementation of energy efficiency measures[21].

For renewable energy projects, we found evidence of only one specified financial instrument, which is a fund under the Bulgarian Economic Transformation Programme[22]. The underuse of financial instruments in the renewable energy sector has already been recognised in the literature. A study[23] conducted by the EIB on the use of financial instruments in Member States with the ERDF showed that the share of financial instruments in the renewable energy sector represents only 1.6% of all financial instruments implemented in five sectors which are deemed to have the potential for the ERDF. The reasons given are (i) the competition with grants and other subsidies available for renewable energy (and lack of possibilities to combine grants with financial instruments), (ii) the cumulation of state aid in this sector, and (iii) the fragmentation of resources across programmes and the unnecessary restriction in eligibility. In particular, the first and second reasons likely also apply to the underuse of financial instruments for renewable energy in the NRRPs.

The **low number of financial instruments for energy infrastructure and sustainable transport** can be attributed to the typically large size of projects in these areas and that they are often regulated assets. Due to these aspects, these projects are often carried out by public authorities or public companies and, thus, are typically funded directly by public money. The imperative role of local and public authorities in these projects presents further obstacles as they may experience insufficient access to technical assistance for the design and implementation of financial instruments. As public authorities face pressures to limit their deficits, the lack of technical assistance exacerbates the capacity of these authorities to encourage the private sector to fund certain investments via complex or advanced financing structures.[28] Projects in these areas are also often reliant on grants to facilitate their

[19] EIB (2020) The potential for investment in energy efficiency through financial instruments in the European Union. Available at: https://www.fi-compass.eu/sites/default/files/publications/energy-efficiency-model_0.pdf.

[20] For example, Bulgaria's NRRP includes a reform for a one-stop shop that aims to reduce the administrative burden (both for households and companies) by accompanying the renovation process through technical assistance and advice. Similarly, Cyprus' NRRP includes a reform to set up digital one-stop shops for RES projects permitting and for energy renovation in buildings.

[21] The EIB has published a model for a financial instrument with a grant component to support energy efficiency. This model provides an example of how the programming, design and implementation requirements can be applied to deliver market-oriented financial instruments to support energy efficiency projects. For more information, see: https://www.fi-compass.eu/sites/default/files/publications/energy-efficiency-model_0.pdf.

[22] It should be noted that there are also other financial instruments that cover renewable energy, such as the Estonian Green Fund and the Greek Loan Facility, however these cover multiple energy categories.

[23] EIB (2020) *Stocktaking study on financial instruments by sector. Progress to date, market needs and implications for financial instruments*, FI-Compass. Available at: https://www.fi-compass.eu/stocktaking-study-financial-instruments-sector.

implementation due to the non-bankable components of many projects. The availability of EU funded RRF grants which may cover 100% of project costs has therefore been also a more attractive choice than financial instruments. In addition, these types of projects are often also covered by TEN-E and TEN-T, and the funding is distributed through the Connecting Europe Facility (CEF) and may also be covered by InvestEU. It is, therefore, not surprising that the financial instruments we identified in these two areas target companies investing in their infrastructure. For example, in one case, the instrument supports companies investing in energy storage to complement the companies' investments in renewable energy sources[24]. Similarly, the one identified financial instrument for sustainable transport targets companies that want to invest in zero-emission mobility (and energy) solutions to establish new products.

There are **no financial instruments targeting hydrogen**, which can be attributed to the nature and maturity of the technology, as more mature technologies allow for more market-based financing, while less mature technologies often rely on grants.[25]

Our review of the NRRPs showed that **about EUR 5.99 billion of RRF funding was allocated to energy-related measures through specified financial instruments**. Compared to financial instruments in other EU funding instruments, this can be considered sizeable. For example, compared to the ERDF and Cohesion Fund for 2014-2020[26], where EUR 3.3 billion (EUR 275.9 million for renewable energy projects) was allocated in financial instruments, RRF funding is significantly higher. Nevertheless, due to the limited available information, the RRF allocations are not always specific to one financial instrument but rather measure-specific, which can skew the monetary amounts presented in Table 7, since some measures have several components with only one of them being a financial instrument relevant for energy projects. For example, some financial instruments are paired with grants under a specific RRF measure. Additionally, in some cases, the allocation of the financial instrument to energy projects is also not clear, as some instruments cover both energy-related projects and other types of projects and are not split by sector or subsector.

[24] However, there are also exceptions to this case as one financial instrument targets in particular large-scale infrastructure investments through equity financing. It focuses though on both energy storage and charging infrastructure and not on traditional energy transmission.

[25] EIB (2020) *Stocktaking study on financial instruments by sector. Progress to date, market needs and implications for financial instruments*, FI-Compass. Available at: https://www.fi-compass.eu/stocktaking-study-financial-instruments-sector.

[26] EUR 3.3 billion covers all the sectors in the funds; Renewable Energy; Urban Development and Transport; Environment; Information and Communications Technology (ICT) infrastructure; and Research, Development and Innovation in SMEs. See: EIB (2020) *Stocktaking study on financial instruments by sector. Progress to date, market needs and implications for financial instruments*, FI-Compass. Available at: https://www.fi-compass.eu/stocktaking-study-financial-instruments-sector.

Table 7. Overview of financial instruments per energy category

Energy category	No. of financial instruments (incl. those that cover multiple categories)	RRF funding, EUR million	No. of unspecified financial instruments* (incl. those that cover multiple categories)	Description of type of financial instruments
Energy efficiency in industry and other	6 (8)	2,819	2 (4)	One guarantee and two loan financial instruments as well as combination instruments of loan and equity, loan and capital rebate and one categorised as other (carbon contracts for difference). The two unspecified ones contain a loan and a combination of bond and guarantee.
Renewable energy production	1 (3)	2,285	0 (2)	A combination of equity and loan financial instruments. The unspecified one is a mix of loan and guarantee
Energy efficiency in buildings (renovation)	2 (2)	732.99	1 (1)	Includes a combination of guarantee and loan and a guarantee instrument. An unspecified instrument consists of an Energy Savings Contract, as well as plans for, e.g. capital rebate.
Energy infrastructure	2 (2)	475	0 (0)	An equity instrument and an instrument combining a loan facility and equity platform.
Sustainable transport	1 (1)	114	2 (2)	A combination of equity and loan financial instruments. The unspecified ones include a reform to update a guarantee financial instrument and one instrument that will be developed following a preparatory study.
Hydrogen	-	-	-	-
Multiple categories**	2	175	2	Includes a guarantee and an equity financial instrument. Unspecified instruments are a combination of loan and guarantee financial instruments as well as a reform to set up a national decarbonisation fund which will include a guarantee financial instrument.
Total	**15**	**5.992,40**		

*Note: The total is larger than the number of financial instruments identified earlier, due to some Member States proposing financial instruments that cover several energy categories. The total number of instruments covering an energy category, including the ones covering multiple categories, is in parentheses. *Unspecified financial instruments are financial instruments mentioned in reforms or those mentioned in investment measures as complementary, but without any indication of RRF funding. **Multiple categories include one Bulgarian and one Estonian financial instrument, which both cover Energy efficiency in industry and Renewable energy production.*

In terms of the type of financial instruments used, **we found that the most common types proposed in the NRRPs were loans (6), followed by guarantees (4) and equity (4)**. The remaining financial instruments were categorised as capital rebates (1)[27] or other (including Carbon Contracts for Difference). It should be noted that in several cases, measures within the NRRPs combined two or more types of financial instruments. In particular, these were combinations of loans with guarantees, equity or a capital rebate.

4.1.1. Rationales for the inclusion of financial instruments related to energy projects

In their NRRPs, Member States put various justifications forward for the inclusion of specific financial instruments. Often these start from **broader justifications for public intervention**, which would also apply to grants. These address, in particular, market failures, support economic recovery or target wider policy objectives related to the green transition, resilience and innovation. These more general rationales include issues such as the lack of liquidity of companies, lack of access to financing due to high commercial interest rates and lack of scale and small project sizes leading to high development and financing costs. Beyond these broader justifications, the level of reasoning provided also varies between the Member States, some provide much more detail, pointing towards specific examples of national issues (e.g., reports on access to finance in their economy, lack of private capital), while others stay at a higher level, highlighting common EU challenges (e.g. need for investments to green the economy) .

Based on the NRRPs and interviews with Member State representatives, we identified the following **five main rationales for including financial instruments in the NRRPs.** These reasons relate to our review of energy projects, but can also be applied more broadly:

1. To leverage public funding and attract additional resources;
2. To incentivise the development of private finance for the green transition;
3. To reduce the dependency on grants for adressing market failures; and
4. To speed up drafting and implementation of the NRRPs by reusing pre-existing and succesful instruments.;
5. To limit the long-term impact on the public deficit when relying on RRF loans.

Concerning the first rationale for **leveraging public funding,** Member States' representatives highlighted the ambition to attract additional resources, both public and private. In particular, proposed schemes foresee encouraging additional private investments in energy efficiency, renovation and renewables by providing guarantees, affordable loans or partial funding for eligible investment projects. These instruments target both industries but also private citizens when it comes to renovation. Some Member States specified particular expected multiplier effects (see also Section 4.2.1), however, in most cases, they remained vague.

In addition to leveraging public funding, some Member States **aimed to incentivise the development of private finance** supporting the green transition. This relates to the challenge of finding financing for companies and, in particular small and medium-sized enterprises (SMEs), which was noted by Member States such as Bulgaria, France and Romania as a

[27] Also, Bulgaria plans to introduce a capital rebate in its program to improve energy efficiency in the housing stock, where owners would receive a loan which would be turned into a partial grant once performance indicators are met. However, this is only in planning according to a Member State representative. In our analysis, the measure is categorised as an unspecified one as it is unclear how much (if any) of the RRF funding would be allocated to this.

reason for proposing a financial instrument. In particular, Romania noted that the COVID-19 pandemic led to a reduction in the financial supply as financial intermediaries became more selective in their lending activities. The types of financial instruments addressing the lack of available financing were diverse; however, in many cases they included guarantees. The lack of private financing for energy projects is often related to the nature of energy projects, which often have a long duration, high risk and high investment needs, or are decentralised, such as residential and industrial energy efficiency projects. For that reason, some Member States (France and Latvia) proposed to make financing available particularly for longer-term investment[28]. Greece and Romania also mentioned the challenge for building owners to stem the high upfront costs combined with long return on investment periods of renovation work and the issue of energy poverty.

Another issue that was reported in the interviews as a reason for introducing financial instruments is the **dependency on grant funding,** with beneficiaries preferring to delay investments pending the availability of grants. In particular, it was noted that there is a low awareness of financial institutions on the investments in energy efficiency, which, combined with the fragmentation of markets (especially for renovation in the residential sector), leads to a preference towards grants. Therefore, some financial instruments, specifically those combined with grants, were introduced to help their economy to move away from grant funding to private financing.

The fourth reason we found is a rather practical one. Member States that included financial instruments in their NRRPs often built on existing instruments or used blueprints of previous ones that worked well. One of the common rationales was the possibility to **build on or reuse pre-existing instruments**, which made it easier to include them in the new plans. For example, the Latvian RRP introduced a tool combining guarantees, loans and grants to improve the energy efficiency of multi-apartment buildings, which was based on previously used instruments under structural funds.

Finally, one reason that is less transversal, but applies to RFF funding from the loan compartment is the aim **to limit impacts on public deficits**. Especially for Member States such as Greece, Poland and Romania which also rely on RRF loans, financial instruments are more attractive as they are repayable forms of financing. This allows later recylcing or reuse of the funds for the same policy purpose, which reduces the long-term impacts on public deficits and thereby supports fiscal sustainability.

4.1.2. Rationales for the exclusion of financial instruments related to energy projects

Since a large number of Member States (19 out of 27[29]) did not include any financial instruments for energy projects to-date, we also investigated through interviews with Member State representative, the reasons for not including financial instruments. In comparison with the reasons for including financial instruments, the ones for excluding them are mainly practical. In particular, we found the following five reasons:

1. no obligation in the RRF legislation to use financial instruments;

[28] For example, in France, the Participatory Recovery Loan (PPR) should support the financial solidity of companies by providing long-term financing that fits into the financing structure between equity and debt. Similar, Romania in its reasoning for including financial instruments highlights a 2020 EIB investment survey that showed that 12 % of Romanian firms can be considered financially constrained with collateral requirements posing one of the largest challenges.

[29] Considering also unspecified financial instruments (i.e. those mentioned in reforms or as complementary measures in investment without specifying any amounts), the number of Member States without financial instruments decreases to 16.

2. lack of time to create and set up new financial instruments, therefore not fitting the timeframe of the preparation of the RRPs;
3. limited awareness of guidance available to Member States on developing, including or reusing financial instruments in their NRRPs;
4. lack of existing private finance markets to tap into with financial instruments; and
5. concerns about duplication as financial instruments already existed in other funds or through other initiatives.

The main reason for Member States not including financial instruments is the simple fact that financial instruments were not envisaged as a mandatory delivery mechanism under the RRF. This led to many Member States preferring grants over financial instruments in disbursing their RRF funding. Grants are also more familiar to Member States and convenient for potential recipients. In interviews, some Member States indicated that grants and other forms of subsidies are simpler to implement and manage[30]. They are also preferred by beneficiaries, which was also confirmed by an expert who argued that there is a clear preference for grants if both options are available. Therefore, since there was **no obligation to include financial instruments** in the NRRPs[31], many Member States found it more convenient to stick to grants in their measures.

A second reason identified is that the timeframe for creating NRRPs was relatively short, and thus **lack of time to set up (and implement) new financial instruments** were mentioned as an obstacle for financial instruments in the NRRP. Financial instruments are generally seen as more long-term instruments. One expert explained that with financial instruments, a layer of complexity is added as one can award a trusted entity, such as a national development bank, with the funding, but that entity has then to go through a financial intermediary, who then would still need to issue the instruments and make risk calculations. This increases the administrative burden and time needed compared to grants. Therefore, they were not seen as fitting the timeframe of the preparation of the NRRPs and simplicity is preferred when fast results are needed. Two Member State representatives also were worried about the rather strict targets under the RRF with their biannual milestones, which make financial instruments in their implementation even more risky compared to grants.

Building on the lack of obligation and limited time available, considering that the RRF offers 100% financing for its grants, there are also **no real incentives for Member States to recycle the funding** or include private financing. As stated above, this does not apply to the loan compartment of the RRF and we, therefore, see also that the few Member States that decided to make use of their loan compartment were keener to include financial instruments (e.g., Poland, Romania and Greece). Additionally, compared to other EU funding programmes, **Member States did not receive extensive formal guidance for introducing financial instruments**[32], even though the updated guidelines following REPowerEU provided more

[30] For example, regarding private renovations to improve energy efficiency, grants are seen as a more efficient option to incentivise renovations due to the simplicity of the process compared to loans. However, Latvia's RRP includes a financial instrument combining guarantees, loans and grants for private renovations. It is based on private banks' reluctance to finance renovations of apartments owned by private people or associations.

[31] In the original guidance document provided by the European Commission, the Commission suggested their use while also cautioning Member States to rely on existing structures as the timeline of the RRF will make it difficult to develop new structures. It should be noted however, that additional guidance was provided informally by the Commission during the negotiations on the NRRPs.

[32] While the original guidance document provides one page of information on financial instruments, this mainly focused on operational aspects, i.e. type of financial instruments, the information which would need to be included in the NRRP, how to make use of the Member State compartment of InvestEU, while it does not provide any further guidance on the set-up and implementation of financial instruments nor any good practices. For more information, see European Commission (2021) Guidance To Member States Recovery And Resilience Plans, SWD(2021) 12 final Part 1/2.

details including also reasons and benefits of including financial instruments as well as examples of the types of financial instruments already included. It also makes specific suggestions for the type of financial instruments that could be included (i.e. guarantee instruments to de-risk energy efficiency renovation schemes, public-private partnerships for renewable energy sources investments, and equity investments in companies or equity funds supporting the green transition) which is recommendable[33].

Moreover, the **lack of existing private finance markets** to tap into financial instruments was observed as one of the obstacles to establishing new instruments under the NRRPs. For example, a representative from one Member State mentioned that financial instruments were considered not to be beneficial in the energy sector due to the immaturity of capital and venture capital markets. Another one explained that a past financial instrument had failed due to the lack of private capital. This was also confirmed by one expert during the validation workshop who argued that it is not possible to leverage private investments as capital markets in some less advanced economies are much shallower than in other Member States.

Finally, in some countries, **financial instruments already exist in other funds or measures**, outside of the NRRP, for example, in Structural Funds and Cohesion Funds, and separate green bonds in Denmark. Setting up new instruments with similar objectives would have overlapped with the other existing instruments, and in the short timeframe, it was difficult to assess complementarity and the need for additional ones.

4.2. Expected multiplier, complementarity and substitution effects of financial instruments

As part of our analysis of the financial instruments, we analysed the expected multiplier effect of public funding for energy measures as well as the complementarity or substitution between RRF funding and other sources of funding for energy projects both at the national and EU level. There is a limited number of financial instruments included in the RRF, thus, it is not possible to draw conclusions about the multiplier, complementarity and substitution effect across the EU27; however, we can provide insights on possible trends.

4.2.1. Multiplier effect

The aim of analysing the **multiplier effect** is to see if financial instruments in the NRRPs can lead to higher national income and consumption, that is to say, multiply the initial amount used in a financial instrument and generate positive economic effects. In the context of energy-related measures, it is possible, for example, that an instrument providing additional funding to companies attracts additional private funding. Many of the Member States do expect their instruments to encourage additional investments in energy-related projects. For example, Estonia's Green Fund which targets green technology companies aims to contribute to raising additional private capital and thereby increase the supply of capital in the field of green technologies.

Some countries provided more detailed estimations of the multiplier effects of their instruments. Bulgaria expects multiplier effects of three times for one of its energy-related funds under the Economic Transformation Programme, an expectation they confirmed in an initial evaluation by the EIF, and two times for the other fund. The minimum estimate for the

[33] The Annex of the REPower EU guidance provides additional information on the use of financial instruments under the RRF, based on the experience gathered with the preparation and implementation of the initial RRPs. For more information, see Commission Notice, Guidance on Recovery and Resilience Plans in the context of REPowerEU, available at: https://commission.europa.eu/system/files/2022-05/c_2022_3300_1_en_0.pdf.

added value of the Romanian Portfolio guarantee for climate action is four times the initial amount. However, Romania's RRP specifies that the exact amount would be determined by the operational agreements to be signed. The rationale for the Greek Loan Facility highlights a large investment gap currently in Greece, which implies that there is a significant pool of mature private investments leading to significant positive long-term multiplier effects without specifying the expected multiplier effect. In its key principles, it is specified that RRF loans under the facility will be leveraged with third-party financing at a minimum level of 50%, including own equity and loans by commercial banks. Moreover, France estimated that its Recovery Participatory Loans could mobilise up to EUR 20 billion of additional funding. It would make the expected multiplier effect of the initial RRF funding of EUR 250 million rather ambitious.

Based on the limited information available in the NRRPs, we concluded that **several financial instruments are expected to have a multiplier effect**. However, it is noteworthy that these numbers and expectations have been presented by Member States, and since the instruments have not been fully implemented, there is limited **data to estimate their final value.** Hence, at this stage, it is difficult to prove the accuracy of the expected multiplier effects.

4.2.2. Complementarity and substitution

Additionality and complementarity with other EU programmes and instruments have been enshrined as key principles in the RRF regulation[34]. However, academic work[35] highlights past issues in the deployment of financial instruments under the European Structural and Investment Funds (ESIF) related to the lack of well-timed implementation, a limited project upstream capacity and substitution for national funding. Considering this aspect as well as the creation of the RRF in a short time-frame to address the COVID-19 related economic crisis, it is crucial to review wether there are any risks in regard to not-adhering to these principles. When analysing the complementarity and substitution effect for RRF for energy projects we analysed multiple angles of complementarity and substitution, namely between:

- RRF funding and use of financial instruments (outside of the RRF);
- Financial instruments included in the RRPs and other funding sources;
- Financial instruments included in the RRPs and InvestEU.

Regarding the **complementarity for energy-related financial instruments between the RRF and other private funding** or the development of financial instruments outside the RRF, the evidence we found was conflicting and could not be substantiated. Stakeholder feedback indicated that there were financial instruments in the pipeline, but their development was stopped once the RRF came about. This would indicate that there has been a substitution effect and the RRF led to decreased private-sector spending. In contrast, however, some Member States authorities shared their expectations that the publicly supported financial instruments could address investment gaps for various types of investments including energy-related projects in their economies caused by economic uncertainties and thereby unlock private investments that are currently withheld. In line with this, it is likely that these financial instruments were simply put on hold due to the unprecedented economic situation caused by

[34] See Art. 9, which states that "*support under the Facility shall be additional to the support provided under other Union programmes and instruments. Reforms and investment projects may receive support from other Union programmes and instruments provided that such support does not cover the same cost*", Regulation (EU) 2021/241.

[35] A. Bartzokas, Giacon, R. and Macchiarelli, C. (2022) Exogenous Shocks and Proactive Resilience in the EU: The Case of the Recovery and Resilience Facility. Available at: https://www.lse.ac.uk/european-institute/Assets/Documents/LEQS-Discussion-Papers/EIQPaper177.pdf.

the pandemic and naturally public support measures (including publicly backed financial instruments) filled the gap.

There is also **conflicting evidence on the complementarity between financial instruments included in the RRPs and other funding sources**. For instance, Bulgaria highlighted complementarity to the ERDF, while Estonia and Latvia highlighted complementarity to private investors and private banks. Some of the Member States, such as France and Bulgaria, used financial instruments to complement grant schemes. In Greece, loans provided by the state should cover a maximum of 50% of the investment costs, with the financial institutions' participation at a minimum of 30%, and debtor participation amounting to at least 20%. regards to coherence, Member States indicated in their NRRPs the use of other EU funds; for example, Romania indicated alignment with ESIF. While the literature highlights the possible synergies between RRF and Cohesion Policy given some common themes and the potential of the RRF to make use of the well-established structures of Cohesion Policy, it also cautions against possible risks. In particular, RRF investments could substitute Cohesion Policy programmes considering their lower administrative burden and higher priority combined with the limited absorption capacity in Member States. Already, there have been delays in the launch and implementation of the 2021-27 Cohesion Policy programmes indicating limited administrative capacity to absorp all of the available funds. However, further analysis is needed to explore the complementarities between the two policies.[36] Furthermore, as indicated in Section 4.1, there is a need for better complementarity between grants and financial instruments for energy projects, especially regarding energy efficiency to ensure the investments are attractive to project promoters.

Finally, while some Member States did not indicate the use of InvestEU and preferred loans from the private market or national funding as these are easier to access, there are some indications of **complementarity between financial instruments included in the RRF for energy projects and InvestEU**. Some Member States indicated that InvestEU will be used to complement measures and financial instruments. For example, the Greek NRRP indicates that Invest EU will be used to complement the loan facility for energy efficiency and demonstration projects in SMEs or larger enterprises; Romania, in its financial instrument for investments in energy efficiency in the residential and buildings sector, indicated that it would include an uncapped portfolio guarantee, partially covered by the InvestEU Romania compartment. Other Member States, which included financial instruments indicated that complementarity with InvestEU is possible, but it is not clear yet whether this will be realised.

4.3. Findings on obstacles and good practices for energy-related financial instruments

In addition to the review of the multiplier, complementarity and substitution effects; the analysis of financial instruments in the NRRPs identified potential obstacles, good practices and lessons learned, namely:

- **Key obstacles:** Factors that hinder the complementarity between RRP measures and alternative financing solutions, as well as the uptake of financial instruments;
- **Good practices:** enabling factors that favour complementarity between RRP measures and alternative financing solutions, as well as the uptake of financial instruments.

[36] J. Barbero, A. Conte, et al. (2022) The impact of the recovery fund on EU regions: a spatial general equilibrium analysis, Regional Studies.

4.3.1. Obstacles

According to the research conducted by the EIB, the main obstacle during the implementation of financial instruments, vis-à-vis the ERDF programme, was related to difficulties in integrating financial instruments into the current environment of grants. Here, the main issues were the[37]:

- insufficient political support;
- lack of market sponsoring; and
- administrative complexity.

From our assessment of the NRRPs and in particular the interviews with Member State representatives, we can conclude that these issues likely also apply to the implementation of the NRRPs and energy projects. The rationales for not including financial instruments described earlier, showcase issues such as a lack of existing private capital markets to tap into[38], a lack of time to create and set up new financial instruments, as well as concerns about duplication risks of already existing financial instruments in other funds. These point to both a **potential lack of market sponsoring** and **administrative complexity** being critical obstacles when implementing the financial instruments and ensuring their complementarity with existing financial instruments and other measures.

Member States that included financial instruments in their NRRPs also highlighted similar challenges. Two Member States highlighted that different ministries were contributing to the NRRPs and for implementation, there are also different ministries involved, which again will have to coordinate with each other, but also with the units involved in implementing other EU and national programmes. In one case, **a lack of political will** due to the absence of a government and upcoming elections was also mentioned as the key cause leading to delays in the signatures of financing agreements with EU institutions. One Member State also remarked on the issue of dealing with several funds, each with its own smaller projects, which require much coordination and thereby complicate ensuring complementarity[39].

A potential obstacle could also be that a majority of the implemented financial instruments are delivered via long-term loans or guarantees. The use of such long-term financial instruments typically targets leveraging investments from the private sector by de-risking investments and offering more flexibility in the investment project design and duration. The operationalisation of such long-term-oriented financial instruments is, however, constrained by the **limited duration of the RRF**.

Another obstacle in implementing financial instruments that were pointed out in our consultation with experts is a **lack of awareness and ownership among the public and stakeholders** caused by a lack of their involvement in many countries. In contrast, however, the literature also points towards the uniqueness of the RRF of creating ownership, by asking national authorities to design and implement their national plans.[40] Nevertheless, continued public involvement in the management of the RRF spending and transparency will be crucial

---

[37] EIB (2020) *Stocktaking study on financial instruments by sector. Progress to date, market needs and implications for financial instruments*, FI-Compass. Available at: https://www.fi-compass.eu/stocktaking-study-financial-instruments-sector.

[38] For example, one Member State pointed out in their interview that a past financial instrument was not successful because the private financing was difficult to obtain, which was one of the reasons for them not to consider financial instruments.

[39] For this reason, to ensure complementarity, one Member State opted to prioritise and strengthen existing measures and not propose any new financial instruments.

[40] A. Bartzokas, Giacon, R. and Macchiarelli, C. (2022) Exogenous Shocks and Proactive Resilience in the EU: The Case of the Recovery and Resilience Facility. Available at: https://www.lse.ac.uk/european-institute/Assets/Documents/LEQS-Discussion-Papers/EIQPaper177.pdf.

to increase efficiency and awareness, which would also help with the uptake of financial instruments.

Strict eligibility criteria can also be an obstacle to the success of a financial instrument after it has been implemented. This was reported in the case of a pre-existing green loan scheme targeting micro-enterprises and SMEs, which has a minimum loan requirement of EUR 50,000 and a maximum of EUR 1,000,000 and must be complemented with company equity of the same amount. Such characteristics, however, limit the possibilities of integrating this financial instrument in different settings, sectors or energy and depend on the access of companies to private financing. The instruments are managed by a public investment bank and several commercial investment banks. It has, however, seen limited use.

Apart from these obstacles caused by the time limitation of the RRF, it was, however, also pointed out by two Member State representatives that the shorter-term character of the NRRP measures could be beneficial, as many of the measures will be implemented earlier. This **could help bridge the gap between the programming periods** of the longer-running programmes under cohesion and structural funds. Others also remarked that simply the fact of their ministries both being responsible for ERDF and RRF programmes, helps with complementarity.

4.3.2. Good practices and lessons learned

It is difficult to identify good practices and lessons learned at this stage, considering that many of the measures under the NRRPs are only being rolled out now and that in particular financial instruments take longer to set up. In many cases, it remains to be seen whether the financial instruments work as intended and how well they complement other existing instruments. One Member State when asked about good practices they follow, remarked that they expect to draw lessons from their first call to be launched under one of their NRRP's financial instruments. Nevertheless, based on their description and our exchanges with Member States' representatives, we can draw some lessons regarding the design of financial instruments. These are presented in the following paragraphs and complemented with findings from an assessment of financial instruments in other EU programmes.

The good practices that we identified can be summarised as follows:

- setting up a **central platform or one-stop shop** to ensure coordination and complementarity between different programmes;
- use of **technical assistance and advisory service both for Member States** to build structures supporting the design and implementation of financial instruments, and for beneficiaries to ensure the success of projects;
- **knowledge sharing and use of blueprints** of successful financial instruments from past programming periods or developed by EU institutions and other Member States;
- **partnering with experienced financial institutions** for the implementation of financial instruments;

- the **perfomance-based nature of the RRF** with the introduction of milestones and targets linked to the release of funds, which facilitates monitoring of progress and creates additional incentives for timely implementation[41].

One Member State representative highlighted the issue of dealing with a myriad of different measures in the form of both grants and financial instruments. To address this, they are **developing an investment platform as a one-stop shop** for financial instruments and grants in the area of energy efficiency. This is complemented by a proposed reform to set up a national fund to better integrate existing funds in the field. This not only improves complementarity but also transparency and ease of access for potential beneficiaries, which would support addressing the issues of a lack of awareness and ownership. Experts in our validation workshop confirmed that the centralisation of government assistance is key as it supports capacity building and the provision of external support.

The above-described platform is being set up with the help of a **technical assistance project** provided through the Technical Support Instrument of DG REFORM. The need for technical assistance to build capacity for preparing quality projects on both national and local levels was also pointed out by experts in our validation workshop. Such technical support was also recommended to complement the funding provided to the beneficiaries. A stocktaking study by the EIB[42] also identified technical assistance as key to developing capacities both for public authorities and project promoters, as these can (i) increase the level of understanding of the pre-requisites needed for both financial instruments to be successful but also for projects to be capable of receiving of a financial instrument support; (ii) raise awareness about existing publicly-supported financing; (iii) address complexities within individual projects accelerating investment readiness; and (iv) support reaching the project maturity required by investors and develop investment-ready business models.

A few Member States also explained that they were able to build on **blueprints from pre-existing financial instruments**. In particular, some of the Ministries involved in designing the NRRP referred to their experience working with similar instruments under ESIF and other programmes. Reusing existing instruments and building similar structures also ensures familiarity of commercial banks with the processes of an instrument supporting its uptake. In another case, a Member State added a financial instrument supporting large infrastructure projects, which is a new measure for them, but which has been designed by the EIF in 2021 and will be rolled out also in other Member States. The transfer of knowledge gathered during the implementation of a financial instrument between Member States (and within Member States) can offer valuable insights, and it is considered good practice to take advantage of experience accumulated within a Member State and to adapt it to one's needs[43].

Linked to the use of blueprints of financial instruments, Member States authorities also referred to **partnering with European or national financial institutions**. For example, some Member States involve the EIB to support them in creating and setting up the financial instrument (e.g. selecting financial intermediaries and managing the funds), which can then also be paired with advisory support from the EIB. Another Member State authority referred to a national development and finance institution, which would support in managing the funds. Involving

[41] This good practice does not only apply to financial instruments, but to the funding programmes as a whole. It nevertheless should be mentioned here as in particular financial instruments can be time consuming to implement and difficult to monitor in their roll-out as they involve intermediary organisations. Therefore, the milestones can be particularly beneficial for financial instruments.

[42] EIB (2020) *Stocktaking study on financial instruments by sector. Progress to date, market needs and implications for financial instruments*, FI-Compass. Available at: https://www.fi-compass.eu/stocktaking-study-financial-instruments-sector.

[43] Ibid.

such institutions allows Member State authorities to free up capacity and rely on their accumulated expertise.

Implementing the RRPs: A first view on good practices

A good example of the **involvement of European financial institutions is the Greek Loan Facility**. In its key principle, it was outlined that the involvement of multilateral organisations to manage the RRF loans and co-finance shall be substantial. The facility signed operational agreements with the EBRD and the EIB with the former agreeing to manage up to EUR 500 million and the latter EUR 5 billion. In addition, following a tender, six Greek commercial banks were selected as implementing partners. In particular, the implementation of the components managed by the EBRD has received active interest from the private sector. The successful execution of these transactions by European financial institutions with loans providing much-needed investment is believed to have a strong signalling effect among the private sector and corporate finance. Similarly, Romania involved the EIB in its 'Fund of funds for digitalisation, climate action and other areas of interest' and the EBRD in the 'Financial instrument for investments in energy efficiency in residential and buildings sector'.

Regarding **knowledge sharing, the French Springboard for the ecological transition** was introduced in the French RRP and implemented by the French Agency for the Ecological Transition (ADEME) and has reportedly experienced considerable success in reaching many SMEs active in various sectors and regions. According to a consulted stakeholder, this success resulted from the broad range of eligibility criteria and the avoidance of competition for the subsidy, which often results in long discussions and lengthy application processes. While being a grant-based measure and not a financial instrument per se, this example highlights how knowledge is already being shared among Member States, since it was reported in our interviews that public authorities from other Member States had approached ADEME to consult on its design and implementation strategy to increase their understanding and possibly replicate, to an extent, the measure's framework.

Finally, regarding the **use of technical assistance** to complement the setting-up of financial instruments and the development of **one-stop-shops**, the Bulgarian RRP built on an existing project under the Technical Support Instrument which is mapping existing funds available in Bulgaria to create an investment platform as a one-stop-shop. Bulgarian financial instruments specified under the Economic Transformation Programme will be able to benefit from this structure and the proposed reform to establish a National Decarbonisation Fund. Regarding **coordination across different EU funds**, Bulgaria also had a good experience with the Fund Manager of Financial Instruments in Bulgaria (FMFIB), a Holding Fund that manages EU shared management resources through 13 different financial instruments on behalf of five Bulgarian managing authorities and which is a case study on the FI-Compass.

Source: Based on Member State interviews; A. Bartzokas, Giacon, R. and Macchiarelli, C. (2022); and EIB (2021).

4.4. Conclusions

A majority of Member States opted to fully rely on grant-based measures for energy projects and only eight Member States specified energy-related financial instruments within their NRRPs. Based on this, one could conclude that the RRF did not lead to the increased use of financial instruments in the energy sector. However, one should consider that financial instruments were not mandatory as a delivery mechanism under the RRF. In addition, limited time, administrative burden and the fact that the RRF grants offer 100% financing and do not require any national co-financing, also reduce incentives for Member States to include financial instruments. **Despite these factors, the RRF led to the uptake of some financial**

instruments, which implies that there was at least some positive impact on the use of financial instruments. In addition, we see in particular a few large financial instruments in energy efficiency, where much investment is needed. Nevertheless, **there could have been scope for further development of financial instruments in the energy sector**. Considering the updated guidance with REPowerEU including a further focus on financial instruments and the ability for Member States to apply for RRF loans until 31 August 2023, there is still the opportunity for more financial instruments for energy projects to be developed. In particular, in combination with RRF loans financial instruments are more attractive as the funding is repaid and can be recylced thereby reducing the impact on public deficits.

Taking a closer look at the types of financial instruments for energy-related measures, we find that **the majority focused on energy efficiency in the industry followed by energy efficiency in buildings**. In comparison, other types of energy-related projects received not much attention, likely due to reasons such as the maturity of the technology (hydrogen), oversaturation with grants and state aids (renewable energy), and the large-scale and often public nature of these projects (energy infrastructure and sustainable transport) among other reasons.

The reasons for not including financial instruments in some Member States to-date were mostly practical. They include the argument that they were not obligatory and that there was limited formal guidance on including them, the lack of time to create and implement them, the lack of existing private finance to tap into, and concerns about duplicating existing financial instruments. In contrast, apart from the reason for reusing pre-existing financial instruments, the reasons for including financial instruments were less practical and included the possibility to leverage public funds, incentivise the development of private finance, and reduce grant dependency on their economy.

Regarding multiplier effects, there is limited information available, but in general, Member States expect their financial instruments **to have a multiplier effect**. However, the expected effect varies across Member States and in most cases is not specified at all or left to assessment once the financial instrument will be set up.

It was pointed out that many measures/financial instruments had already been part of national plans, however, it is not clear whether there had been national funding for them and if so, how the unprecedented situation of the pandemic affected this funding. Considering also the unique economic situation, there are indications that the RRF measures and financial instruments will unlock private investments and close the investment gap. There is inconclusive evidence of **complementarity between some financial instruments included in the RRPs and other funding sources** with some literature pointing towards the challenge of coordinating the different funding streams and ensuring absorption by public authorities. However further specific research on the complementarity with other EU funds is required.

Potential obstacles to the implementation of the financial instruments and their complementarity with other measures related **to insufficient political support, lack of market sponsoring, administrative complexity, and lack of awareness and ownership**. In particular, issues of coordinating between different funds, ministries and with other government levels (EU, regional) and the ensuing complexity in light of the short timeframe, seems to be a key obstacle. Furthermore, the issue of a lack of private capital markets and the competition for limited financial resources has also been brought up, specifically in Member States with less advanced economies. Political support can become an issue when governments and therefore, priorities change.

To overcome these potential obstacles, several **good practices** were identified in our assessment. These include ensuring coordination, transparency and complementarity of funding through a central investment platform; the use of **technical assistance to support** the design and implementation of financial instruments as well as project promoters; sharing

knowledge and reusing pre-existing financial instruments, and involving experienced financial institutions such as the EIB or EBRD.

5. Discussion and policy recommendations

Based on the evidence collected, analyses presented, and conclusions drawn, this chapter presents the policy recommendations that we developed to support investments in the energy sector in the framework of the RRF. Specifically, the recommendations aim to suggest measures to assess the impact of the RRF on achieving energy targets, and measures that could highlight what complementary measures could be implemented to ensure a strong and long-lasting positive impact of the energy projects within the NRRPs.

In addition, this chapter reflects on issues that emerged during the development of this study which warrant further investigation. The last section, therefore, presents some ideas on potential avenues for future research on the topic.

5.1. Presentation of policy recommendations

Before presenting the policy recommendations elaborated in the development of this study, it is important to note that these recommendations reflect the state of play of the RRF in November 2022. At the time of writing, the implementation of NRRPs is still in its early stage. Therefore, a more structured assessment of impacts once the RRF has been fully implemented could provide more details and recommendations on shortcomings to address in future policymaking.

Our proposed policy recommendations are grouped around two topics. These are:

- Measures to assess the impact of the RRF on achieving energy targets;
- Complementary measures to ensure a long-lasting effect of the RRF.

The next sections present our policy recommendations across these topics. We first present the key findings of the study, followed by the recommendation to address them.

Assessing the impact of the RRF on achieving energy targets

Key finding 1: At this juncture, it is **difficult to quantify the expected impact** of energy measures within the NRRPs on GHG emissions. While some Member States included estimates in their NRRPs on how measures would reduce for example CO2 emissions, not all have done it at a similar level of detail.[44] It was required for 37% of funding to be allocated to climate spending, which was checked at the Member State level by following the Climate Tracking Methodology outlined in Annex VI of the RRF Regulation. However, this assessment does not entail an estimate of the contributions to climate targets.

Due to the different levels of detail and methodologies chosen at the stage of drafting the NRRPs, a commonly agreed methodology is needed to assess the expected impacts. Such common indicators are part of the recovery and resilience scoreboard in Regulation (EU) 2021/2106, which also includes the requirement for regular reporting under the European Semester[45]. The following three indicators are of particular interest in supporting the clean energy transition:

[44] Germany for one used a traffic light system based on a qualitative assessment and only provided for a few measures numbers on expected GHG emission reduction, while Bulgaria and France have done more detailed assessments.

[45] All Member States are required to report to the Commission twice a year in the context of the European Semester on the progress made in the achievement of their RRPs, including the operational arrangements, and on the common indicators.

- savings in annual primary energy consumption;
- additional operational capacity installed for renewable energy; and
- alternative fuels infrastructure (refuelling/recharging points).

Further to these indicators and reporting requirements, Member States are already required to report every two years – following a progress reporting template – on the progress in regards to their NECP targets. Considering our finding on a lack of comparability between the measures outlined in the NRRPs and their expected impacts with the measures and targets included in the NECPs, we believe further analysis can be carried out by **better using the existing reporting requirements and applying a common methodology to assess energy impacts**.

Recommendation 1

- To address the different levels of detail and methodologies chosen at the stage of drafting the NRRPs, the European Commission should **develop a simple methodology for assessing the GHG emission reductions related to investment measures** in terms of their savings in annual primary energy consumption, additional renewable energy capacity and alternative fuels infrastructure installed. This could be done using the existing common indicators. The methodology should differentiate between different types of investments (e.g. additional renewable energy sources, energy efficiency in buildings and industry)[46] and allow to derive estimates for GHG reductions of measures. Considerations should also be made in case measures could lead to additional energy consumption (e.g. for measures in the domain of hydrogen or electromobility).
- To avoid doubling efforts between reporting requirements for the NECP and the European Semester, the **European Commission reviewed its NECP progress report template to assess if it properly incorporates the RRF (and REPowerEU) as a funding source.** RRF is now being included in progress reporting as one of the available funding sources. While this review is valuable and streamlines reporting, NECP reporting could further reflect on the contribution to reducing GHG emissions of individual NRRPs' measures.

Objective

- The aim is to arrive at a clearer understanding of how current RRF measures contribute to the energy targets of Member States and complement other existing (and planned) measures. Such an analysis would allow the Member States and the European Commission to better assess the contribution of the NRRPs to the overall EU energy (and climate) targets for 2030 and 2050. While the integration of RRF as a funding source is underway in NECP reporting, creating a clearer link between the measures funded by such a facility and their contribution to GHG reduction would be a valuable addition.

[46] For example, for its Cohesion Policy, the European Commission provided guidance on financial tracking of investments with climate impact, see: https://cohesiondata.ec.europa.eu/stories/s/Tracking-climate-related-investments/a8jn-38y8.

Complementary measures to ensure a long-lasting effect of the RRF

Key finding 2: Member States largely relied on grants as opposed to financial instruments for energy projects in the NRRPs to quickly reach beneficiaries and foster the uptake of measures. There are multiple reasons for this decision. First, financial instruments were not required by the RRF Regulation. Second, **grants were more attractive options** due to the lack of time in preparing the plans, the short timeframe for implementing the NRRPs, and their simplicity compared to setting up new financial instruments. The latter is probably the most significant reason, as setting up new ones is further complicated by the lack of existing financial instruments to be used as blueprints. Finally, the lack of financial instruments is partly explained by the specific nature of certain energy projects (i.e. large energy infrastructure and sustainable transport projects are carried out by public authorities and thus are typically funded directly by public money or that more mature technologies allow for more market-based financing, while less mature technologies often rely on grants as is the case for hydrogen).

Recommendation 2

- The Commission could further strengthen its guidance to the Member States in designing financial instruments[47] for different types of energy projects, taking into account their specific nature e.g. in terms of maturity. To this end, it could raise awareness of the available support, e.g. via the Technical Support Instrument, and develop a report on the financial instruments successfully implemented across NRRPs with steps to replicate them. This could be incorporated with or used to complement existing guidance prepared by the EIB under the fi-compass.
- In particular, considering the possibilities of complementing public funding with private finance and reusing money after repayment through financial instruments, the European Commission could – to the extent possible, given the specific nature of certain energy projects – encourage Member States with sufficiently developed private financial markets to make use of their currently underused loan compartments to set up new financial instruments. This could also allow Member States that had their RRF allocation reduced due to updated economic indicators to find ways to finance RRF measures they would otherwise not be able to fund. The guidance and possible replicable blueprints of financial instruments mentioned above could help Member States in setting these up more easily.

Objective

- This recommendation aims at developing financial instruments for energy projects to boost private financial participation. This will help ensure a long-lasting impact on the RRF after its funding channel runs out as money can be reinvested after repayment.

[47] See for example recent publications from the FI-Compass on financial instruments for energy efficiency in buildings: https://ec.europa.eu/regional_policy/en/newsroom/news/2022/06/21-06-2022-commission-and-eib-launch-two-new-blueprints-for-repowereu-and-new-european-bauhaus-financial-instruments.

5.2. Further research

A key finding of this study is **the lack of research available on the RRF and its potential impacts** on achieving energy targets. Partially, this is due to most measures not yet being implemented and only a few having been launched. Therefore, any existing assessment is preliminary and relies on estimates provided by Member States in their RRPs. With recommendation 3.1 we suggest developing further analysis of the impact of emissions on the basis of the existing reporting by the Member States, which could prove useful for the NECP. However, beyond the aspect of monitoring by Member States (and the European Commission), we also identified a few other areas of research that could benefit from further investigation. These research areas related to financial instruments, complementarity between the RRF and Cohesion Policy funding, the revision of energy targets in the NECPs and the impacts of energy projects within the NRRPs:

- Ex-post assessment of the multiplier effect of financial instruments for different energy categories. This would provide an assessment of how well they functioned in terms of crowding in private financing and creating private investments for the energy transition[48]. This recommendation is valid for all EU instruments.
- Recent evidence on the complementarity between RRF and Cohesion Policy funding remains inconclusive. Literature points towards both potential synergies in implementation of measures as well as risks of substitution.[49] Member States, on the other hand, indicate that the funds are complementary. Therefore, a thorough assessment of the relationship between Cohesion Policy funds and the RRF in the energy field is warranted to unpack the relationship between the two once both are firmly in place to be properly assessed.
- With the adoption of revised NECPs in 2023, a further comparison could reveal insights into the role of NRRP measures as part of the national policy mix to achieve the updated energy and climate targets. This analysis can help validate the results of this study and identify the energy categories and targets to which the highest contributions have been made.
- Assessment using CGE modelling of investments in energy projects included in the RRF to analyse their impact on reaching energy and climate targets in 2030, 2040, and 2050 under different scenarios (comparing against a baseline scenario that excludes the COVID-19 recovery funding and policies). Such an approach will be especially useful in estimating the gap between the planned recovery spending and the investments in the energy field needed to meet the Paris Agreement goals.[50]

[48] For an example of a study done for ESIF, see: https://www.imf.org/en/Publications/WP/Issues/2021/04/30/The-Fiscal-Multiplier-of-European-Structural-Investment-Funds-Aggregate-and-Sectoral-Effects-50249.

[49] J. Barbero, A. Conte, et al. (2022) The impact of the recovery fund on EU regions: a spatial general equilibrium analysis, Regional Studies.

[50] Rochedo, P., et al (2021) "Is Green Recovery Enough? Analysing the Impacts of Post-COVID-19 Economic Packages" *Energies* 14(17):5567. https://doi.org/10.3390/en14175567.

List of literature

Agora Energiewende (2022), Matching money with green ideas. A guide to the 2021–2027 EU budget. Available at: https://static.agora-energiewende.de/fileadmin/Projekte/2021/2021-04_ClimFin/AEW_215_Matching-money-with-green-ideas-EU_WEB.pdf

Bär, V., Leisinger, C., and Neubert, C., (2021), German Development and Resilience Plan: missed opportunity for climate-friendly and social mobility?, Forum for Ecological-Social Market Economy. Available at: https://foes.de/publikationen/2021/2021-04_FOES_DARP.pdf

Barbero, J., Conte A., et al. (2022) The impact of the recovery fund on EU regions: a spatial general equilibrium analysis, Regional Studies. Available at: https://www.tandfonline.com/doi/full/10.1080/00343404.2022.2123467

Bartzokas, A., Giacon, R. and Macchiarelli, C. (2022), Exogenous Shocks and Proactive Resilience in the EU: The Case of the Recovery and Resilience Facility. Available at: https://www.lse.ac.uk/european-institute/Assets/Documents/LEQS-Discussion-Papers/EIQPaper177.pdf

Corti, F., and Ferrer, J., (2021), Steering and Monitoring the Recovery and Resilience Plans - Reading between the lines, Centre for European Policy Studies. Available at: https://www.ceps.eu/wp-content/uploads/2021/04/Recovery-and-Resilience-Reflection-Paper-No-2.pdf

Corti, F., Gros, D., Liscai, A., and et al., (2022), The European added value of the Recovery and Resilience Facility, European Parliament. Available at: https://www.europarl.europa.eu/RegData/etudes/STUD/2022/699513/IPOL_STU(2022)699513_EN.pdf

EIB (2020), Stocktaking study on financial instruments by sector. Progress to date, market needs and implications for financial instruments, FI-Compass. Available at: https://www.fi-compass.eu/stocktaking-study-financial-instruments-sector

EIB (2020), The potential for investment in energy efficiency through financial instruments in the European Union. Available at: https://www.fi-compass.eu/sites/default/files/publications/energy-efficiency-model_0.pdf.

EIB (2021), FMFIB: Fund Manager of Financial Instruments in Bulgaria – a multi-sector fund of funds. Available at : https://www.fi-compass.eu/publication/case-studies/fmfib-fund-manager-financial-instruments-bulgaria-multi-sector-fund-funds.

EIB (2022), ELENA – European Local ENergy Assistance. Available at: https://www.eib.org/en/products/advisory-services/elena/index.htm

European Commission (2015), Guidance for the Member States on Financial Instruments – Glossary. Available at: https://ec.europa.eu/regional_policy/en/information/publications/guidelines/2015/guidance-for-member-states-on-financial-instruments-glossary

European Commission (2015), A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2015:80:FIN

European Commission (2021) Guidance To Member States Recovery And Resilience Plans, SWD(2021) 12 final Part 1/2. Available at: https://commission.europa.eu/system/files/2021-01/document_travail_service_part1_v2_en.pdf.

European Commission (2021) Guidance To Member States Recovery And Resilience Plans, SWD(2021) 12 final Part 2/2. Available at: https://commission.europa.eu/system/files/2021-01/document_travail_service_part2_v3_en.pdf.

European Commission (2022) Commission Notice. Guidance on Recovery and Resilience Plans in the context of REPowerEU. Available at: https://commission.europa.eu/system/files/2022-05/c_2022_3300_1_en_0.pdf.

European Commission (2022), Technical Support Instrument. Avalable at: https://ec.europa.eu/info/funding-tenders/find-funding/eu-funding-programmes/technical-support-instrument_en

European Commission, and European Investment Bank (2022), Model for a financial instrument with a grant component to support energy efficiency - a fi-compass model. Available at: https://www.fi-compass.eu/sites/default/files/publications/energy-efficiency-model_0.pdf

European Committee of the Regions (2021), ECON-VII/018 147th plenary session, 1-2 December 2021 , Opinion: Implementation of the Recovery and Resilience Facility.

European Parliament (2022), Recovery and Resilience Plans: the involvement of stakeholders and their views. Available at: https://www.europarl.europa.eu/RegData/etudes/IDAN/2022/699530/IPOL_IDA(2022)699530_EN.pdf.

European Parliament (2017), Financial Instruments: defining the rationale for triggering their use. Available at: https://www.europarl.europa.eu/RegData/etudes/STUD/2017/603787/IPOL_STU(2017)603787_EN.pdf

Faiña, A. et al. (2012), “Expert evaluation network delivering policy analysis on the performance of Cohesion Policy 2007-2013. Task 1: Financial engineering”. Available at: https://www.researchgate.net/publication/292617027_Expert_evaluation_network_delivering_policy_analysis_on_the_performance_of_Cohesion_policy_2007-2013_-_Financial_engineering

Green Recovery Tracker (2021), Recovery Investments and the European Energy Transition. Available at: https://www.greenrecoverytracker.org/

Jasper (2022), Joint Assistance to Support Projects in European Regions. Available at: https://jaspers.eib.org/

The Clean Energy Ministerial (2022), High Upfront Costs. Available at: https://www.cleanenergyministerial.org/resources-cesc/finance/barriers/high-upfront-costs/

Walsh, J., (2021), DYK: climate action is supported with major EU investments in the regions, European Commission. Available at: https://cohesiondata.ec.europa.eu/stories/s/Tracking-climate-related-investments/a8jn-38y8

Wishlade, F. and Michie, R. (2017) Financial Instruments in Practice : Uptake and Limitations. Available at: https://www.oecd.org/cfe/regionaldevelopment/Wishlade_Michie_Financial-Instruments-in-Practice.pdf

Whishlade, F. (2017), Improving the take-up and effectiveness of financial instrument. Available at: https://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/improve_effective_fei_en.pdf

World Bank (2021), What You Need to Know About IFC's Green Bond. Available at: https://www.worldbank.org/en/news/feature/2021/12/08/what-you-need-to-know-about-ifc-s-green-bonds

Annex A – List of financial instruments

In the following two tables, we present the specified and unspecified financial instruments identified in the NRRPs. The first table lists the specified instruments, including also the allocated RRF funding, energy categories, types of financial instruments as well as short descriptions of each instrument. The second table shows the instruments that were mentioned in the NRRPs but were lacking some elements of information (e.g., allocated funding from the RRF) needed for a more detailed analysis.

Table A.1 Specified financial instruments in the NRRPs

Member State	Name of the financial instrument/measure	Funding from RRF (EUR million)	Energy category	Type of financial instrument	Short description
BG	Economic Transformation Programme - Fund 2: Green Transition and Circular Economy	75	Energy efficiency in industry and other; Renewable energy production	guarantee	One element of the fund is a guarantee instrument for renewable energy sources and energy efficiency.
BG	Economic Transformation Programme - Fund 3: Investment in Climate Neutrality and Digital Transformation	30	Energy infrastructure	equity	Equity instruments for infrastructure projects (project financing) to produce and store green energy as well as charging infrastructure and digital infrastructure.
DE	Pilot programme for carbon contracts for difference	550	Energy efficiency in industry and other	other	Pilot programme for CCfDs, the exact concept is being developed.
EE	Green Fund	100	Renewable energy production; Energy efficiency in industry and other	equity	Investment program for green technology companies, offering direct investments and investments in private venture capital funds.
EL	RRP Loan Facility - Energy efficiency and demonstration projects in SMEs or large enterprises	4,128	Energy efficiency in industry and other; Renewable energy production; Energy infrastructure	loan; equity	Measure includes several separate financial instruments aiming to promote private investments, especially in the areas of renewable energy, energy efficiency and smart energy systems.
FR	Recovery Participatory Loans	250	Energy efficiency in industry and other	loan; guarantee	Distributed by credit institutions, the instrument makes it possible to finance, over the long term, investment operations and development projects (e.g. for energy transition).
LV	Improving the energy efficiency of multi-apartment buildings and transition to renewable energy technologies	74.817306	Energy efficiency in buildings (renovation)	loan; guarantee	The objective is to promote energy efficiency improvement, smart energy management and the use of renewable energy resources at apartment buildings by offering guarantees, loans and grants.

LV	Energy efficiency improvement measures, deployment of renewable energy technologies and R&D activities	120.586	Energy efficiency in industry and other	loan; capital rebate	The objective is to encourage companies to invest in R&D, especially in energy efficiency and transition to renewable energy sources, by offering loans and capital rebates.
PL	Support for a low-carbon economy	114	Sustainable Transport	loan; equity	The fund will provide equity and debt support for corporate investment projects related to the development of industry for low and zero-emission solutions in the field of sustainable mobility and energy.
RO	Portfolio guarantee for climate action	200	Energy efficiency in industry and other	guarantee	Portfolio guarantees, implemented by European Investment Fund, aim to, for example, improve the energy efficiency.
RO	Fund of funds for digitalisation, climate action and other areas of interest	300	Energy efficiency in industry and other	loan	The instrument provides large companies access to finance while one third of the allocation will be dedicated to green transition investments.
RO	Financial instrument for investments in energy efficiency in residential and buildings sector	50	Energy efficiency in buildings (renovation)	guarantee	Instrument for investments in energy efficiency and renewable energy, including an uncapped portfolio guarantee.

Table A.2 Unspecified financial instruments in the NRRPs

Member State	Name of the financial instrument/measure	Funding from RRF (EUR million)	Energy category	Type of financial instrument	Comment
BG	National Decarbonisation Fund	0	Energy efficiency in industry and other; energy efficiency in buildings (renovation); renewable energy production	other; guarantee	Reform
BG	National Trust EcoFund (NDEF)	0	Sustainable transport	guarantee	Reform
BG	Energy efficiency in the building stock: measures to improve energy efficiency in the country's housing stock	608.17	Energy efficiency in buildings (renovation)	other	Unspecified. As the measure has several elements, it is unclear what is the exact amount of RRF funding allocated to the financial instrument.
CY	State funded equity fund: Cyprus Equity Fund (CEF)	N/A	unspecified	equity	Unspecified. The objective area is broad and will be specified in 2023. Hence, the instrument's link to energy projects is not clear.
FR	Pret Vert (Ademe-Bpifrance green loan)	N/A	Energy efficiency in industry and other	loan	Unspecified. Lacking the information on the allocated RRF funding.
FR	Relance bonds (OR)	N/A	Energy efficiency in industry and other	bond; guarantee	Unspecified. Lacking the information on the allocated RRF funding.
HR	Increasing the structural sustainability of the economy and fostering the green transition	N/A	Energy efficiency in industry and other; renewable energy production	loan; guarantee	Reform
LU	Aid scheme for charging stations	N/A	Sustainable Transport	N/A	The design of the financial instruments will depend on the results of a preparatory study.

Annex B – Country fiches

The country fiches are presented in alphabetical order:

Austria

Total budget of the NRRP	EUR 3.46 billion
Grants	EUR 3.46 billion
Loans	EUR 0 billion

Overview - The NRRP of Austria contains 27 reforms and 37 investments related to energy projects. In particular for investments, five are on energy efficiency in buildings (renovation), one on energy efficiency in industry and other, three on renewable energy production, one on hydrogen, none on energy infrastructure and four on sustainable mobility. The highest NRRP funding is dedicated to sustainable mobility and energy efficiency in buildings (EUR 1352.6 million and EUR 777.9 million). Our findings show that energy efficiency in buildings and renewable energy production are often combined while energy infrastructure, energy efficiency in industry, and hydrogen are not a large focus. In regard to financial instruments, the NRRP does not include any financial instruments.

Overview of energy and climate targets of Austria and relevant policy initiatives

The Austrian NECP foresees a 36% reduction in 2030, mainly from transport, agriculture, buildings and waste. There is not a target for the share of renewable energy but it will be in the range of 45 to 50%.

Austria's national Recovery and resilience plan (NRRP)

There are four components of the Austrian RRP: (i) sustainable building (EUR 1507.5 million), (ii) digital design (EUR 1828 million), (iii) knowledge-based construction (EUR 868.4 million), (iv) equitable construction (EUR 295.7 million).

Austria submitted its NRRP on 30 April 2021 which was endorsed by the European Commission on 21 June 2021 and the Council adopted the plan on 13 July 2021.

Assessment of the topic of energy efficiency in buildings (renovation)

Our analysis of the NRRP identified one reform and five investments targeting energy efficiency in buildings for an amount of EUR 777.9 million. The aim of these investments focus on the phasing out of oil and gas heaters in buildings for homeowners, businesses as well as measures and support for combating energy poverty.

Assessment of the topic of energy efficiency in industry and other and renewable energy production

Our analysis of the NRRP identified one investment in energy efficiency in industry for an amount of EUR 100 million. This investment is focused on transforming industry to

becoming climate neutral. This investment is also categorised as a renewable energy production energy project as it the aim of the measure is to stimulate industry to become climate neutral by increasing the share in renewable energy sources and energy efficiency measures. In total our analysis of the NRRP identified two investments and one reform in renewable energy production. In addition to the share measure of climate-neutral industry, the reform establishes the Renewable Expansion Act and the other on stimulating ecological investments in enterprises.

Assessment of the topic of hydrogen

Our analysis of the NRRP identified one investment targeting hydrogen for an amount of EU 125 million. The focus of this investment is on supporting the building of a European hydrogen ecosystem.

Assessment of the topic of energy infrastructure

Our analysis of the NRRP did not identify any specific investment on energy infrastructure.

Assessment of the topic of sustainable mobility

Our analysis of the NRRP identified four investments and two reforms targeting sustainable mobility for an amount of EUR 1352.6 million. The focuses of the investments are on promotion of zero-emissions buses and commercial vehicles including the required infrastructure. The two reforms include the Mobility Master Plan 2030 and the Introduction of 123 climate tickets.

Use of financial instruments in Austria's NRRP

Austria's NRRP does not provide detailed information on the financial instruments dedicated to green investments. Many of the grants for energy efficiency and mobility energy projects fund part of the investments to encourage private investments in those areas as well however, the NRRP does not explicitly include a financial instruments.

Conclusion on Austria's NRRP

The NRRP is in line with the NECP. The measures included in the NRRP in regards to energy efficiency in buildings and mobility link to the targets and ambitions set out in the NECP. The NRRP explicitly mentions the NECP and its targets and that all the measures outlined in the plan will contribute to the achievement thereof. It is unlikely that the NRRP measures go beyond the NECP targets.

The NRRP shows high ambitions for the **energy efficiency in buildings**, which is also in line with the goals of the NECP. For **renewable energy production**, similarly, the aggregated targets for the production capacity of the NRRP can be compared more closely with the NECP.

Both **energy efficiency in industry** and **energy infrastructure** are particularly difficult to compare with the NECP as there are not many measures in the NRRP. However this is also in line with the NECP as the focus is more on other types of energy investments. Especially for energy infrastructure the measures are centred more on reforms such as

the regulatory law market incentives, relaxing power line regulations, and developing Austrian grid infrastructure plan. **Hydrogen** measures are focused on supporting EU hydrogen ecosystem.

Finally, **sustainable mobility** receives a lot of attention in both the NRRP and the NECP. In the NECP there is a reduction in 7.2 million tons of CO2 equivalent compared to 2016 totals. The NRRP makes specific links to the NECP's targets of electrification by reducing GHG by 37% compared to 2005, however it does not specifically detail how much the NRRP contributes to it.

Belgium

Total budget of the NRRP	EUR 5.9 billion
Grants	EUR 5.9 billion
Loans	EUR 0.0 billion
% supporting climate objectives	49.6%

Overview - The NRRP of Belgium contains 12 reforms and 35 investments related to energy and climate projects. In particular for investments, 14 are on sustainable transport, 13 on Energy efficiency in buildings (renovation), 2 on Energy efficiency in industry and other, 3 on Hydrogen, 3 on Energy infrastructure and 0 on Renewable energy production. The highest NRRP funding is dedicated to Sustainable Transport (EUR 856 million), followed by Energy Efficiency in buildings (EUR 582 million). Our findings highlight that significant shares of the RRF funding target sustainable transport, energy efficiency in buildings (renovation), and also address energy infrastructure and hydrogen aspects, while energy efficiency in industry is not a considerable part of the focus. Regarding the financial instruments, the NRRP does not develop extensively on the instruments being developed.

Overview of energy-related targets in Belgium's National Energy and Climate Plan (NECP)

The NECP of Belgium seeks to achieve several high-level and specific objectives in line with the five dimensions of energy established by the Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action: decarbonisation, energy efficiency, energy security, internal market and research, innovation and competitiveness. The Belgian NECP is organised around the Federal government, the three regions (Wallonia, Flanders and the Brussels Region) and the three communities (Flemish, French-speaking, and German-speaking community). This division of competences is reflected in the integrated NECP. It covers the five dimensions of the Energy Union, with clear national contribution being developed GHG emission reduction, energy efficiency and renewable energy. Notably, the NECP was sent for to the European Commission in late 2018 and finalised in late 2019. Many of the targets set in the plan, such as the renewable energy and energy efficiency targets, have been judged as unambitious or with low ambition by the Commission.

Belgium's national Recovery and Resilience Plan (NRRP)

The 6 axes of the Belgian RRP plan are (i) Climate, Sustainability and Innovation (EUR 2.02 billion); (ii) Digital Transformation (EUR 0.763 billion); (iii) Mobility (EUR 1.292 billion); (iv) Humans and Society (EUR 0.834 billion), (v) Economy of the Future and Productivity (EUR 1.008 billion), and (vi) Public Finances - Expenditure Audits (EUR 8.30 million) comprising in total 124 measures, of which 36 reforms and 88 investments.

The Climate, Sustainability and Innovation axe is divided into 4 components: (i) Renovation of Buildings (EUR 1,012.15 million), (ii) Emerging Energy Technologies (EUR 607.95 million), (iii) Climate & Environment (EUR 399.66 million), and (iv) Improved Energy Subsidy Scheme (EUR 264 million). Meanwhile, the Mobility axe is divided into 3

components: (i) Cycling and Walking Infrastructure (EUR 410.17 million), (ii) Modal Shift (EUR 672.01 million), and (iii) Greening Road Transport (EUR 209.46 million).

Belgium submitted its NRRP in May 2021, which was then endorsed by the European Commission in June of the same year. The European Commission has disbursed EUR 770 million in pre-financing to Belgium in August 2021.

Assessment of the topic of energy efficiency in buildings (renovation)

Our analysis of the NRRP identified 13 investments and 3 reforms targeting energy efficiency in buildings, for a total of roughly EUR 860 million allocated to the different measures. These measures, contributing to the long-term goal of achieving complete decarbonisation of the civil sector in 2050, aim to overcome economic and non-economic barriers that reduce investment choices in interventions of energy requalification of buildings, or that slow down the execution of the works. The measures of the NRRP in building efficiency mostly focus on investing in social housing and public buildings (schools, sports centres) renovation, and reforming the subsidy scheme for private housing renovation.

Assessment of the topic of energy efficiency in industry and other

Our analysis of the NRRP has identified 2 investments related to energy efficiency in industry, for an amount of EUR 76.45 million. The aim of these investments is to support the development of a low-emission industry in the Walloon region as well as advance research into low-carbon technologies in French-speaking universities.

Assessment of the topic of renewable energy production

Our analysis of the NRRP identified no investments or reforms targeting primarily renewable energy production. However, the proposed measures to develop and expand district heating networks in Flanders, and to support the development of an offshore energy island for connection of wind generation capacity are expected to contribute to an increasing share of renewable energy sources in the Belgian energy mix.

Assessment of the topic of hydrogen

Our analysis of the NRRP identified 3 investments and 1 reform targeting hydrogen, for a total of EUR 175 million allocated from RRF funds to the different measures. The proposed measures aim to develop an industrial hydrogen value chain at the federal level, but also regional levels for Wallonia and Flanders by providing investment support in technologies enabling the use of hydrogen in industry.

Assessment of the topic of energy infrastructure

Our analysis of the NRRP identified 3 investments targeting energy infrastructures, for a total of roughly EUR 239.3 million allocated to these measures The proposed measures aim to develop a hydrogen transport network, focusing on the main industrial clusters in Flanders and Wallonia (Antwerp, Ghent, Hainaut, Liège), and Brussels. Furthermore, investments in the expansion of district heating in Flanders are supported with the aim to increase the use of waste heat and renewable heating. Additionally, an offshore energy island is planned to create the infrastructure for 2.1 GW of offshore wind generation capacity. Supporting this project with EUR 100 million will ultimately reduce the cost burden on consumers, as it is not eligible for the calculation of distribution tariffs.

Assessment of the topic of sustainable transport

Our analysis of the NRRP identified 14 investments and 7 reforms targeting sustainable transport, for a total of roughly EUR 856 million allocated to the different measures. The proposed measures aim first to build charging infrastructures in order to promote the development of electric mobility and accelerate the transition from the traditional model of fuel-based refuelling stations. Secondly, the measures target the gradual replacement of buses and public transport vehicles with new, less polluting vehicles, in particular electric vehicles. And finally, the measures support the modal shift from individual fuel-based transport to public transport and cycling by investing in expanding the infrastructure in all regions.

Use of financial instruments in Belgium's NRRP

Belgium's NRRP does not provide detailed information on the financial instruments dedicated to green investments. However, the NRRP makes clear that reforms on energy subsidy schemes related to energy efficiency in buildings are key to a fast transition for the housing stock (e.g. allowances linked to housing renovation, EPC label bonus, VAT reduction on demolition and reconstruction). In addition, the RRP focuses on investments through subsidies for renovation and improvement of energy efficiency of the existing public building stock, such as sports and cultural venues, but also social housing units. For this, the RRP foresees a small part of the budget to cover additional interest fees which should help regions to access financing means from financial markets.

Conclusion on Belgium's NRRP

The comparability between the NRRP and the NECP is somewhat limited by the lack of a systematic correspondence between the measures proposed in the NRRP and the environmental targets of the NECP. This indicates a high level of additionality, but the different impact assessment metrics do not allow for a comparison at the same level. Overall, the NRRP explicitly mentions that all the measures outlined in the plan will contribute to the achievement and the overcoming of the objectives defined by the NECP in force.

Energy efficiency in buildings: both the NECP and the NRRP develop measures to improve energy efficiency in buildings. However, those measures do not target the same objectives. Indeed, the NRRP focuses on investments to renovate parts of the public building/housing stock (mainly social housing and cultural/sports venues), and on the reform of energy subsidy schemes across the different regions. On the other hand, the NECP focuses on establishing objectives to reduce the consumption of the private building stock through diverse measures. Therefore, the two plans are working on different aspects of the transition to improve energy efficiency in buildings and the RRP measures can be expected to have a high contribution to the overall GHG reduction from buildings.

Energy efficiency in industry and other: there is a limited number of measures elaborated in both the NECP and the NRRP concerning the energy efficiency in industry and other sectors. For the NRRP, various measures are introduced to reduce CO2 emission of the industry in the Walloon region and French-speaking community, while the NECP focuses on targeting neutral tertiary buildings by 2050. These measures will likely only have a direct small impact on the ambition and potential results.

Renewable energy production: when addressing the production of renewable energy, the NRRP only does so indirectly. The investments to increase the capacity of the offshore energy island are projected to enable 2.1 GW of wind generation capacity. The same applies to district heating networks that will enable heat from renewable and waste heat sources.

Hydrogen: some general objectives linked to hydrogen are mentioned in the NECP, but no specific target or measure is described, The NRRP in contrast describes precise measures to develop the industrial value chain for hydrogen across the different regions of the country, and the definition of a regulatory framework for the hydrogen market. It can thus be concluded that the RRF funds will likely support Belgium in advancing on hydrogen integration.

Energy infrastructure: both the NRRP and the NECP integrate measures to develop district heating networks in Flanders. The NECP also contains the development of the energy island, and it can be assessed that the additional funds coming from the RRF will allow an increased capacity to provide renewable energy to Belgium. In addition, the RRP includes the development of a hydrogen and CO2 transportation network (100-160 km) that expands the infrastructure for these. The NECP defines precise targets in terms of renewable energy share and capacity to reach. With the additional funding and additional measures in the NRRP, it is assessed that there is a high likelihood for Belgium to reach higher energy targets through this measure.

Sustainable transport: the NECP develops an exhaustive list of measures aiming at green mobility. The NRRP also includes a long list of 14 investments to boost electromobility and modal shift to less energy and carbon-intensive transport means. When comparing the RRP to the NECP, it can be observed that the list and volume of measures to promote public transport can be expected to improve the climate impact of the transport sector, while the measures on electromobility will add smaller amounts to schemes planned in the NECP. Therefore, it has been assessed that there is a high likelihood of reaching higher energy target for this dimension.

Bulgaria

Total budget of the NRRP	EUR 5.69 billion[1]
Grants	EUR 5.69 billion
Loans	-
% supporting climate objectives	

Overview - The NRRP of Bulgaria contains 14 reforms and 14 investments related to energy projects. In particular for investments, 4 are in Energy efficiency in buildings (renovation), 1 in Energy efficiency in industry and other, 3 in Renewable energy production, 1 in Hydrogen, 2 in Energy infrastructure and 3 in Sustainable transport. The highest RRF funding is dedicated to the implementation of the renovation wave with EUR 1.616 billion (EUR 2.085 billion incl. national and private co-financing).

The NRRP includes 1 investment setting up new guarantee and equity financial instruments with a focus on energy efficiency in industry, renewable energy production and energy infrastructure. It also includes 1 reform to set up a National Decarbonisation Fund which will include credit lines and guarantees as well as 1 reform of an existing financial instrument (National Trust EcoFund)

Overview of energy-related targets in Bulgaria's National Energy and Climate Plan (NECP)

The NECP of Bulgaria aims to promote low-carbon economic development, develop a competitive and secure energy sector, reduce dependence on fuel and energy imports, and ensure that energy is available at affordable prices to all consumers. Notably, for energy, it seeks to increase energy security and diversify the supply of energy resources, develop an integrated and competitive energy market, use and develop energy from renewable sources, enhance energy efficiency by developing and implementing new technologies, and enable consumer protection by ensuring fair, transparent and non-discriminatory conditions for the use of energy services. In the NECP, Bulgaria sets itself the following 2030 targets: 27.09% share of renewable energy in gross final energy consumption; lowering primary energy consumption compared to the PRIMES 2007 baseline by 27.89% to 17,466 ktoe; 0% target for GHG emissions not covered by the EU Emissions Trading System compared to 2005; and an electricity interconnection level of 15%.

Bulgaria's national Recovery and Resilience Plan (NRRP)

Bulgaria's NRRP has an estimated total cost of EUR 6.9 billion, which is above the non-repayable financial support (grants) available to Bulgaria under the RRF Regulation of EUR 6.27 billion. Bulgaria has not requested any loans. The NRRP is structured around twelve components grouped in four policy pillars: i) Innovative Bulgaria; ii) Green Bulgaria; iii)

Connected Bulgaria; and iv) Fair Bulgaria. It consists of 103 individual measures (47 reforms and 56 investments).

Most energy-related projects fall under the Green Bulgaria pillar. This pillar accounts for 41.9% (EUR 2.896 billion) of total RRF resources. Adding to this, the Bulgarian authorities are expecting additional resources of EUR 25.7 million from the national budget and EUR 1.269 billion from private investments. Investments in the area of energy projects stem mainly from the Green Bulgaria component but also from Connected Bulgaria and to some extent the Innovative Bulgaria and Fair Bulgaria pillars. The former concerning sustainable transport and the latter two regarding energy efficiency in industry and buildings. According to our assessment, the total funding allocated to energy investment is EUR 6.270 billion with EUR 4.096 billion from the RRF.

Assessment of the topic of energy efficiency in buildings (renovation)

Our analysis of the NRRP identified 4 investments and 4 reforms targeting energy efficiency in buildings, for a total of roughly EUR 1.616 billion (EUR 2.085 billion including national and private co-financing) allocated to the different measures. Building renovation is seen as essential to support economic recovery by creating jobs in the construction sector, energy savings, healthier living conditions and reducing energy poverty. To achieve this, the NRRP foresees investments in the energy efficiency of the building stock (both residential and non-residential), artificial outdoor lighting for municipal systems, and the modernisation of educational and long-term care institutions. These are complemented by enabling reforms such as setting up a National Decarbonisation Fund to invest in low carbon development through targeted financing, a reform of the Condominium Property Management Act to address barriers in energy efficiency investments for residential buildings, the introduction of a definition and criteria for energy poverty to be used in prioritising energy efficiency projects, and the setting up of a one-stop shop to reduce the administrative burden for households and companies by providing information, technical assistance and advice on regulatory, technical and financial aspects.

The intended impact of these measures is an approximate annual primary energy savings of 784 GWh/y, annual GHG emission reduction of 287 ktCO2/y and refurbishment of 5,685,118 m2 by 2026. As such, the measures contribute to Bulgaria's overall ambitions of a renovated area of 22,203,509 m2 by 2030.

Assessment of the topic of energy efficiency in industry and other

Our analysis of the NRRP identified 1 investment and 3 reforms targeting energy efficiency in industry and other purposes, for a total of roughly EUR 688.296 million (EUR 1.498 billion including national and private co-financing) allocated to the different measures. The proposed measures target in particular the efficiency of the energy sector by encouraging the decarbonisation of the energy sector through a Climate Change Reduction Act and the reduction of GHG emissions from coal-fired power plants. Beyond this, programs aim to set up and propose instruments to incentivise and support energy efficiency investments in the industry. For example, a reform proposes to set up a National Decarbonisation Fund to provide grants, credit and guarantees to end-users of energy. Another reform proposes a financing mechanism for energy efficiency to explore the possibilities for implementing

measures and projects to increase energy efficiency and the use of energy from renewable sources in a context of limited financial resources. Finally, the first strand of the Green Transition and Circular Economy Fund (Economic Transformation Program) aims to support the transition to climate neutrality by improving energy efficiency and enterprise-level independence. For this purpose, a guarantee instrument for energy efficiency and renewable energy is foreseen.

For the decarbonisation of the energy sector, the intended impact is to reduce carbon emissions from electricity generation by 40% by 2030, while the Economic Transformation Program aims to save 110,761 tCO2 by 2026.

Assessment of the topic of renewable energy production

Our analysis of the NRRP identified 3 investments and 6 reforms targeting renewable energy production, for a total of roughly EUR 587.418 million (EUR 1.321 billion including private and national co-financing) allocated to the different measures. These measures aim to address Bulgaria's ambition of reaching a 27.09% share of energy from renewable sources in gross final energy consumption by 2030 (21.6 % in 2019). In particular, this share is projected to be achieved by increasing the installed capacity of renewable energy plants by up to 3,000 MW, with 6,973 MW of plants expected to be connected to the electricity system by 2030.

To achieve this, the NRRP proposes two reforms, the aforementioned National Decarbonisation Fund and a financing mechanism for renewable projects. The former once set up, would use a combination of financial instruments ad grants to promote renewable energy projects with a target additional capacity of 4,500 MW. The latter does not specify any targets. In addition, a programme for financing single measures for renewable energy in single-family buildings and multi-apartment buildings should encourage 9,500 households to increase the use of renewable energy by financing the costs of purchases. Another reform aims to incentivise the production of electricity from renewables by reducing the administrative burden for investments. It targets an additional 3,500 MW of new RES capacity (wind and solar) by June 2026. Finally, an investment scheme is proposed to support the construction of 1.4 GW of renewables combined with storage facilities through five tender procedures as well as another scheme funding a pilot project for the use of geothermal energy to produce 10 MW of electricity and 30 MW of heat.

These measures are further complemented by the introduction of the Climate Change Reduction Act (Reform on the decarbonisation of the energy sector, a reform to set up a Commission for the Energy Transition and a reform to liberalise the electricity market. Overall, the measures set out ambitious targets with an installed renewable capacity of 9.41 GW which exceeds the targets of the NECP.

Assessment of the topic of hydrogen

Our analysis of the NRRP identified 1 investment and 1 reform targeting hydrogen, for a total of roughly EUR 34.935 million (EUR 69.819 million including private and national co-financing) allocated to the one investment measure. The proposed reform aims to adopt a national roadmap for the promotion of hydrogen technology and production. The roadmap

should be developed in the first quarter of 2023 building on a report assessing the potential of Hydrogen (Q3/2022). Beyond this reform, an investment support scheme for pilot projects to produce green hydrogen and biogas is proposed. It will be implemented through industry and research funding targeted at new production facilities and should be complemented by private co-financing (50%). It aims at installing a production capacity for green hydrogen of 65MW or 9,000 tonnes a year by 2026. In itself, the hydrogen ambitions of Bulgaria are not high, however, the pilot project exceeds its initial ambitions of 20MW when it was proposed in the NECP.

Assessment of the topic of energy infrastructure

Our analysis of the NRRP identified 2 investments and 2 reforms targeting energy infrastructures, for a total of roughly EUR 985.728 million (EUR 1.109 billion including private and national co-financing) allocated to the two investment measures. The proposed measures aim to modernise and liberalise as well as improve governance for energy infrastructure. In particular, one investment targets the digital transformation through the development of information and real-time systems for the Energy System Operator. This investment would modernise the planning, management and maintenance activities of the country's electricity grid. This is coupled with two reforms, one to liberalise the electricity market, including wholesale and retail, and the other to improve the corporate governance of state-owned companies in the energy sector by unbundling the ownership of the two TSOs for natural gas and electricity from the corporate structure of Bulgarian Energy Holding. Finally, also investments into a national infrastructure for electricity storage facilities are planned through the RESTORE project, which foresees to install of a total charging capacity of 6,000 MW/h. This is also flanked by reform on e-mobility, which aims for the construction of charging infrastructure, reaching the construction of at least 10,000 public charging points for electric vehicles.

Assessment of the topic of sustainable transport

Our analysis of the NRRP identified 3 investments and 3 reforms targeting sustainable transport, for a total of roughly EUR 188.220 million (182 million from the RRF) allocated to the different measures. A central measure proposed, is the updating of the strategic framework of the transport sector, which among others will set specific targets to increase the share of renewable energy in transport fuel consumption to reduce the carbon footprint of the transport sector. The framework will have three strands: 1) decarbonisation of road transport; 2) investment preparation and prioritisation for state-owned transport companies; and 3) rail transport.

This strategic framework is flanked by two other reforms, one on sustainable urban mobility which encourages Integrated Territorial Strategies (ITS) for the development of NUTS 2 planning areas & implementation of Sustainable Urban Mobility Plans. These will be a prerequisite for investments supported by the European structural and investment funds. The other is the aforementioned reform on e-mobility, which aims to accelerate the construction of charging infrastructure and the electrification of vehicles and initiate the implementation of a comprehensive long-term vision for sustainable national and urban electromobility. Investments in the area focus on the construction of an intermodal freight

terminal in the region of Ruse, which should reduce road freight traffic, and the construction of a new metro line in Sofia reducing the number of cars on the road in the city by close to 7,000 per day, and a green mobility pilot scheme. The pilot scheme will provide funding to public transport services to support the integration of zero-emission public transport vehicles, and the construction of charging stations for public transport vehicles, among other activities.

Overall, since the NECP does not contain any clear targets for sustainable transport, its ambition is not comparable with the NRRP. Many of the measures in the NRRP echo proposed measures from the NECP, however, some also seem to go beyond what had initially been proposed.

Use of financial instruments in Bulgaria's NRRP

The NRRP of Bulgaria contains 2 relevant financial instruments within the Economic Transformation Programme (ETP). Through its three separate funds, the ETP aims to provide EUR 1.497 billion in funding (46% from the RRF and 54% from private investments). All measures under the first fund (Recovery and growth and Innovation) do not have any direct impact on the energy transition. The two relevant funds for the energy transition are the "Green Transition and Circular Economy" fund and the "Investment in Climate Neutrality and Digital Transformation" fund.

The "Green Transition and Circular Economy" fund consists of three separate measures, the first and third are grant scheme and not financial instruments. The first measure has a budget of EUR 202 million and aims to support manufacturing companies to install energy production coupled with energy storage capacities, while the third has a budget of EUR 92 million and helps companies to transition to a circular economy. Both have a requirement to co-finance at least 50%. The second measure is a guarantee financial instrument. The European Investment Fund (EIF) will be responsible for this instrument following InvestEU rules and the total funding is EUR 75 million which after attracting private financing is expected to grow to EUR 225 million. This expected increase of three times the initial funding was validated by an evaluation of the EIF. The guarantee will be used for loans that target the installation of renewable energy production and energy efficiency projects. In contrast to the first measure, the energy production created through this measure can also be sold and is not just for the own use of the company. After the guarantee agreement is signed with the EIF, the EIF will select financial intermediaries and other credit institutions to start issuing loans. It is expected that the instrument will be on the market early 2023. The Bulgarian Ministry responsible for the instrument has experience working with the EIF on similar instruments such as the JEREMIE initiative and a separate SME initiative that ran from 2014 – 2020. Commercial banks are also familiar with the process.

The "Investment in Climate Neutrality and Digital Transformation" fund consist of one measure, an equity instrument supporting the development of large infrastructure projects such as for generation and storage of renewable energy, biomass storage, charging infrastructure for electric vehicles and hydrogen infrastructure, but also digital infrastructure. The budget for this instrument is EUR 30 million which should be

complemented by private co-financing of the same amount. It is not specified how much of this money will go to green and how much to digital projects as this is up to the financial intermediaries, which will be selected by the EIF who will manage the instrument. This is a new measure for the Bulgarian government, however it will be structured and managed by the EIF based on an instrument that the EIF has started to develop in 2021 and which will be delivered also in other Member States.

Beyond this, the NRRP also mentions a **few other potential financial instruments**. First and foremost, a reform to establish a **National Decarbonisation Fund**, which aims to make use of credit lines and guarantees next to grants and technical assistance. The aim of Bulgarian policy makers is to gradually decrease the use of grants since grants cannot cover all the territory and take time in achieving their targets. The ambition is to pilot instruments and schemes that support financial instruments and their introduction as well as to reduce administrative burden in accessing financial instruments. Beyond this larger reform, there is also a proposed reform to upgrade the existing **National Trust EcoFund**, which provides incentives for constructing and managing electric charging infrastructure. Finally, an investment measure for the financing of renovation in the residential and non-residential building stock through Energy Saving Contracts or other financial mechanism is mentioned, which will be implemented with the involvement of the Bulgarian Development Bank and the Energy Efficiency Fund.

Bulgaria is also planning to introduce another financial instruments following the discussion on updating their NRRP as part of REPowerEU. The reason is that due to the reduction of grant funding one measure had lost its grant funding which Bulgaria aims to make up through funding from financial instruments..

Conclusion on Bulgaria's NRRP

The comparability between the NRRP and the NECP is somewhat limited by the lack of a systematic correspondence between the measures proposed in the NRRP and the energy targets of the NECP. Nevertheless, the NRRP explicitly mentions the NECP and its targets and that all the measures outlined in the plan will contribute to the achievement thereof. It is unclear however in most cases how and to what extent the NECP's objectives are addressed by NRRP measures.

The NRRP shows the highest ambitions, in terms of funding, for **energy efficiency in buildings**. Here targets are also more clearly described and when compared to the ambitious NECP targets they reach only 25% in terms of refurbished area compared to Bulgaria's 2030 target. Still, the targets of the NRRP are supposed to be reached by 2026, which would give additional time to build on initial successes and further increase the renovation ambitions.

For **renewable energy production**, similarly, the aggregated targets for the production capacity of the NRRP can be compared more closely with the NECP. Here the targets exceed what had been proposed by the NECP by 2GW. As much of the foreseen newly installed capacity comes however from reforms and not investments by facilitating private industry and household investments, it is unclear if these ambitions are realistic.

Hydrogen does not receive a lot of attention either in the NECP or the NRRP. The former focuses on the use of hydrogen in transport (annual consumption of 32 GW/h by 2030) and 47 GW/h of electricity dedicated to producing green hydrogen, while the latter proposes a roadmap as well as takes one of the proposed measures from the NECP (pilot project for hydrogen production) and increases its ambition from 20 MW to 65 MW.

Both **energy efficiency in industry** and **energy infrastructure** are particularly difficult to compare with the NECP as there are no comparable targets. However, both will receive considerable support through the proposed National Decarbonisation Fund and the financing under the Economic Transformation Programme. In particular, for energy efficiency, the proposed savings in CO2 emissions have the potential to lead to great improvements in energy efficiency. For energy infrastructure, measures focus on energy storage and batteries, which will likely not contribute to higher overall interconnectivity targets.

Finally, **sustainable transport** is not comparable as there are no targets specified in the NECP. Overall, the number of proposed measures in the NRRP shows however that Bulgaria advanced in building on what is in the NECP by creating more concrete measures.

Republic of Croatia

Total budget of the NRRP	EUR 6.41 billion
Grants	EUR 6.41 billion
Loans	-
% supporting climate objectives	37%

Overview – The NRRP of Croatia contains 4 reforms and 13 investments related to energy projects. A majority of which, are related to the enhancement of the transformation and greening of the transport sector (3 reforms and 8 investment projects). Herein, ensuring the transformation of the country's rail sector plays a significant component in the overall NRRP. Next to this, one reform and one investment projects target the energy efficiency in buildings (renovation), one investment project on the energy efficiency in industry and other, one investment project in the production of renewable energy, as well as one investment project on Hydrogen and one reform and one investment project on the energy infrastructure of the country.

The analysis of the NRPP has shown that on many fronts, the measures and reforms described in the document go beyond the measures described in the NECP. These elements are presented and discussed in more detail below.

Overview of energy-related targets in Croatia's National Energy and Climate Plan (NECP)

The NECP of Croatia addresses the five dimensions of the Energy Union (decarbonisation, energy efficiency, energy security, the internal energy market and research, innovation and competitiveness) with the presentation of various key strategies per dimension. The NCEP states the key objective to be the reduction in greenhouse gas emissions for the year 2030, the share of renewable energy sources (RES) in the gross final energy consumption of 36% in 2030, and energy efficiency expressed as consumption of primary energy and direct consumption of energy. For the decarbonisation element of the NCEP, 63 measures are presented and discussed in detail. For the energy dimension, 19 measures are described. For the Energy security dimension, 8 dimensions. Internal energy market, 5 measures are described. Lastly, for the research, innovation and competitiveness element of the NECP, 6 measures are discussed.

Romania's national Recovery and Resilience Plan (NRRP)

Croatia's Recovery and Resilience Plan is consists of five components, (i) the Croatian economy (EUR 3.5 billion, 54% of funds); (ii) Public Administration, Justice and State Property (EUR 600 million, 10% of funds); (iii) Education science and research (EUR 1 billion, 10% of funds); (iv) Labour market and social protection (EUR 300 million of funds, 4% of funds); (v) Health care (EUR 340 million, 5% of funds); (vi) Renovation of buildings (EUR 800 million, 12% of funds). The largest component, the Croatian Economy, is further

divided into six sub-components; Strengthening the competitiveness of the economy (12.5 %), 1.2. Energy transition (10.2 %), Water management and waste management (13.4 %), Transport system (11.3 %), Strengthening the food supply chain (2.0 %) and Developing sustainable, innovative and resilient tourism (4.5 %).

All in all, the reforms and investments under all components and initiatives are reported to mitigate the impact of the Covid-19 crisis, as well as the recovery, resilience and competitiveness of the economy. The recovery and resilience plan, worth EUR 6.42 billion (HRK 48.2 billion), consists of 76 reforms and 146 investment measures.

Assessment of the topic of energy efficiency in buildings (renovation)

Our analysis of the NRPP of Croatia identifies 1 reform and 4 investment initiatives targeting the energy efficiency in buildings, for a total of roughly EUR 1.44 billion allocated to various measures. These measures are aimed at contributing to the process of renovation, reconstruction and revitalisation of notably, earthquake-affected areas, while also increasing their energy efficiency. To make buildings more resilient to earthquakes and other natural disasters, the building sector will be upgraded. It will respond to the challenge of a lack of investment in energy renovation of buildings, which will increase the renovation rate in Croatia in order to get closer to the EU average, as well as investment funds for complete anti-earthquake renovations. Energy renovation of buildings is a prerequisite for achieving the EU's green targets, as buildings consume 40 % of primary energy and emit 36 % of CO2 emissions in Croatia. Therefore, as a precondition for the green transition and decarbonisation, it is necessary to increase investment in energy efficiency and renewable energy measures in the building sector.

Assessment of the topic of energy efficiency in industry and other

Our analysis of the NRPP identifies 1 investment measure which supports businesses for the transition to an energy and resource-efficient economy. The Croatian economy is characterised by a significant share of service activities, which account for around 60 % of Croatia's GDP and 70 % of the labour force. The industry sector, including construction, accounts for around 20 % of GDP and 27.6 % of all employees. Due to low total factor productivity growth, Croatia lags behind Central and Eastern European countries, making it difficult to reach the EU average. Croatian industry is mainly based on lower value-added products. Industrial production is mainly focused on activities with low technology, outdated machinery and equipment, particularly in the metalworking, textile, food, chemical, construction and woodworking industries. Within this area, there is an opportunity to make a significant contribution to global challenges in relation to secure, clean and efficient energy, combat climate change and increase resource efficiency by redirecting the economy towards new green technologies. The programme will focus on new investments in environmentally friendly production processes and resource efficiency in private SMEs and mid-caps, in order to achieve the objectives of the EU Taxonomy consisting of the following key elements: mitigation and adaptation to climate change, sustainable uses of natural resources, transition to a circular economy, pollution prevention and control. This action will finance, through grants, productive investments by small, medium and mid-cap companies in green technologies that contribute to an energy- and resource-efficient

economy. Investments will focus on energy-intensive industries, including metalworking, textiles, food, chemicals, construction and woodworking.

Assessment of the topic of renewable energy production

Our analysis of the NRPP identifies only one measure in the form of investments for the renewable energy production. It consists of an investment project for a biorefinery for the production of advanced biofuels. The project is described as an imperative element for meeting the objectives of the National Energy and Climate Plan for 2030 (relating to the share of RES in the transport of 14 %). Furthermore, in order to achieve the decarbonisation of the transport sector, it is argued to be necessary to ensure sufficient amounts of advanced biofuels on the Croatian market. The investment is planned within the existing infrastructure through the transformation of one of the oldest oil refineries in the EU (Sisak) into a modern biorefinery which will be the core of further development of an industrial centre focused on the development of advanced and green technologies. In addition to the production of advanced bioethanol, the complex also includes the largest biogas plant in Croatia and a high-efficiency cogeneration plant to cover most of its own green energy needs. The investment in biorefinery aims at creating a long-term sustainable biomass supply chain and building a bio-based industrial complex designed to produce advanced bioethanol with the goal of notably enabling the transition of the transport sector towards more sustainable and alternative fuels.

Assessment of the topic of hydrogen

The analysis of Croatia's NRPP has identified one investment measure to establish the production and distribution of hydrogen. In accordance with the NCEP, a national hydrogen strategy is under preparation to be adopted by the end of 2021. The strategy for the development of hydrogen emphasizes the potential for renewable hydrogen production, which, together with the inclusion of advanced biofuels, will increase the share of renewable energy and strengthen decarbonisation in the transport sector. However, in addition to developing renewable hydrogen production capacity, it is argued to be imperative to build the necessary infrastructure for the use of hydrogen in transport. In this regard, the aim is to build an initial 10 MW electrolyser and 6 hydrogen charging stations.

Assessment of the topic of energy infrastructure

Our analysis of the NRPP identifies one reform and one investment measure on the topic of energy infrastructure. As the NRPP argues that the current electricity system of Croatia will not be able to accommodate the large amount of renewables planned by 2026 and 2030, more efforts should be conducted in developing the energy infrastructure of the country. This aspect is stated to be imperative, as renewable energy production is a focal element for the formulated decarbonisation measures. The underdeveloped electricity system of the country may therefore undermine the achievement of the 2030 target to increase renewable energy sources in final consumption. More specifically, in accordance with the NECP, the achievement of the 36.6 % renewable energy targets in final energy production and in particular the share of electricity from renewable sources of more than 60 % in 2030 will only occur with additional development projects are able to connect and manage electricity and heat systems, and the deployment of advanced biofuels and renewable electricity and hydrogen in transport via an efficient electricity grid.

Assessment of the topic of sustainable transport

Our analysis of the Croatian NRRP identifies 3 reforms and 8 investment measures relevant to the sustainable transport dimension. The proposed investment measures in the NRRP for transport infrastructure and the promotion of sustainable transport and the removal of bottlenecks are found to be among the most concrete objectives and investment measures of the NRRP. The variety of measures target the promotion of sustainable transport such as financial incentives to acquire cleaner or electric vehicles, and the development and reform of Croatia's railway line and rail rolling stock. Such measures are considered vital to the greening of the country's transport sector as the average age of passenger cars is more than 12 years old and emits on average about 3 tonnes of CO2 per year, compared to an average of 1 ton of CO2 emitted by modern hybrid vehicles.

Use of financial instruments in Croatia's NRRP

Our analysis identifies one financial instrument described in the Croatian NRRP. It entails a EUR 532 million measure which has the aim of strengthening the resilience and competitiveness of Croatian enterprises and the public sector by encouraging investment in new investment projects, with particular emphasis on green technologies in order to develop and enhance the country's competitiveness. To this end, these measures propose to implement grants and financial instruments (guarantees, more favourable loans) with a particular focus on SMEs. This approach of combining private and public funds will result in greater investment volumes and also ensure the long-term sustainable development of the Croatian economy.

A key institution involved in the implementation of this measure is the Croatian Agency for SMEs, Innovations and Investments (HAMAG-BICRO) and will provide an instrumental role in filling the gap of the lack of access for SMEs to access to financial products. As the HAMAG-BICRO has ample experience in facilitating access to finance for SMEs, it is expected this expertise will provide play an important role in the successful implementation of the measure and encourage investments. Furthermore, HBOR will be able to increase its technical capacity to carry out a thorough assessment of the contribution of investment projects to sustainability objectives and assess environmental, social, climate risks and impacts of supported investment projects.

Conclusion on Croatia's NRRP

The Croatian NRPP coincides and has developed further on various elements and goals set by the NECP. However, some key elements have been identified to come short of the envisaged development and progress towards one of the key dimensions of the NRPP.

Energy efficiency in buildings: The measures and reforms proposed in the NRRP of Croatia coincide with the measures presented in the NECP. While the two documents present similar and consistent measures and reforms toward achieving energy efficiency in buildings (through renovation), the NRPP comes short of exemplifying the actual estimated effects and benefits of the proposed measures. Indeed, while the

NECP described in a clear manner, the amount of CO2 and energy savings due to the proposed measures, the NRPP does not give any clear indication of such indicators.

Energy efficiency in industry: The NRPP comes short of the envisaged pathway and measures described in the NECP. While the latter document described in detail the desired pathway for various Croatian industries, complemented with various goals and indicators to measure the progress, and the various reforms to achieve it, the described measures in the NRPP for the energy efficiency in industries bear little resemblance to this approach.

Renewable energy production: The NRPP proposed one investment project for the production of renewable energy (biofuels for the transport sector). While it is described as particularly important because the transport sector is well below the 2020 target, and without increasing the share of advanced biofuels Croatia will not be able to reach the renewable energy target in transport, the measure comes short of the proposed measures and reforms discussed in the NCEP. More specifically, according to the goals of the NECP, the document provides clear targets and objectives, such as the total energy consumption by 2050 be reduced by about 16% compared to 2017 and estimates a strong increase in the share of variable RES (wind farms and solar plants) in the country through continuous development. The elements discussed in the NRRP however do not correspond to this envisaged pathway for the renewable energy production of the country.

Hydrogen: The NECP has set Croatia's goal to identify the opportunities associated with the use of hydrogen, and to explore the possibilities of financially stimulating hydrogen production and consumption. This goal, therefore, does not offer any practical reforms or investments regarding the use of hydrogen but rather aims at creating a hydrogen technology platform, bringing together national stakeholders relevant to the research and application of hydrogen technology. To this end, it should establish a strategy for the development of hydrogen and is envisaged to clearly outline the pathway for the development of renewable hydrogen from production to its distribution. Accordingly, Croatia's NRRP builds on this proposed hydrogen strategy with a detailed investment measure for the construction of 10 MW of electrolyser for the production of green hydrogen and its distribution to the transport sector. Investments cover the production of renewable hydrogen (construction of 10 MW of electrolyser) and the establishment of renewable energy infrastructure (6 hydrogen charging stations and infrastructure for the distribution of hydrogen in the transport sector) worth around EUR 77 million.

Assessment of energy infrastructure: The NECP argues for the accelerated development of the country's energy infrastructure to accommodate the rise of RES on its energy grid. Accordingly, the reform and investment measures presented in the NRPP reiterate this by describing investment measures for the development of the internal infrastructure, which holds an important position in the heat and cooling elements of the construction of new buildings and renovating the existing building stock. These measures (one investment and one reform) however come short of the measures presented in the NECP and its envisaged goals as it gives a more detailed pathway for

the development of the country's energy infrastructure and the estimated costs and benefits of such endeavours.

Sustainable transport: One of the key measures to promote energy efficiency in transport is to encourage the use of energy-efficient vehicles through public co-financing and the development of the Croatian rail network. While the latter was already incorporated in the country's NECP, 5 new initiatives are described in the NRPP targeting the railway network, previously not incorporated to this extent in the NECP. Although the NRPP does not give specific estimates about the amount of GHG saved due to the implementation of these reforms and investments, the analysis of Croatia's NRPP concludes these measures to coincide and go beyond the measures described in the NECP

Cyprus

Total budget of the NRRP	EUR 1.2 billion
Grants	EUR 1 billion
Loans	EUR 0.2 billion
% supporting climate objectives	41%

Overview - The NRRP of Cyprus contains 5 reforms and 10 investments related to energy projects. In particular for investments, 3 are on Energy efficiency in buildings (renovation), 2 on Energy efficiency in industry and other, 2 on Energy infrastructure and 3 on Sustainable transport. The highest NRRP funding is dedicated to Energy infrastructure (EUR 135 million). Our findings highlight that the NRRP is generally in line with the NECP goals even though for certain energy categories there is a difference in the quantitative target/expected impact of similar measures present in both plans or there is lack of data to allow a thorough comparison.

In regard to financial instruments, the NRRP includes 2 financial instruments, while the use of a pre-existing financial instrument was confirmed by Cyprus' Ministry of Finance.

Overview of energy-related targets in Cyprus' National Energy and Climate Plan (NECP)

The NECP of Cyprus outlines how the country intends to address energy efficiency, renewables, greenhouse gas emissions reductions, interconnections, research and innovation. The Plan elaborates on the five (5) dimensions of the Energy Union; namely, decarbonisation which is broken down into two (2) distinct areas: greenhouse gas emissions and renewable energy sources, energy efficiency, security of energy supply, internal energy market, and research, innovation and competitiveness.

Cyprus' national Recovery and resilience plan (NRRP)

The plan contains a total of 133 reforms and investments structured around 13 components grouped in 5 policy axes. These are (i) public health, civil protection and lessons learned from the pandemic, (ii) accelerated transition to a green economy, (iii) strengthening the resilience and competitiveness of the economy, (iv) towards a digital era, and (v) labour market, social protection, education and human capital. The measures are mainly future-oriented with a strong focus on the green and digital transition and reflecting a coherent overall strategy. The green investments and reforms in the area of energy projects accumulate to roughly EUR 210 million in funding in the form of grants and EUR 100 million in the form of loans. Indicatively they include the electricity interconnection of Cyprus with Greece, extensive programmes of energy efficiency upgrades in residential and public buildings, the installation of publicly accessible charging infrastructure for electric vehicles and the establishment of the regulatory framework for the participation of storage facilities in the electricity market which is expected to promote the generation of electricity from RES.

Assessment of the topic of energy efficiency in buildings (renovation)

Our analysis of the NRRP identified 3 investments and 1 reform targeting energy efficiency in buildings, for a total of roughly EUR 44.95 million allocated to the different measures. The reform aims at the establishment of a Digital Platform for One-Stop Shop for RES and Energy Renovation in Buildings. Regarding the renovations, the objective of the measure is to establish a single point of contact for technical and financial support for the purposes of energy renovation of buildings. One of the investments aims to promote the use of renewables and the application of energy efficiency measures in at least 16,200 residential buildings and at least 270 energy poor households as well as households with people with disabilities. Within the 3 years of implementation, the scheme is expected to bring about 9,000 PV installations corresponding to a power of about 50 MW, 2,000 roof thermal insulations of dwellings (achieving a U-value of below 0,4 W/m2K) and 3,000 replacements of Solar Water Heating (SWH). For the large stock of old infrastructure used by local authorities and NGOs, the NRRP contains a measure that promotes the use of RES and energy efficiency measures. The same measure extents to investments in the energy efficiency of public lighting (in parks, public squares, cycle roads, pavements, parking, roads), pumping stations (of water supply, irrigation, sewerage), sports facilities (community stadiums, swimming pools, floodlights and lighting installations) and the processing and transformation of plant and wood cuttings into pellets (a Renewable Energy Source) which will be awarded to citizens for use as a fuel in fireplaces and wood stoves. All the above are expected to materialize in at least 580 investments for improving energy performance and resilience in buildings and other public infrastructure. achieving on average at least a 30% primary energy demand reduction and a 55% CO2 reduction by 2030 for the selected municipalities. Another measure targets the energy upgrading and increased energy efficiency of selected public buildings i.e., thermal insulation and photovoltaic systems installed in at least 405 schools; installation of photovoltaics system at the Nicosia General Hospital of total capacity of 943 KW; installation of photovoltaic systems, of a total capacity of 2.200KW, in water pump stations and fire stations.

Assessment of the topic of energy efficiency in industry and other

Our analysis of the NRRP identified 2 investments and 1 reform targeting energy efficiency in industry and other, for a total of roughly EUR 60 million allocated to the different measures. The reform introduces a carbon tax for fuels used in the sectors of the economy that do not fall under the Greenhouse Gas Emissions Trading Scheme focusing on homes, cars, small businesses and agriculture. The introduction of carbon tax is expected to lead to a reduction in the use of energy by 100-130 ktoe or 6-8% annually after five years from the initial introduction of the tax One investment aims at the reduction of primary and final energy consumption and the CO2 emissions in buildings and/or facilities owned or operated by SMEs, local authorities (Municipalities and Communities) and organizations of the wider public sector. The intervention will affect at least 275 entities for building renovation and for making production processes more efficient in order to achieve on average at least a 30% primary energy demand reduction. Another measure for industries, businesses and organizations, consists in setting up a support scheme providing financing, equivalent to the cost for the purchase of greenhouse gas emission allowances to be avoided due to the reduction in emissions resulting from the beneficiaries' actions. At least 354,566 tons of CO2eq shall be reduced as a result of the support provided.

Assessment of the topic of renewable energy production

Our analysis of the NRRP identified 2 reforms targeting renewable energy production. The first one with a budget of EUR 0.5 million has already been mentioned under the energy category of energy efficiency in buildings (renovation) and it concerns the establishment of a Digital Platform for One-Stop Shop for RES and Energy Renovation in Buildings. Regarding RES, the objective of the measure is to promote the implementation of RES projects by streamlining the RES projects permitting process. The one-stop-shop can also cover some additional elements (i.e., repowering of existing RES plants). Furthermore, it is envisaged to link the above procedure (for the mature projects) with a financing mechanism that can further support the mature projects in their commercial operation. The second reform relates to the establishment of a regulatory framework for promoting the participation of storage facilities in the electricity market. This is expected to promote the generation of electricity from RES and to contribute to the efficiency and economic viability of the electricity market as a whole,

Assessment of the topic of hydrogen

In the NRRP of Cyprus, there are no measures dedicated to hydrogen production and/or use.

Assessment of the topic of energy infrastructure

Our analysis of the NRRP identified 2 investments targeting energy infrastructures for a total of EUR 135 million. The first one is the “EuroAsia Interconnector”, a Project of Common Interest that aims to build electricity interconnection between Cyprus-Crete (Greece). Such interconnectors can increase the capacity of integrating RES (on average 38-46 GWh/year according to European Network of Electricity Transmission System Operators (ENTSO-E) 2030 scenarios). The second investment relates to the roll out of 400,000 smart meters for end-users of electricity. It is a measure intended to meet part of the NECP target in end-use energy savings and to increase the flexibility of the energy system regarding renewable energy production.

Assessment of the topic of sustainable transport

Our analysis of the NRRP identified 3 investments and 2 reforms targeting sustainable transport, for a total of roughly EUR 70.3 million allocated to different measures. One reform aims to provide the regulatory framework for an electric vehicle (EV) recharging infrastructure and an efficient EV recharging market. One of the investments promotes the installation of 10 publicly accessible fast charging stations for electric vehicles (demonstration projects) and provides funding for the installation of at least 1,200 charging (including normal, double, fast charging and photovoltaic charging) points purchased and installed in public buildings, in local authorities, SMEs and private households. Electricity will have to be generated (if possible, totally, or partially) from RES. A combination of one investment and one reform aim to promote the purchase of pure EVs, Low Emission Vehicles (LVs i.e., a car of < 50 gr/km of CO2-WLTP) and alternative use of transport (e.g., bus, bicycle) while simultaneously removing older polluting vehicles from circulation. The expected impact is that at least 5,750 electric vehicles and bicycles will be purchased and at least 3,150 (up to 3,500) high emission vehicles will be scrapped and replaced by electric

bicycles, annual bus ticket(s) and LVs by the end of 2025. Another investment aims to support the use of public transport and alternative mobility options via the implementation of Sustainable Urban Mobility Projects (SUMP) and accessibility enhancing measures. The expected impact is a reduction in the share of commuters using a private vehicle from 93% to 81% and an increase in public transport passengers by a five-fold in the period between 2019-2030.

Use of financial instruments in Cyprus' NRRP

Regarding the use of financial instruments, a state funded equity fund will be established to support the efforts of the Government to enhance access to alternative sources of finance aiming to foster economic development and growth and enhance the competitiveness of small-medium enterprises in Cyprus and contribute to the enhancement of the ecosystem for equity and venture capital investments. The expected impact is to support at least 12 investees (start-ups and innovative companies) through the Fund by mid-2026. Additionally, a NRRP reform entails the establishment of a National Promotional Agency, to support businesses by providing financial instruments such as loans, guarantees and equity financing in a coordinated way, ensuring expertise and operational synergies.

Regarding co-financing cases, for the reduction of CO2 emissions from non-ETS activities in industries, businesses and organisations there are considerations to complement the RRF funds with Just Transition and LIFE funds to cover ETS activities. Also, for the reform that concerns the development of the Energy Storage Regulatory Framework, the Just Transition Fund will be used in conjunction with RRF. And for the investment that relates to the promotion of RES and energy efficiency measures in dwellings, the combination of national funds, ESIF and RRF funds is foreseen.

Conclusion on Cyprus' NRRP

According to the NRRP, the plan is in line with the strategic priorities of Cyprus' NECP, and the specific targets set by the latter. Our analysis per category revealed the following:

Energy efficiency in buildings: According to the NECP, the energy efficiency measures in 63,000 households and in 10,000 non-residential buildings are expected to bring 182.95 ktoe of cumulative end use energy savings. The corresponding measures in the RRP target at least 16,200 households, at least 270 energy poor households and 580 investments in non-residential buildings which are expected to deliver a total of more than 37 ktoe cumulative final energy savings. Thus, the NECP had set higher targets. However, it is worth noting that the NECP had identified multiple EU and national funding streams to accommodate the renovations which could lead to the conclusion that the renovations in the RRP are only extending the country's target for energy efficiency in buildings.

Energy efficiency in industry and other: The implementation of all the NECP energy efficiency in industry measures that have been assigned a quantitative target would result in 124.62 ktoe of cumulative end use energy savings. Additionally, the RES and Energy Conservation fee (tax) applied on electricity in 2021 is expected to bring 93.3 ktoe of cumulative end use energy savings. For the RRP, the introduction of the carbon

tax is expected to result in 100-130 ktoe annually after five years from the initial introduction of the tax. The other RRP measures in this category have quantitative targets in other units of measurement (e.g., in CO2 reduction) and as a result a complete comparison of the two plans cannot be realized. However, the NECP measures included the provision of support to at least 250 businesses to reduce their emissions and the RPP raised this to at least 275 entities for both building renovations and for making production processes more efficient.

Renewable energy production: The NECP considers the following measures for renewables: promoting RES self-consumption; net metering for charging electric vehicles; schemes to support RES installation and energy storage. The measure included in the RRP are of the same nature, meaning that both plans focus on the use of RES in buildings and in the transport sector and not on large scale plants. The NECP has quantitative expected impacts and the NRRP only qualitative, meaning that a more thorough comparison is not possible.

Hydrogen: Hydrogen measures are not included in neither the NECP nor the NRRP.

Energy infrastructure: Regarding energy infrastructure, in the NECP it is stated that the Ministry of Energy, Commerce and Industry has accepted the EuroAsia Interconnector application file for the starting of the statutory permit granting procedure and in the RRP, RRF funds were allocated for the construction of the interconnector. However, the NECP also refers to the gas infrastructure EastMed Pipeline project between Cyprus, Israel and Greece, which is not mentioned in the RRP. With regard to the roll-out of smart meters, the two Plans are aligned on the target (400,000 smart meters) but set different deadlines for deployment (NECP: by the end of 2027 and RRP: by 30 June 2026).

Sustainable transport: As regards sustainable transport, according to the NECP, 10 high charging stations would be installed in highways and public roads. The RRP, apart from these 10 stations added a measure for installing at least 1,200 charging points in public buildings, local authorities, SMEs and private households. Also, both plans are aligned on the scraping scheme for old vehicles, and the provision of incentives for the purchase of EVs, as well as on the promotion of modal shift and the implementation of SUMPs. However, in terms of alternative fuels, the NECP refers to the use of natural gas, biogas and biofuels, which is not the case for the NRPP.

Czechia

Total budget of the NRRP	EUR 7.0 billion (CZK 179,143 million)
Grants	EUR 7.0 billion (CZK 179,143 million)
Loans	EUR 0.0 billion (CZK 0)
% supporting climate objectives	41.6%

Overview - The NRRP of Czechia contains 5 reforms and 15 investments related to energy projects. In particular for investments, 4 are on Energy efficiency in buildings (renovation), 0 on Energy efficiency in industry and other, 3 on Renewable energy production, 0 on Hydrogen, 0 on Energy infrastructure and 8 on Sustainable transport. The highest NRRP funding is dedicated to Sustainable transport (EUR 967 million)]. Our findings highlight that the Czech NRRP does not include funding dedicated to some key energy categories, and overall the plan does not seem to add any ambition compared to the NECP.

In regard to financial instruments, the NRRP does not provide detailed information on the financial instruments to be used for energy-related projects, but the NRRP mentions that national investments can be further multiplied by strategic co-financing with loans and capital contributions from the European Bank for Reconstruction and Development (EBRD) and the private sector with the aim of making the most efficient use of funds from the RRF through synergies and leverage.

Overview of energy-related targets in Czechia's National Energy and Climate Plan (NECP)

The NECP of Czechia seeks to achieve several high-level and specific objectives in line with the five dimensions of energy established by the Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action: decarbonisation, energy efficiency, energy security, internal market and research, innovation and competitiveness. The NECP outlines a set of climate and energy targets and describe a set of policies and measures to achieve such targets. Examples of targets include a 30% reduction in GHG emissions by 2030 compared to 2005 levels, a 22% share of renewables in gross final consumption by 2030, 462 PJ of cumulated energy savings by 2030, corresponding to annual energy savings of 0.8% of annual final energy consumption, and a 44.1% level of interconnectivity by 2030. The European Commission assessed the target on GHG emission reductions to be in line with the Effort Sharing Regulation, the target on increasing the share of energy from renewable sources has been defined unambitious, and the energy efficiency target has been judged to be modest. Measures are sub-divided into categories such as GHG emissions and removals, renewable energy, and energy efficiency. Notably, the NECP of Czechia was sent to the European Commission in November 2019 and finalised after the Commission's assessment in October 2020.

Czechia's national Recovery and Resilience Plan (NRRP)

Czechia's NRRP is divided into six pillars: (i) Digital Transformation (CZK 27,854 million, EUR 1.1 billion); (ii) Physical Infrastructure and the Green Transition (CZK 85,182 million, EUR 3.3 billion), (iii) Education and the Labour Market (CZK 41,006 million, EUR 1.6 billion); (iv) Institutions and Regulation and Business Support in Response to COVID-19 (CZK 10,895 million, EUR 0.2 billion); (v) Research, Development and Innovation (CZK 13,200 million, EUR 0.3 billion); (vi) Population, Health and Resilience (CZK 12,441 million, EUR 0.5 billion).

The Physical Infrastructure and Green Transition pillar of the Czechia's NRRP is divided into 9 components, with those focusing on energy projects being: (i) Sustainable Transport (EUR 0.94 billion), (ii) Reducing Energy Consumption in the Public Sector (EUR 0.32 billion), (iii) Transition to Cleaner Energy Sources (EUR 0.26 billion), (iv) Development of Clean Mobility (EUR 0.19 billion), and (v) Renovation of Buildings and Air Protection (EUR 0.63 billion).

Czechia submitted its NRRP in June 2021, which was then endorsed by the European Commission in July of the same year. In September 2021, the European Commission disbursed EUR 915 million in pre-financing to Czechia, and in July 2022 Czechia and the European Commission signed the Operational Arrangements for the monitoring, implementation and fulfilment of the envisaged milestones and targets.

Assessment of the topic of energy efficiency in buildings (renovation)

Our analysis of the NRRP identified 4 investments and 2 reforms targeting energy efficiency in buildings. As described in the NRRP, the main objective of these measures is to increase energy efficiency throughout the economy in relation to the objectives and commitments set out in the revised Energy Efficiency Directive, meaning supporting the fulfilment of the 32.5% energy efficiency target by 2030 and the renovation of the national stock of buildings. The investment targeting energy reduction in public buildings is expected to lead to a reduction of 606 TJ in energy consumption and to increase the number of high-quality, medium and deep renovations. Additional 286 TJ of energy savings are expected following the implementation of energy-saving measures in public-lighting systems.

Assessment of the topic of energy efficiency in industry and other

Our analysis of the NRRP did not identify any investment or reform targeting energy efficiency in industry.

Assessment of the topic of renewable energy production

Our analysis of the NRRP identified 3 investments and 2 reforms targeting renewable energy production. Within this energy category, it is possible to identify three main investment areas: the construction of new photovoltaic energy sources, the modernisation of heat distribution in district heating systems, and the transition to cleaner energy sources in the household sector via replacement of fossil heating sources with renewable energy sources. With regard to the second investment area, Czechia aims to increase the efficiency of hot water distribution systems and to modernise transfer stations, control systems and pumping stations for the distribution of thermal energy to save about 254 TJ

of primary energy, and to replace CHP sources using fossil fuels with CHP sources with significantly lower carbon footprint (including using renewable energy sources).

Assessment of the topic of hydrogen

Our analysis of the NRRP did not identify any investment or reform targeting hydrogen. The NRRP only includes references to the EU initiatives aimed at developing the hydrogen market in terms of future installed capacity of electrolysers and production of renewable hydrogen.

Assessment of the topic of energy infrastructure

Our analysis of the NRRP did not identify any investment or reform targeting energy infrastructure.

Assessment of the topic of sustainable transport

Our analysis of the NRRP identified 8 investments and 1 reform targeting sustainable transport. Key elements of the Czech NRRP are the reinforcement and modernisation of the existing railway infrastructure network as well as an investment in railway electrification to increase the energy efficiency of transport. The NRRP is compliant with the investments reported in the NECP. Regarding road transport, the listed measures towards clean mobility, including support for the purchase of clean vehicles (electric, H_2, e-bikes) for businesses, municipalities, regions and central administration, as well as building charging infrastructure stations for public transport, private companies and residential buildings, are aimed at transforming the local automotive industry and contributing to achieving a 14% share of energy in transport from renewable energy by 2030. Czechia is aiming to increase the number of recharging and refuelling stations for alternative fuels and the number of vehicles with zero or low-emissions, and the measures included in the NRRP will support the achievement of this target, although there is no reference to their quantitative impact.

Use of financial instruments in Czechia's NRRP

Czechia's NRRP does not provide detailed information on the financial instruments dedicated to energy-related investments, but the plan mentions that the investments aimed at digitalising the economy and facilitating the transition to a sustainable green economy and infrastructure can be partly realised through private entities. The plan describes that these investments can be linked to smaller support projects implemented by independent European financial institutions, for example the EBRD. Priority national investments can thus be further multiplied by strategic co-financing with loans and capital contributions from the EBRD and the private sector with the aim of making the most efficient use of funds from the RRF through synergies and leverage. Additionally, the Czechia's NRRP explains that part of the funds from the RRF and Next Generation funds can be implemented through financial instruments at the national level, which however are voluntary and for the moment do not have a fixed allocation.

Conclusion on Czechia's NRRP

The Czech NRRP presents investments and reforms in most energy categories but excluding energy infrastructure and hydrogen. The plan clearly explains how the green

component of the NRRP has been prepared in full compliance with the NECP of Czechia, but the lack of description and quantification of the expected impacts of the measures included in the NRRP limits substantially the assessment of how much more ambitious the NRRP is compared to the NECP. Overall, the impression is that the NRRP of Czechia is not going beyond the measures already included in the NECP.

Energy efficiency in buildings: The NRRP of Czechia includes numerous measures targeting energy efficiency in buildings, especially in residential and public buildings. Nevertheless, these measures appear to be intended to support the achievement of the targets already set in the NECP and at the EU level rather than going beyond already existing targets.

Energy efficiency in industry and other: The Czech NRRP does not include clear energy efficiency investments for the industrial sector. Rather, it focuses on promoting circular economy principles and water savings in this sector.

Renewable energy production: The NECP sets the goal of the share of renewable energy in gross final consumption by 2030 and anticipates an increase in solar photovoltaic installed capacity by 3,975 Mwe by 2030. Nevertheless, more capacity additions will be needed to achieve such target, also considering the phase out of old solar photovoltaic plants. With regard to renewable energy, the Czech NRRP explicitly mentions that the goal set in the NECP of achieving a 22.0% share of renewable energy in gross final consumption by 2030 could be exceeded with the additional installation of 270 MW of solar PV capacity as described in the NRRP, but the expected additional impact is very limited (from 22.0% to 22.09% share of renewable energy by 2030).

Hydrogen: The Czech NRRP does not include any measure aimed at developing a hydrogen market in Czechia.

Energy infrastructure: The Czech NRRP does not include any measure targeting energy infrastructure.

Sustainable transport: The NRRP of Czechia presents several measures aimed at incentivising sustainable transport and electro mobility, and these are compliant with the investments reported in the NECP. Overall, it is challenging to judge whether the listed measures could help achieve more ambitious targets, especially considering that the plan lacks some important elements such as the planned number of publicly accessible electric recharging infrastructure in the future.

Denmark

Total budget of the NRRP	EUR 1.5 billion
Grants	EUR 1.5 billion
Loans	EUR 0
% supporting climate objectives	59%

Overview - The NRRP of Denmark contains 4 reforms and 13 investments related to energy projects. For investments, 3 are on Energy efficiency in buildings (renovation), 4 on Energy efficiency in industry and other, 1 on Hydrogen, 2 on Energy infrastructure and 3 on Sustainable Transport. The highest NRRP funding is dedicated to Energy efficiency of Industry and other (EUR 645 million). Our findings highlight that out of the seven components of the NRRP, “Green Tax Reform” is the one with the largest dedicated funding (EUR 523 million). This mission is pursued through several sub-reforms, such as new emission taxes on industry and investment window for businesses. The NRRP provides no detailed information on the financial instruments dedicated to green investments. However, in some cases, the plan mentions the use of ownership tax on cars to partly cover some of the measures to support green and smart mobility investments.

Overview of energy-related targets in Denmark’s National Energy and Climate Plan (NECP)

The NECP of Denmark seeks to achieve ambitious and specific objectives in line with the five dimensions of energy established by the Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action: decarbonisation, energy efficiency, energy security, internal market and research, innovation, and competitiveness. The NECP outlines a set of climate and energy targets and describes a set of economic, regulatory, and planning instruments to achieve such targets. Listing a total of 59 instruments, the NECP was sent to the European Commission in late 2019.

Denmark’s national Recovery and Resilience Plan (NRRP)

Denmark’s NRRP is divided into seven components: Strengthening the Resilience of the Health Care System (EUR 26.8 million), Green transition of Agriculture and Environment (EUR 174.6 million), Energy Efficiency, green heating, and CCS (EUR 268 million), Green Tax Reform (EUR 523.7 EUR million) Sustainable Road Transport (EUR 214.8 million), Digitalisation (EUR 94 million) and Green Research & Development (EUR 241.7 million).

The green investments in the area of energy projects accumulate to roughly EUR 1.1 billion in funding. Key reforms, such as “Incentives to choose green cars” and “Emission taxes on industries” pave the way for a new legal framework to support green mobility and GHG emission reduction.

At the time of submission of the NRRP, Denmark was a lot further off reaching its 2030 energy and climate targets than it is now, at the end of 2022. Therefore, the RRP together with other measures has advanced the energy transition in this short period.

Assessment of the topic of energy efficiency in buildings (renovation)

Our analysis of the NRRP identified 3 investments targeting energy efficiency in buildings, for a total of roughly EUR 205 million allocated to the different measures. These measures aim to replace oil burners and gas furnaces, improving energy efficiency in public buildings and households. The total effort for improving energy efficiency in buildings is expected to reduce CO_{2eq} emissions by 0.6 Mt by 2025.

Assessment of the topic of energy efficiency in industry and other

Our analysis of the NRRP identified 4 investments and 2 reform targeting energy efficiency in industry and other purposes, for a total of roughly EUR 645 million allocated to the different measures. The proposed measures aim to develop incentives for green industry (innovative and smart machinery) as well as increasing emission taxes for industry. The impact of these measures is estimated to entail a CO_2 reduction of 0.53 Mt by 2025.

Assessment of the topic of renewable energy production

Our analysis of the NRRP identified neither investments nor reforms in the field of renewable energy production. Support to RES development is created in different instruments, including a commitment to regional collaboration for more RES generation capacity across the EU Member States around the Baltic Sea.

Assessment of the topic of hydrogen

Our analysis of the NRRP identified 1 investment targeting hydrogen, for a total of roughly EUR 23 million. The proposed measure ("Green research and innovation: green fuels for transport and industry i.e., Power-to-X") aims to enhance private-public partnerships with projects within Power-to-X technologies. Although this measure has no specific quantitative target, it will foster research and innovation on the topic of hydrogen, leading to pilot initiatives.

Assessment of the topic of energy infrastructure

Our analysis of the NRRP identified 2 investments targeting energy infrastructures, for a total of roughly EUR 50 million. The proposed measures aim to support the development and demonstration of CO_2 storage sites in depleted oil and gas fields in the Danish part of the North Sea. These pilot initiatives will pave the way for CCS storage development, which in the Danish context has a CO_2 reduction potential of 4-9 m. tons CO_2 by 2030.

Assessment of the topic of sustainable transport

Our analysis of the NRRP identified 4 investments and 1 reform targeting sustainable transport, for a total of roughly EUR 363 million allocated to the different measures. The proposed measures aim to build enabling infrastructures to promote the development of sustainable mobility, such as infrastructural scheme for electric bicycles and investments for green ferries. The intended impacts of these measures are a stock of approx. 775,000

green cars by 2030 (of which 715,000 are passenger cars and 60,000 are vans), green transition of approximately 23 ferries and CO_2 reduction of. 0.5 million tonnes in 2030 through new incentives to use green cars.

Use of financial instruments in Denmark's NRRP

Denmark's NRRP does not provide detailed information on the financial instruments dedicated to green investments. However, the NRRP mentions the use of financial resources from ownership taxes and new road-pricing toll for heavy vehicles to cover part of the incentives to use green cars. Also, for some measures an additional funding through the Cohesion Policy is foreseen. In January 2022., a Green Bond framework was adopted in Denmark with a focus on renewable energy generation and clean transportation. This instrument is based on the EU Green Bond Standards and not included in the RRP.

Conclusion on Denmark's NRRP

The NRRP supports a national political agreement on the decarbonisation of Denmark's economy by offering a larger funding pool to implement the various measures. In combination with several other instruments that were implemented with the national budget, the energy transition has been advanced.

Energy efficiency in buildings: While the NECP allocates EUR 118 million between 2021 to 2024 to energy efficiency measures in buildings, the NRRP foresees an additional EUR 204 million between 2021 and 2025. In particular, the efforts to replace oil burners and gas furnaces is strongly supported through the NRRP (+730% compared to the investments set in the NECP). A new measure on energy efficiency in households in expected to result in a reduction of CO_{2eq} in 2025 by further 0.05 Mt. Also, the NECP essentially reintroduces the same measures set in the National Energy Efficiency Action Plan (NEEAP) from 2017, while the NRRP sets new targets and new investments. For this reason, the assessed likelihood of reaching more ambitious energy targets is high.

Energy efficiency in industry and other: The NECP only sets measures for energy efficiency for enterprises. On the other hand, the NRRP narrows down the scope to industry, introducing a large number of reforms to foster green investments and energy saving. Although the comparability between the two plans is hardly assessable, targets and financial resources set in the NRRP seem to be higher.

Renewable energy production: No measures related to renewable energy are set in the NRRP.

Hydrogen: Compared to the NECP, an additional EUR 23 million (financed through RRF) has been allocated to a National fund for Power-to-X-projects establishing big scale production and storage of green hydrogen. These projects have an ambition to demonstrate production and consumption of green hydrogen on near market-based conditions. Also, through the National Power-to-X Strategy (2021) the Government already planned an investment of EUR 167 million through a Power-to-X tender aimed at operating support for the production of hydrogen and other Power-to-X products. However, it seems that those objectives were set before those contained in the NRRP (which foresees additional funding for this measure).

Energy infrastructure: The complementarity between the two plans is not assessable, because of the inconsistency of targets, indicators, and measures (which are globally limited in number and resources).

Sustainable transport: While the NCEP allocated EUR 13 million for investments in new cycling paths, this amount reaches EUR 188 million through the NRRP. New investments for green ferries are made available. Quantitative targets for incentives to choose green cars are set. Also, in December 2020, the Danish government announced a plan to put 775,000 electric cars on roads by 2030. This target was not contained in the NECP but has been included in the NRRP. Overall, the NRRP seems to set more ambitious targets than the NECP.

Estonia

Total budget of the NRRP	EUR 969.3 million
Grants	EUR 969.3 million
Loans	-
% supporting climate objectives	42%

Overview - The NRRP of Estonia finances energy and sustainable transport projects under components 2. Green transition for companies, 4. Energy and energy efficiency, and 5. Sustainable transport. The total amount of funding for the three components is EUR 408.25 million, corresponding to 42.1% of the total RRF funding. In regard to Energy and energy efficiency, the plan will finance two reforms and five investments, with corresponding funding of 47.15 EUR million. With respect to the Green transition for companies, the Plan foresees three investments and one reform relevant to energy projects, with corresponding RRF funding of EUR 158.4 million. EUR 96.05 million of RRF funding is dedicated to sustainable transport measures, including one reform and four investments.

In regard to financial instruments, the NRRP includes one financial instrument, the Green Fund, with a focus on green technologies, including energy in general. Highest share, total of EUR 100 million from the RRF has been dedicated to the Green Fund, accounting for biggest share of funding in climate- and energy-related measures.

Overview of energy and climate targets of Estonia and relevant policy initiatives

The NECP of Estonia seeks to achieve several climate objectives in, among others, greenhouse gas (GHG) emissions, renewable energy and energy efficiency. Targets include non-ETS GHG emissions reduction of 13% by 2030 compared to 2005 and 42% of renewable energy sources. Estonia has a focus on sustainable transport and energy efficiency in buildings, both in its NECP and NRRP.

Estonia's national Recovery and resilience plan (NRRP)

The Estonian RRP includes all six pillars: (i) Green transition (EUR 312.2 million); (ii) digital transition; (iii) smart, sustainable and inclusive growth; (iv) social and territorial cohesion; (v) health, economic, social and institutional resilience; and (vi) next generation, children and youth. It consists of 6 components and 41 measures, of which 16 are reforms and 25 investments.

For the green transition pillar, apart from the RRF budget mentioned above, Estonia is expecting additional mobilised investment resources from the public and private sector, as well as other EU funds, such as European Regional Development Fund (ERDF) and REACT-EU. Energy efficiency and sustainable transport are major focus areas in the plan regarding climate and energy targets. The key reforms are identified as the following: Promoting energy efficiency of buildings, Boosting the decarbonisation of the energy

sector, Green transition of companies, and Introduction of safe, environmentally friendly, competitive, need-based and sustainable transport and energy infrastructure.

Assessment of the topic of energy efficiency in buildings (renovation)

Our analysis of the NRRP identified one reform and two investments related to energy efficiency in buildings (renovation), total funding for the measures from the RRF being EUR 47.15 million. Other funding is received from REACT-EU (EUR 26.25 million) and from ERDF 2021-2027 (EUR 296 million) leading to a total sum of EUR 367 million. In addition to loans and financial support, the objective of the reform is to boost energy efficiency and renovations by removing administrative barriers through advice, support housing associations, households and local authorities. Housing in Estonia, due to its Soviet legacy and private ownership, is one of the focus areas in the NRRP but also crucial in achieving the climate and energy targets in general.

Assessment of the topic of energy efficiency in industry and other

Our analysis identified one reform, 'Green Transition of companies', being slightly related to the energy efficiency in industry and other, but the plan does not provide any concrete measures on the topic. Two more general investments, 'Green technologies development programme' and 'Green Fund', are also related to the topic. The funding to these measures from RRF is EUR 8.38 million respective EUR 100 million.

Assessment of the topic of renewable energy production

Our analysis identified one reform ('Boosting the decarbonisation of the energy sector') and one investment ('Programme to boost energy production in industrial areas') that are directly related to renewable energy production. The funding for the investment from the RFF is EUR 7 million. The reform aims to support the target of 42% share of renewables in gross final consumption of energy.

In addition, the reform Green transition of companies and its investments partially support also the introduction of renewable energy.

Assessment of the topic of hydrogen

The NRRP includes one investment covering the hydrogen, 'Creating opportunities for the uptake of renewables-based green hydrogen technologies'. EUR 50 million from RFF is directed to this particular measure. The objective of the investment is to support the deployment and testing of integrated value chains of hydrogen technologies from generation to consumption, across different application areas.

Hydrogen measure is additional to the NECP, as the NECP does not include hydrogen-related measures or targets.

Assessment of the topic of energy infrastructure

Our analysis identified one reform ('Boosting the decarbonisation of the energy sector'') and two investments related to energy infrastructure ('Programme to strengthen the

electricity grid to increase renewable energy production capacity and adapt to climate change' and 'Energy storage pilot programme'). Total funding for the investments from the RRF is EUR 30 million and EUR 8 million. First-mentioned investment overlaps with the category of renewable energy production, as its objective is to increase the connection capacity for renewable energy installations up to 310 MW. The energy storage pilot programme aims to store renewable energy in seawater, taking advantage of Estonia's long coastline and the historical patrimony of empty oil shale mines. It will be a basis for investing in similar projects on a larger scale and therefore contributing to renewable energy uptake and energy security.

Assessment of the topic of sustainable transport

Sustainable transport is one of Estonia's focus areas in reaching its climate targets. The NRRP includes a reform 'Introduction of safe, environmentally friendly, competitive, need-based and sustainable transport and energy infrastructure' under Component 5. Sustainable transport. The reform's aim is to reduce CO2 emissions of transport by 700 kt compared to 2018. The reform includes three investments targeting at particular transport development plans: construction of a railway between Turba-Rohuküla, Joint terminal of Ülemiste, and construction of Tallinn Old Town Harbour tram line. Total funding for these measures is EUR 91.05 million from RRF. In addition, the fourth investment, worth EUR 5 million from the RRF, with provides funding for local authorities to invest in bicycle and footpaths.

Use of financial instruments in Estonia's NRRP

The NRRP includes one financial instrument regarding energy projects: 'Green Fund' under component 2. 'Green transition for companies'. It is providing companies direct investment and investments through venture capitals to projects related to, for example, energy. The aim of the instrument is to offer capital and resources to green research and development since there are not enough of them in the market. Moreover, it is expected that the instrument will attract private investors in the green technology sector. The public institution SmartCap has the responsibility for managing the Green Fund. The Green Fund consists of the two following elements:

Direct investments: Implementation of direct investments has not started yet, and more information will be announced to the public in October 2022.

Investments in private venture capital funds: During the first stage of the fund investments, up to two main investments are planned, accounting for EUR 20 million per fund. Their investments should contribute to the development of the local capital market and business environment, as well as raise awareness about the most relevant environmental issues.

Using grants instead of financial instruments for all the other measures has been a conscious choice by Estonia. For example, grants for private house owners in order to fund renovations and improve the energy efficiency rather than creating financial instruments was preferred due to its simplicity.

Conclusion on Estonia's NRRP

According to our analysis and the NRRP itself, the plan is in line with the strategic priorities of Estonia's National Energy and Climate Plan and the specific targets set within. The NRRP has even potential to go beyond the NECP targets, as new, more ambitious climate targets have already been planned during the development of the plan. Our analysis per category is as follows:

Regarding **energy efficiency in buildings**, the NRRP provides concrete measures to boost renovations in private and public buildings and thus their energy efficiency. The NECP mentions several existing and planned measures in the area. Due to the country's building stock from the Soviet era, houses have not been energy efficient enough, and thus measures in the area are seen very crucial in achieving the climate targets.

Energy efficiency in industry is broadly addressed in the component 'Green transition of companies' but the NRRP does not provide any concrete measures on the topic. The NECP does not have concrete, direct measures in the topic area either.

In terms of **renewable energy production**, Estonia aims, according to both the NECP and NRRP, to achieve the target of 42% share of renewables in gross final energy consumption. The RRP provides several measures to boost the renewable energy production and consumption.

For **hydrogen**, the NRRP includes an investment under component 'Green transition of companies' with EUR 50 million RFF funding. The NECP does not provide any measures directly related to hydrogen but it mentions the hydrogen working group that aims to analyse the opportunities for implementing hydrogen and fuel element technology in Estonia.

Energy infrastructure is addressed in several measures in the NRRP, with objectives connected to energy security and decarbonisation. Regarding the NECP, it has energy infrastructure measures, particularly in energy security area.

Sustainable transport is one of Estonia's main focus areas in the climate sector. The NRRP provides a sustainable transport reform with four concrete investments in public and sustainable transport. The RRP is in line with the NECP, as it also includes several measures to boost the transition to more sustainable transport.

Finland

Total budget of the NRRP	EUR 2.1 billion
Grants	EUR 2.1 billion
Loans	EUR 0.0 billion
% supporting climate objectives	50%

Overview - The NRRP of Finland contains 7 reforms and 9 investments related to energy projects. In particular for investments, 2 are on Energy efficiency in buildings (renovation), 2 on Energy efficiency in industry and other, 2 on Renewable energy production, 1 on Hydrogen, 1 on Energy infrastructure and 2 on Sustainable Transport. One measure covers both Renewable energy production and Energy efficiency in industry and other. Our findings highlight that the Finnish NRRP clearly includes measures which increase the level of ambition in the categories of Energy efficiency in buildings, industry, and sustainable transport.

In regard to financial instruments, the NRRP does not include innovative instruments other than grants and tax reduction. However, it complements the following as potential sources of co-funding: other EU programmes and national instruments, the Horizon Europe programme, the Just Transition Fund (JTF), the EU Innovation Fund and CEF funding for PCIs under the TEN-E Regulation.

Overview of energy-related targets in Finland's National Energy and Climate Plan (NECP)

The NECP of Finland seeks to achieve several high-level and specific objectives in line with the five dimensions of energy established by the Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action: decarbonisation, energy efficiency, energy security, internal market and research, innovation and competitiveness. The main energy and climate targets of Finland to be reached by 2030 are reducing greenhouse gas emissions in the effort sharing sector by 39%, renewable energy share of final energy consumption at least 51%, renewable energy share of final energy consumption 30% in road transport, and final energy consumption not more than 290 TWh, corresponding to approximately 405 TWh of primary energy consumption.

Finland's national Recovery and resilience plan (NRRP)

The four pillars of Finland's national Recovery and resilience plan (NRRP) are (1) green transition; (2) digitalisation; (3) employment and upskilling, and (4) access to health and social services, comprising in total 67 measures, of which 26 reforms and 41 investments.

The NRRP of Finland finances energy projects under four components in Pillar 1: Component 1 (energy system transition), Component 2 (industry renewal and investments

supporting the green and digital transition), Component 3 (reducing the climate and environmental impacts of the building stock) and Component 4 (low-carbon solutions in communities and transport). The total amount of funding for these components is EUR 685 million, corresponding to 33% of the total RRF funding. With respect to the energy system transition, the plan foresees three investments and two reforms relevant to energy projects, with corresponding RRF funding of EUR 319 million. In regard to Component 2, the plan will finance two investments and one reform relevant to energy projects, with funding of EUR 216 million. Regarding Component 3, the plan will finance two investments and two reforms related to energy projects, with corresponding funding of EUR 110 million. Finally, for Component 4, the plan will finance two energy project related investments and two reforms with a value of EUR 40 million.

An additional economic boost scheme from the national budget was adopted in 2022 and includes a response to the challenges posed by the Russian invasion in Ukraine. The funding amount of EUR 850 million was dedicated to broader transition needs in 2022 and 2023, including an increase in the green transition.

Assessment of the topic of energy efficiency in buildings (renovation)

Our analysis of the NRRP identified two investments and two reforms targeting energy efficiency in buildings, for a total of roughly EUR 110 million allocated to the different measures. These measures aim to invest in the green transition, particularly the use of clean and efficient energy, and renovating buildings to convert them from oil heating to systems that are more energy and resource efficient to directly address one of the key actions and flagship areas of the RRF (Renovation Wave). The objectives of these measures are to phase out oil heating by the beginning of 2030 and to reduce carbon dioxide emissions from the building stock by 90% between 2020 and 2050, accelerating the phasing out of oil-based heating in low-rise housing and improving greenhouse gas efficiency by more than 30%.

Assessment of the topic of energy efficiency in industry and other

Our analysis of the NRRP identified two investments and four reforms targeting energy efficiency in industry and other purposes, for a total of roughly EUR 221 million allocated to the different measures. The proposed measures aim to facilitate the green transition while achieving significant reductions in emissions, and to promote resource efficiency and carbon handprint solutions[51] in industry. The intended impacts of these measures are a significant reduction of energy use of coal by about 40% to 80% from 2019 levels by 2026, improving the potential for industrial enterprises to electrify their processes and to adopt new energy technologies, improving the operating potential for non-combustion heat production, achieving a further reduction of 1.65 Mt in greenhouse gas emissions by 2030, increasing the use of sustainable energy so that it will come to account for more than 50% of total energy consumption in the course of the 2020s, and decreasing direct and indirect greenhouse gas emissions by an average of at least 30% from what they were prior to the investments.

Assessment of the topic of renewable energy production

[51] In contrast to the carbon footprint, the carbon handprint relates to activities with a climate benefit such as exported energy from on-site generation, carbon removals, etc.

Our analysis of the NRRP identified two investments targeting renewable energy production, for a total of roughly EUR 164 million allocated to the two measures. The potential impacts of the two investments in renewable energy production are increasing the use of sustainable energy so that it will come to account for more than 50% of total energy consumption in the course of the 2020s, and building 17MW of solar energy capacity by the year 2030.

Assessment of the topic of hydrogen

Our analysis of the NRRP identified one investments targeting hydrogen, for a total of EUR 156 million allocated to the measure. The proposed measure aims to achieve significant reductions in carbon dioxide emissions through hydrogen economy solutions and to strengthen their competitiveness. The intended impact of this measure is a reduction of 2 Mt of CO2eq per year by 2026, with a further target of enabling emission reductions in other areas of the economy through sectoral integration, and achieving a combined reduction of 1 Mt of CO2eq per year by 2026.

Assessment of the topic of energy infrastructure

Our analysis of the NRRP identified one investment targeting energy infrastructure, for a total of roughly EUR 155 million allocated to the measure. The proposed measure aims to invest in the energy system and clean energy production to facilitate the green and digital transition while achieving significant reductions in emissions. The intended impact of these measures is a reduction of 2 Mt of CO2eq per year by 2026, by enabling larger district heating networks and electricity connections from RES generation sites to the main grid, including across the border to Sweden.

Assessment of the topic of sustainable transport

Our analysis of the NRRP identified two investments and two reforms targeting sustainable transport, for a total of roughly EUR 40 million allocated to the different measures. The proposed measures aim to achieve emission reductions and to transition to fossil-free transport. Finland's aim is to halve the greenhouse gas emissions of domestic transport by 2030 and achieve zero emissions from transport by 2045. The intended impacts of these measures are enabling emission reductions by encouraging use of vehicles using alternative motive power, and reducing emissions through a transition from fossil fuels to electric, biogas or other motive power.

Use of financial instruments in Finland's NRRP

Finland's NRRP does not provide detailed information on the financial instruments dedicated to green investments. However, the NRRP mentions that some projects may receive support from other EU programmes or through national instruments. At the innovation stage, projects may find funding through the Horizon Europe programme, and some funding may be available through the Just Transition Fund (JTF) in regions. At the investment stage, funding may be available from the EU Innovation Fund. For the cross-border energy infrastructure project, the first plan is to obtain funding from CEF as it is included on the PCI list for electricity interconnection.

Innovative financial instruments were not selected for the RRP because of the short timeline for its development. The definition of new instruments would have taken longer than what was intended for the adoption of the RRP. Many grant instruments also already existed before the RRP. The choice to increase their funding rather than developing new measures was based on the intention to limit the administrative work, which was already established and familiar for both authorities and funding applicants. The exception to this is the participation in the IPCEI on hydrogen.

Conclusion on Finland's NRRP

The comparability between the NRRP and the NECP is somewhat limited due to the lack of a systematic correspondence between the measures proposed in the NRRP and the environmental targets of the NECP. Overall, the NRRP mentions that Pillar 1 (green transition) provides cross-cutting support for the implementation of national climate and energy plans such as the NECP.

Energy efficiency in buildings: Improving the energy efficiency of buildings and phasing out oil heating by 2030 were already part of the NECP (e.g. subsidies for energy efficiency in buildings, promoting the use of bioliquids in heating of buildings). However, apart from the target of raising the annual share of biofuels in 2030 to 10%, the NECP does not include quantifiable targets and a higher ambition of the NRRP is evident (improving greenhouse gas efficiency by more than 30%).

Energy efficiency in industry and other: Finland's indicative national energy efficiency target in the NECP for 2020, in accordance with the Energy Efficiency Directive, was the absolute level of final consumption of energy at 310TWh, and the 2030 energy efficiency target is 290TWh. In terms of GHG emission reductions, the NCEP includes a target of 0.45 Mt CO2eq reduction in 2030, while the NRRP aims at a reduction of direct and indirect GHG emissions by an average of at least 30%, and a further reduction of 1.65 Mt in GHG emissions by 2030, indicating an increase in ambition in the NRRP.

Renewable energy production: Finland sets a 51% share for Finland's national contribution to the EU's binding target of 32% of renewable energy in the NECP, and the combined target of the relevant measures is a combined increase in renewable energy of 31.4 TWh. The NRRP target of the share of renewable energy sources in Finland's total energy consumption is set at more than 40%. In accordance with the National Energy and Climate Strategy 2030, the target is to increase the use of sustainable energy so that it will come to account for more than 50% of total energy consumption in the course of the 2020s. The NRRP also aims to build 17MW of solar energy capacity by the year 2030.

Hydrogen: The NECP makes no mention to measures related to hydrogen, while the NRRP includes two investment measures in hydrogen.

Energy infrastructure: The NECP only vaguely mentions energy infrastructure and does not include specific measures. The NRRP aims at a reduction of 2Mt of CO_{2eq} per year by 2026 via increasing clean energy production and storage and integrating energy systems with one another more closely.

Sustainable transport: The NECP proposes a target of 30% share of renewable energy of final energy consumption in road transport and reaching a 1.22Mt CO_{2eq} emission reduction by 2040. The NRRP aims at achieving emission reductions and transitioning to fossil-free transport by halving GHG emissions of domestic transport by 2030 and achieving zero emissions from transport by 2045, indicating a higher ambition in the NRRP.

France

Total budget of the NRRP	EUR 100 billion
Grants	EUR 38.4 billion
Loans	EUR 62.6 billion
% supporting climate objectives	46%

Overview - The NRRP of France is organised around three main dimensions that are considered essential to strengthening the fundamentals of the French economy and remain in full coherence with European challenges and priorities. The first dimension, is dedicated to the greening of economy, with EUR 30 billion dedicated to financing investments for the green transition in all its dimensions. The second dimension, aims to strengthen the competitiveness and independence of the French production system, with EUR 34 billion allocated on the one hand to a massive reduction in production taxes and on the other hand to investments in technologies for the future and the digital transition. Finally, EUR 36 billion is devoted to social and territorial cohesion and investment in skills and jobs.

Overview of energy and climate targets of France and relevant policy initiatives

The French NECP provides key strategies and measures relating to the five dimensions of the Energy Union. Complementary to this, key environmental indicators are proposed such as; the national target for total GHG of -40% by 2030 compared to 1990, renewable energy contribution of 33% of final energy consumption in 2030, and the renovation of 370,000 residential buildings by 2030. All in all, the NECP of France extensively presents its actions and priorities relating to energy and climate for the period between 2020 and 2030.

France's National Recovery and Resilience Plan (NRRP)

Assessment of the topic of energy efficiency in buildings (renovation)

Our analysis of the NRRP identifies 2 reforms and 8 investment measures for the renovation of buildings for the enhancement of energy efficiency of the building stock in France. The building sector accounts for 25% of greenhouse gas emissions, and improving the efficiency energy efficiency of the buildings is therefore argued to be essential to meet the challenge of the ecological transition of France's economy. About two-thirds of these emissions come from the residential sector, which must therefore be the subject of special attention, regardless of whether it targets the private stock or social housing. Energy renovation work is primarily aimed at combating global warming by reducing energy consumption and greenhouse gas emissions associated with the heating and cooling of buildings. In total, the identified measures are roughly estimated at EUR 10.2 billion

Assessment of the topic of energy efficiency in industry and other

Our analysis has identified 1 reform and 6 investment measures for energy efficiency in the industry. The decarbonization of the industry is essential to achieving the climate objectives that France has fixed, nearly 20% of greenhouse gas emissions in France come from industrial activities. Decarbonization is described as a potential performance lever in the NRRP for the French industry in the medium term. As a result, the Government is providing

support for reform and investment measures in line with several existing public policies, such as the anti-waste laws for contributing to a circular economy. This measure aims to accelerate the development of a circular production and consumption model in order to limit the production of waste and preserve natural resources, biodiversity and the climate. For these investments, roughly EUR 2.2 billion of funds have been allocated.

Moreover, the investment measure Springboard for the ecological transition of SMEs implemented by the French Ecological Transition Agency has been particularly successful in reaching various different SMEs in France for small to medium green investment projects, according to one consulted stakeholder. The investment measurement is in the form of subsidies aimed at supporting SMEs in renovation projects and the use of renewable energies to reduce their energy consumption and GHG emissions. To this end, the measure allowed various types of SMEs, such as small manufacturers but also boulangeries or pharmacies to invest in such green projects. According to a consulted stakeholder, within a few months, more than 2000 companies in France participated, each receiving around EUR 15,000 to 17,000 for these projects. Around 95% of these companies were new to ADEME, allowing the agency to engage a broader group of companies in future programmes. According to an evaluation performed by ADEME, for each EUR 150 to 370 of investments conducted by the participating SMEs, one tCO2 of emissions will be avoided in the future. These costs were considered particularly efficient, notably due to the majority of the SMEs not having conducted these investments if it were not for this Springboard measurement. Its success has also induced other EU member states to seek guidance from ADEME on its efficient implementation of the project, resulting in the potential of the measure being used as best practice.

Assessment of the topic of renewable energy production

Our analysis of the NRRP has identified 1 reform relevant to the topic of renewable energy production. This reform consists of the broadly scoped Climate and Resilience Bill which aims at ensuring a lasting transformation of the French economy into a more sustainable greener by supporting the development of green technologies through investments. This reform, however, does not state any specific investments in particular projects related to the production of renewable energy (e.g. solar, wind, hydro).

Assessment of the topic of hydrogen

Our analysis of France's NRRP has identified 2 investment measures relating to hydrogen. These investment measures cover two thematic areas. First, it proposes to increase the development of alternative energy modes for French ports. By means of investment projects, this measure aims at being able to provide alternative energy such as hydrogen to docked ships. The second measure aims at the development of decarbonised hydrogen to increase and enhance the usage of hydrogen in France. Roughly EUR 2.2 billion are allocated to fund these two hydrogen measures. Two other measures, categorized under the electro-mobility dimension, can be linked to the development of hydrogen technologies in transport. Notably, one investment measure aims to support the research and development of the use of hydrogen in the aviation sector while another investment measure aims to provide financial incentives to the public to trade in old and pollutant vehicles for electric or hydrogen-powered vehicles.

Assessment of the topic of energy infrastructure

Our analysis has identified 2 investment measures relating to the French energy infrastructure. These investment measures are notably intended to accelerate the use of technologies and enhance the energy infrastructure, in particular through the fourth future investment program (PIA4) which has been introduced to accelerate innovation in key technologies, notably related to the green transition. Other investment measures are aimed at supporting rural electrification with the development of solutions for more efficient management of the electrical network, which allows reducing emissions of GHGs associated with the electrical system. For these investments, roughly EUR 80 million has been allocated according to the NRRP.

Assessment of the topic of sustainable transport

Our analysis has identified 8 investment measures and 1 reform concerning the topic of sustainable transport. As the transport sector is one of the main emitters of CO2 in France and represented 38% of total emissions in 2017 in which road transport was responsible for 96% of these emissions. As a result, this thematic area has received particular attention in France's NRRP and describes several investment measures for various modes of transport. These measures aim at the one hand to encourage alternative modes of transport with little or no emissions. And on the other hand, the development of new technologies (such as the use of alternative fuels hydrogen in the aviation sector) and the development of France's rail network and other public transport in rural and urban areas. More specific investments include the 'prime à la conversion' in which citizens are incentivized to trade in older and pollutant motor vehicles for more modern, hybrid, electric or hydrogen-powered vehicles. For the set of investments and reforms, roughly EUR 9.8 billion of funds have been allocated.

Use of financial instruments in France's NRRP

In our analysis of France's NRRP we have been able to identify 4 financial instruments for the funding, to a certain extent, the investment projects related to several energy categories.

First, the green loan scheme for the 'Decarbonisation of the industry' measure aims to support micro, small and medium-sized enterprises (MSMEs) to commit to the ecological transition and in order to amplify and accelerate the actions of economic actors to increase sustainable business practises and processes. The financial instrument is managed by the BPI France and various private banks and serves as an extension of the current Diag ECO-Flux programme (also implemented by BPI France). The Diag Eco-Flux programme serves is a personalised support program for companies wishing to rapidly make sustainable savings (energy, materials, water) or reduce their waste. The green loan scheme then complements these support services by providing financial support to invest in projects related to optimisation, produce new sustainable energies, or acquire services from external firms relating to environmental sustainability. The eligible firms already have received ample support in the identification of appropriate sustainability opportunities during the Diag Eco-Flux programme and are therefore considered an important aspect of the implementation of the green loan scheme.

It is expected that the qualitative effects of the financial instrument will provide an uptake of private financing solutions as the green loan scheme requires that a minimum of 50% of the total loan amount is funded by private financial institutions. Therefore, no other EU-level funding will be involved in the implementation of green loans. Furthermore, the

characteristics of the loans involve a minimum requirement of EUR 10,000 and a maximum of EUR 100,000. These amounts are mainly due to the target group of MSMEs, such characteristics however, limit the possibilities of integrating this in different settings, sectors or energy. BPI France plays an imperative role as the coordinating party for the implementation of green loans and is tasked to avoid double funding and the general optimal allocation of resources. The financial institution is considered to be well positioned for this role as it has played an instrumental role in the Diag Eco-Flux programme.

In order to contribute to the recovery of French enterprises, the Recovery Participatory Loans (PPR) supports enterprises with development projects requiring them to strengthen their solvency. Distributed by credit institutions, the PPR makes it possible to also strengthen an enterprise's financial solidity by providing long-term financing in the forms of equity and debt for investment operations (related to strengthening and modernizing production processes or investments in R&D) as well as development projects (digital or energy transition, or commercial development in France or abroad).

Small and medium-sized enterprises (SMEs) and intermediate sized enterprises registered in France with development prospects but whose balance sheet structure has been weakened by the Covid-19 crisis, are eligible. This is made possible by the French Government providing guarantees (to 90%) for the loans and aims at rectifying the market failure where enterprises do not have sufficient access to financial instruments. This core element of the PPR is envisaged to result in an increase of private financing solutions as credit institutions will be more willing to finance SME sustainability projects with this state guarantee scheme. This financial instrument is specifically tailored for the RRP of France and has a novelty approach to support the cash flows of companies. It has been reported that this guarantee will mobilise up to EUR 20 billion in funding, which could not have been mobilised in the absence of the measure, with a contribution of 250 million from the RRF.

While the use of the loans is intended for investments in sustainable projects, it targets a broad range of 12,000 SMEs operating in different sectors to help them strengthen their balance sheets. The granted beneficiaries can apply under simple terms and attractive rates, however, considerations could be made to explore possible expansion of these financial instruments towards larger firms to integrate best practices in different settings.

Lastly, stimulus bonds under the name 'Relance Bonds' (OR) correspond to a State guarantee bond scheme with the goal of strengthening the balance sheet of French companies and enhance the financial situation of SMEs and intermediate-sized companies as well as meeting specific ESG objectives related to the ecological transition.

With a duration of 8 years, the ORs are repayable in one instalment at the maturity of the bond. Roughly EURO 1.7 billion has been allocated for this financial instrument/fund and is jointly created by the members of the French Insurance Federation (FFA), together with AFG and France Invest, the fund is guaranteed by the French state and will operate with the backing of the French Treasury (up to 30%). It is unspecified whether other EU funding, such as the RRF will be used for the financial instrument.

The ORs are expected to increase the uptake in private financial solutions as the financial instrument system is intended for any French SME and intermediate-sized

enterprises that wish to develop and invest by strengthening their balance sheet. Furthermore, next to the removal of inhibiting factors for French enterprises to have access to financial products, the ORs also offer financing without opening up their capital to outside shareholders, preventing any required changes in the governance of the enterprise, and solves any market failures related to traditional dilutive financing options.

A previous financial instrument includes the energy savings loan (PEE), which makes it possible to finance energy efficiency improvement projects related to lighting, heating and electric motorisation processes. It is implemented by BPI France with loans that can go up to 500 thousand euros, repayable over a period of three to seven years, with a deferred capital amortisation of up to two years. Additionally, it is possible for eligible enterprises to combine the ORs with the Recovery Participation Loans programme, resulting in further incentives for enterprises to explore sustainability possibilities and spur the French industrial ecological transition.

Conclusion on France's NRRP

The French NRRP corresponds in various key energy categories with the NECP and in several categories builds on it further. However, some measures and key energy categories fall short to the envisaged goals and objectives of the NECP. These findings are discussed below in more detail.

Energy efficiency in buildings (renovation): The measure described for the renovation of buildings provides greater detail and information on the pathway, key (environmental) indicators, objectives and strategy to enhance the energy efficiency of the French buildings stock. More specifically, the financial aid programme MaPrimeRénov' (MPR), has become the main public support for energy renovation for private housing and is proportional to household income. The measure is argued to be imperative in achieving the targets of 40% reduction in energy consumption by 2030 (compared to 2010), by 50% by 2040 and 60% by 2050. More broadly, the presented measures reflect the ambitions and goals stated in the NECP and build further upon them.

Energy efficiency in the industry: The NRRP described various measures for the transition plans, the diversification and economic reconversion and the limitation of emissions, by supporting integrated sustainable development. These measures are found to be consistent with the measures presented with the NCEP and build on them with more detailed approaches and objectives for several sectors, areas and key environmental issues. In particular, those relating to land use planning, such as; the natural risk prevention plan, the disaster prevention plan, seismic risks, and the development master plan.

Renewable energy production: This component of the NRRP is notably described with the presentation of the new PIA 4 (programme d'investissement pour l'avenir) which aims at financing several R&D projects related to the production of renewable energy. It however does not provide any tangible examples (next to hydrogen) as to what type of renewable energies will be the focal point. Contrarily, the NECP provides much more detail and information on the type, costs and timeline of specific types of renewable energy projects in France. Specifically related to on- and off-shore wind. The discussion of this energy category in the NRRP and the proposed measures fall short in comparison to the NECP.

Hydrogen: The NRRP has two investment projects concerning the implementation and development of hydrogen technology in France. Its development in France is argued to directly contribute to the achievement of the 2030 climate objectives and the neutrality objective 2050 climate since it has the potential to provide 6.5GW of installed electrolysis power in substitution for the production of fossil hydrogen which generates more 10kg of CO2 for 1 kg of hydrogen produced. These measures however present a more limited and less detailed approach to developing this alternative energy source in terms of the NCEP.

Energy infrastructure: While the NRRP provides a detailed pathway and describes the improvement of the resiliency of the French energy infrastructure with ample attention to both urban and rural areas, it does not provide concrete examples of potential projects, nor does it give a clear link to the agglomeration of renewable energy production compared to the described measures in the NECP.

Sustainable transport: Measures identified in the RRP of France offer various new strategies, investments and approaches compared to the NCEP. Notably the major investments in the French railway sector building on the New Railway Pact and the reform of the mode railway implemented by France and also the consideration of improving the efficiency and sustainability of freight via rail. Other notable measures include the 'prime de la conversion', which aims at inducing older and more polluting car owners of acquiring a newer and environmental vehicle. The NECP has already very ambitious objectives in this regard, (7% of all sold cars to be electric by 2023 and 27% by 2028 and 100% by 2040). The proposed measures in the NRRP reinforce the necessary mechanisms that will allow achieving the target objectives of the energy-climate plan. Several measures for electromobility are discussed in the NRRP which are not as prominently discussed in the NCEP. Notably, measures contributing in particular to the reduction of fossil energy consumption by the development of the recharging infrastructure, transfer to less massified modes of transport and the reduction of solo driving.

Germany

Total budget of the NRRP	EUR 25.6 billion
Grants	EUR 25.6 billion
Loans	EUR 0
% supporting climate objectives	40%

Overview - The NRRP of Germany contains 14 investments (some of them accompanied by reforms) related to energy projects. In particular for investments, 2 are on Energy efficiency in buildings (renovation), 3 on Energy efficiency in industry and other, 0 on Renewable energy production, 2 on Hydrogen, 0 on Energy infrastructure and 7 on Sustainable Transport. The highest NRRP funding is dedicated to sustainable transport (EUR 5.43 billion). Our findings highlight that a large number of measures cover important demand-side areas such as electric vehicles and energy efficiency, as well as hydrogen, while not providing any support to renewable energy production.

In regard to financial instruments, the NRRP includes a pilot project for Carbon Contracts for Difference (CCfD) as an innovative financial instrument. However, this is only in the concept stage so far.

Overview of energy-related targets in Germany's National Energy and Climate Plan (NECP)

The NECP of Germany seeks to achieve several high-level and specific objectives in line with the five dimensions of energy established by the Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action: decarbonisation, energy efficiency, energy security, internal market and research, innovation and competitiveness. The NECP outlines a series of climate and energy targets and defines instruments to pursue these targets. The instruments are grouped in the required dimensions and include a national emissions allowance scheme, taxation, funding programmes, as well as regulatory and soft measures. Measures are sub-divided into categories such as GHG emissions and removals, renewable energy sources and other measures in the decarbonisation dimension.

Germany's national Recovery and Resilience Plan (NRRP)

The six pillars of the German NRRP plan are (i) climate strategy and energy transition (EUR 11.26 billion); (ii) digitalisation of the economy and infrastructure (EUR 5.90 billion); (iii) digitalisation of education (EUR 1.43 billion); (iv) strengthening social participation (EUR 1.26 billion), (v) strengthening the pandemic-resilience of the health system (EUR 4.56 billion), and (vi) modern administration and dismantling of investment barriers (EUR 3.35 billion). Together, these pillars comprise a total of 40 measures, of which 4 reforms and 36 investments.

Assessment of the topic of energy efficiency in buildings (renovation)

The NRRP contains 2 measures explicitly dedicated to energy efficiency in buildings. Together, the RRF funding of these amount to EUR 2.55 billion of grants. The vast majority of this amount is targeted at deep renovations of residential and non-residential buildings to increase energy efficiency and integrate renewable energy sources for heating and cooling. 40,000 housing units are to be renovated with this support. The measure adds funding to a large national incentive programme for energy-efficient housing and increases the number of projects that can be supported in the short term. In addition, 10 real-life labs for energy-efficient neighbourhoods are supposed to showcase potential solutions at a community level and produce lessons for other neighbourhoods. Together, these measures will have short and long-term benefits to the energy efficiency of buildings in Germany.

Assessment of the topic of energy efficiency in industry and other

Our analysis of the NRRP identified 3 investments (one includes a reform) targeting energy efficiency in industry and other purposes, for a total of EUR 1.06 billion. However, it should be noted that the main objective is to reduce GHG emissions rather than energy demand. The largest measure in terms of RRF funding aims at developing pilots for carbon contracts for difference (CCfD) to increase investment security for low carbon investments in industrial processes. Even larger if national funding is considered is the support programme for decarbonisation in the industry, which is expected to produce long-term GHG emission reductions of 0.56 Mt CO_{2eq}/year through the RRF funds. The last and smaller measure is open to SMEs to find solutions for replacing carbon-intensive inputs with low-carbon alternatives or develop climate-friendly production processes and products. The additional funding volumes and measures created as a result of the NRRP can be expected to go beyond the measures included in the NECP.

Assessment of the topic of renewable energy production

Our analysis of the NRRP identified no dedicated investments or reforms targeting renewable energy production. The R&D for hydrogen generation from offshore wind as well as support for commercial climate mitigation technology development provide small elements to an increase in renewable energy production. However, the focus of the NRRP measure clearly lies on the demand side of electro mobility, energy efficiency and renewable energy supply readiness in production processes. These can be expected to enable the use of renewable energy sources in sectors with currently low renewable shares, but do not actively increase renewable energy production.

Assessment of the topic of hydrogen

Our analysis of the NRRP identified 2 investments in the area of hydrogen. These relate to R&D projects and upscaling of infrastructure for electrolysis, transport, and value chains. These projects, partly with the ICPEI label, aim to advance the decarbonisation potential from hydrogen along the entire industry value chain beyond the German borders. Together with funding from the national Energy and Climate Fund (which contains EU-ETS auctioning revenue), at least 500MW of electrolysis capacity are to be built among a series of more qualitative objectives.

Assessment of the topic of energy infrastructure

The only measures in the NRRP related to energy infrastructure are for hydrogen infrastructure and remain at the niche level. In the long term, these may have an important impact but for the duration of the NRRP, no major changes in the energy infrastructure are expected.

Assessment of the topic of sustainable transport

The NRRP contains 6 investments and 1 reform targeting transport and mobility explicitly. This is the largest number for any sub-dimension across the German NRRP. The funding volume of EUR 5.43 billion is also the highest in this comparison. In the area of road transport, electric vehicles are incentivised for individuals and private entities, vehicle fleets of public administration, and public transport. All this aims at contributing to achieving 7-10 million EVs in use in 2030. A minimum of 560,000 vehicles will be supported. This is complemented with grants for public and private EV charging infrastructure. Alternative non-fossil rail fuels for non-electrified tracks are also supported through grants. Finally, dedicated support for the value chain of hydrogen use in transport aims at lowering emissions from otherwise hard-to-abate uses.

Use of financial instruments in Germany's NRRP

Germany's NRRP presents a pilot project for CCfDs as an innovative financial instrument to reduce investment uncertainty for low-carbon investments in e.g., renewable energy-ready processes or major energy efficiency technologies. However, this measure is fully funded by the RRF (EUR 550 million) and no details are available as a concept still has to be presented by the government.

Conclusion on Germany's NRRP

The NRRP and the NECP pursue different objectives and mostly do not use the same indicators for measures. This limits the comparison between the two. Most of the NRRP measures can also be found in the NECP and were part of the policy landscape for energy and climate before the COVID-19 pandemic. These have either been extended in time or in funding volume. It remains unclear in most cases if a quantifiable contribution or increase to the NECP targets is envisaged.

Energy efficiency in buildings: the NRRP increases the volume of the main instrument to increase energy efficiency in buildings, the federal investment programme. The added funding volume is notable but not major in comparison with the overall volume foreseen in the national budget. Still, the additional means that are available in the short term, as well as demonstration projects at the neighbourhood level can be expected to make a contribution.

Energy efficiency in industry and other: the measures targeted at energy efficiency in industry increase the volume of existing funding programmes over the course of the NRRP period. With an addition of 31% in funding volume, a substantial impact can be expected. Furthermore, the implementation of CCfD as a novel instrument can be

expected to reduce market barriers for low-carbon investments. An assessment of this impact is however not possible, yet.

Renewable energy production: renewable energy generation is not explicitly addressed in the NRRP, as its measures predominantly target the demand side. However, the measures relating to electric mobility and - in a more indirect way - also energy efficiency in buildings and industry enable the use of renewable energy sources in sectors with currently low renewable shares.

Hydrogen: Germany's hydrogen strategy lays out key action points for the sectors industry, heating/cooling, and transport. These are strongly supported by the NRRP measures. For example, a contribution to the electrolysis capacity is envisaged and further investments in R&D, as well as market introduction, are foreseen. A potential key deficit lies in the source of the energy for hydrogen production. The lack of measures to increase renewable energy generation risks limiting the production of green hydrogen in the near to mid-term future.

Energy infrastructure: only hydrogen infrastructure is included in the NRRP. However, in the context of the overall energy infrastructure, these are small and unlikely to have substantial direct effects. A higher effect is expected for the hydrogen uptake in general than for changes in the infrastructure.

Sustainable transport: The grant support for electric mobility combines the previously existing environmental bonus systems but increases the funding volume and duration. In line with the recent increase in EV registrations, this can be expected to contribute to the number and share of electric vehicles. Charging infrastructure and electrification of public transport represent other areas of urgent need for action, where the NRRP measures provide promising initiatives. However, compared to the previously existing measures, the additional impact is limited.

Greece

Total budget of the NRRP	EUR 29.1 billion
Grants	EUR 17.8 billion
Loans	EUR 12.7 billion
% supporting climate objectives	37.5%

Overview - The NRRP of Greece contains 5 reforms and 14* investments related to energy projects. In particular for investments, 5 are on Energy efficiency in buildings (renovation), 4 on Energy efficiency in industry and other, 4 on Energy infrastructure and 2 on Sustainable transport. The highest NRRP funding is dedicated to Renewable energy production (EUR 2.5 billion). Our findings highlight that the NRRP is generally in line with the NECP goals even though for certain energy categories there is a difference in the level of target/ambition or there is lack of data to allow a thorough comparison.

In regard to financial instruments, the NRRP includes 2 financial instruments with a focus on the "RRP Loan Facility" which aims to bridge the "investment gap" from private funds

Overview of energy- related targets in Greece's National Energy and Climate Plan (NECP)

The NECP of Greece presents a detailed roadmap regarding the attainment of specific energy and climate objectives by 2030. Its main objective is to design and implement socially and environmentally efficient and cost-effective policy measures that will help attain the long-term national energy and climate objectives. The final version of the NECP - submitted in December 2019- set climate and energy objectives which were more ambitious than the core objectives set by the EU. The plan includes 169 policy measures of regulatory, technical and/or economic nature, categorized under seven different themes 1.Climate change, emissions and removals of greenhouse gases (15 measures), 2.Renewable energy sources (27 measures), 3.Improvement in energy efficiency (47 measures), 4.Security of energy supply (18 measures), 5.Energy market (20 measures), 6.Agriculture, shipping, tourism (32 measures), and 7.Research, innovation and competitiveness (10 measures).

Greece's national Recovery and resilience plan (NRRP)

The four pillars of the Greek RRP plan are green transition (EUR 6.2 bn), digital transition (EUR 2.2 bn), employment, skills and social cohesion (EUR 5.2 bn) and private investment and economic and institutional transformation (EUR 4.9 bn), comprising in total 175 measures, of which 67 reforms and 108 investments. The RRF funds will be made available in the form of grants and loans. The NRRP devotes in total 37.5% (37.81% grants and 37% loans) to the green transition pillar, thus surpassing the RRF Regulation's mandatory minimum allocation. The green investments in the area of energy projects accumulate to roughly EUR 3.9 billion in funding in the form of grants and EUR 4.1 billion via financial

instruments (FIs). Indicatively they include a massive programme of renovation and energy efficiency upgrade of residential, commercial, industrial and public buildings, the installation and operation of publicly accessible charging infrastructure for electric vehicles, the interconnection between the Greek islands and the mainland, which will significantly reduce energy costs for households and businesses and will allow to better tap the Renewable Energy Sources (RES) potential of the country and the simplification of the licensing procedure for RES.

Assessment of the topic of energy efficiency in buildings (renovation)

Our analysis of the NRRP identified 5 investments and 1 reform targeting energy efficiency in residential, public-administrative, commercial and judicial buildings, for a total of roughly EUR 1,560 million[52] in the form of grants or subsidized loans, allocated to the different measures. For the residential buildings, the measures will affect 105,000 households, including energy poor residences. The expected impact from these measures is annual energy savings of 213 ktoe and with primary energy savings, on average, of at least 30%. For the public sector buildings, investments are foreseen for the renovation of at least 210 buildings with a view to increasing their energy efficiency and thus achieving a reduction of about 40%-50% in direct and indirect GHG emissions, through the involvement of energy savings companies (ESCOs). Renovations are also foreseen for HOCRE (Hellenic Organization of Cultural Resources Development) Stores, which collect the proceeds from archaeological sites, historical sites, etc. Funds will be also made available to municipalities in order to renovate and re-use buildings in their jurisdictions, such as old factories and to the national justice system to renovate judicial buildings and construct new ones with primary energy demand at least 20% lower than the NZEB (nearly zero-energy building) requirement.

Assessment of the topic of energy efficiency in industry and other

Our analysis of the NRRP identified 4 investments targeting energy efficiency in industry and other purposes, for a total of EUR 978 million[53] in the form of grants. The first measure targets 9,700 private sector entities and aims to reduce their GHG emissions via energy-efficient renovations of their buildings and processes. The measure includes two sub-programmes: (a) energy efficiency renovations in the tertiary and secondary sectors for at least 1,200 medium, large and very large enterprises and (b) installation of energy efficient equipment and systems for energy conservation in production, storage, distribution of products and the operation in at least 8,500 very small enterprises. The expected impact is the reduction of annual primary energy consumption by 380 GWh and annual greenhouse gas emissions by 90 kt of CO2 equivalent (a reduction of about 30%-40% in direct and indirect and indirect GHG emissions). Additionally, the NRRP includes 3 investments that target the improvement of the energy efficiency and carbon footprint of specific sectors. In the agricultural sector, a measure includes energy upgrade of production units, buildings and mechanical equipment, the use of electric cars and of solar energy. In the touristic sector, a proposed measure entails the energy upgrades of buildings

[52] The RRF budget of EUR 1,560 million covers only the renovations in existing buildings and not the construction of new energy efficient buildings. If the RRF budget for the construction of new energy efficient buildings is also considered then the total RRF budget for Energy efficiency in buildings amounts to EUR 1,758 million.

[53] All the investments reported under this category cover multiple energy categories (energy efficiency in buildings, energy efficiency in industry and other, sustainable transport, hydrogen & renewable energy production). They are reported here due to the fact that they target the industry or another specific economic sector (agriculture, tourism, R&D).

and ports, and the construction of 1MW wind energy systems. In the R&D sector, a measure relates to the establishment of new industrial parks which will make use of RES, have energy efficient buildings and water treatment processes and use alternative fuel for transport.

Assessment of the topic of renewable energy production

Our analysis of the NRRP identified 3 reforms targeting renewable energy production. The first reform with a total budget of EUR 202 million in the form of grants will support the installation of new RES capacity by covering considerable shares of RES producers' feed-in tariffs and feed-in premiums. This measure is expected to lead to the deployment of 3 GW of additional renewable energy capacity in Greece by mid-2025. Moreover, the RRP includes provisions for the simplification and digitalisation of the licensing procedure for new RES plants, the establishment of a clear framework for installation procedures in relation to land uses, as well as the development of a new dedicated framework for offshore RES plants.

Assessment of the topic of hydrogen

In the Greek RRP, there are no measures dedicated to hydrogen production and/or use. Brief mentions on hydrogen pilot applications are made under certain investments (investment that relates to the establishment of industrial parks, investment that promotes green transportation, investment that concerns the establishment of a carbon capture and storage facility).

Assessment of the topic of energy infrastructure

Our analysis of the NRRP identified 4[54] investments targeting energy infrastructures, for a total of roughly EUR 807 million in grants allocated to the different measures. The first set of interventions relates to the electricity interconnection of islands and the upgrading of the electricity network. The measure is expected to lead to the progressive decommissioning of the polluting oil-fired units that currently supply the Cycladic islands that will reduce CO2 emissions (by 99,562 tonnes/year from 2025 and by 120,808 tonnes/year in 2030) as well as to the full exploitation of local RES potential in Cyclades and Peloponnese. The second set of interventions entails the increase of the capacity of existing High Voltage/Medium Voltage substations of the distribution network to address the congestion of the grid and thus allow the integration of 1,755 MW of RES capacity in the network. Also, support will be provided for the development of the first carbon capture and storage facility in Greece. Regarding the facility's capacity it is estimated to initially have a CO2 injection rate of 1 million tonnes/year. The last investment relates to the installation of 1,380 MW capacity of energy storage systems to enhance RES penetration. This measure shall allow the system integration of new RES capacity which is required for the achievement of NECP targets.

Assessment of the topic of sustainable transport

Our analysis of the NRRP identified 2 investments and 1 reform targeting sustainable transport, for a total of roughly EUR 370 million in grants allocated to the different measures. The measures encompass the establishment of a comprehensive regulatory

[54] One of these investments is split into 2 sub-projects. Sub-project 1 relates to the establishment of a CO2 capture and storage and is reported under this category and Sub-project 2 relates to electromobility R&D and is reported in the next section. However, in the RRP there is no disaggregation available of the total budget of 300 million. We assumed that each sub-project is assigned half the total budget (i.e., EUR 150 million).

framework for the installation and operation of charging points for electric vehicles, financial support for the installation of 8,656 publicly accessible charge points by the end of 2025, the replacement of old buses with 220 new electric ones and the replacement of old taxis with 2,000 battery electric vehicles (approximately 6% of the existing taxi fleet in Greece). All these actions are expected to reduce CO2 emissions, reduce dependency on oil and increase RES penetration in the country's final energy consumption. Additionally, support will be provided for the establishment of more than 10 industrial units with R&D departments for e-mobility activities, such as the recycling of electric car batteries through re-use of raw materials like lithium and cobalt or the designing of electric vehicles and regular or high-power charge points. Lastly, the RRP includes an investment for the upgrade and redeployment of the Greek rail network system and infrastructure, which foresees the elimination of non-electric trains from the main and two regional rail network branches[55].

Use of financial instruments in Greece's NRRP

The main financial instrument described in the Greek NRRP is the "RRP Loan Facility" will make use of different distribution channels, namely International Financial Institutions and commercial banks through corporate bond purchases or syndicated loans, an equity platform, and the Member State compartment of the InvestEU Programme. The loans will cover a maximum of 50% of the investment costs, with the financial institutions' participation at a minimum of 30%, and debtor participation of least 20%. The RRP Loan Facility budget relevant to energy related projects is: for Renewable energy production EUR 2,285 million, for Energy efficiency in industry and other: EUR 1,398 million and for Energy Infrastructure EUR 445 million. The "RRP Loan Facility" is established in order to bridge the large investment gap characterising the Greek economy over the past ten years: in 2019 investment spending stood at 10.1% of GDP compared to a eurozone average of 22.2%. Additionally, the NRRP mentions the provision of interest rate subsidies for energy renovations on residential buildings.

Regarding co-financing, for the energy renovations on residential buildings the total budget will be covered by RRF funds (direct grants and interest rate subsidy), national budget, the NSRF 2014- 2020, the REACT-EU and private capital. Other energy efficiency interventions in residential areas and in the building-stock will be covered by RRF grants, the national budget and private contribution. And for the renovations on judicial buildings, the budget will be covered by RRF grants and national budget.

Conclusion on Greece's NRRP

According to the RRP, the plan is in line with the strategic priorities of Greece's NECP, and the specific targets set by the latter. Our analysis per category revealed the following:

Energy efficiency in buildings: The NECP includes a measure to renovate 600,000 homes by 2030 with a budget of EUR 11 million. According to the RRP, by 2025, the energy renovation programme for residential buildings will contribute up to 15% to meeting the NECP target with annual energy savings of 210 ktoe and a budget of EUR 3 million. It is evident that additional public funding will be needed to mobilise the total volume of investments necessary to deliver on the remaining of the energy savings

[55] The primary goal of this investment is not energy/climate related but rather to restore the "design speed" in all sections of the infrastructure and improve the network's reach and reliability in terms of journey time and levels of safety. Also, it is not possible to disaggregate the budget and isolate its "green" component. Therefore, the RRF budget for this investment is not included in the EUR 370 million budget of the sustainable transport category.

required to achieve the objective set in the NECP. However, in its NECP Greece set a target to renovate 28 public buildings while the RRP set measures for the energy upgrade of 210 public premises.

Energy efficiency in industry and other: The RRP includes measures for the support of small, medium and large enterprises to improve their energy efficiency and lower their carbon footprint. This is in line with the NECP which also refers to financing programmes for the improvement in the energy efficiency of industries. However, with regard to the agricultural sector, the NECP included measures that related to the production and use of biomass and biofuels while such measures are not present in the RRP.

Renewable energy production: According to the NECP, the new RES capacity for the period 2020-2030 is estimated at 8-9 GW. The RRP states that 4.7 GW from RES are expected to be added in the electricity production capacity due to the new RES remuneration scheme and the upgrade of the electricity distribution network. All other RES related measures in the RRP are not accompanied by a quantitative target. Qualitatively though, the two plans are mostly aligned on the measures that relate to RES penetration, except for the use of RES in the transport sector: the NECP promotes the use of biofuels and natural gas which is not the case for the RRP.

Hydrogen: Both the NECP and the RRP refer to pilot facilities for the production and use of green hydrogen. However, neither of these plans includes any specific measures targeting hydrogen technologies.

Energy infrastructure: Regarding energy infrastructure, the NECP and the RPP are aligned as they both refer to the enhancement and expansion of energy infrastructure in both the transmission system and the distribution network for tackling congestion that prevents further growth of RES plants in specific areas. Additionally, both plans include measures that promote investments in CO2 capture and storage and in RES storage.

Sustainable transport: The NECP laid out a set of sustainable transport measures, including the completion of the necessary energy infrastructures for recharging electric vehicles and the development of a framework of incentives for the use of electric vehicles which would result in 30% share of electric vehicles in the domestic market by 2030. Similarly, the RRP allocated funds to the development of charging infrastructure and promoted the use of incentives for the use of public and private electric vehicles. However, the NECP also envisioned the use of natural gas, biomethane and other alternative fuels for the transport sector (road), as well as the development of the regulatory framework and appropriate infrastructure that will enable the electrification of ships.

Hungary

Total budget of the NRRP	EUR 7.2 billion (HUF 2,511.3 billion)
Grants	EUR 7.2 billion (HUF 2,511.3 billion)
Loans	EUR 0.0 billion (HUF 0.0 billion)
% supporting climate objectives	40%

Overview - The NRRP of Hungary contains 0 reforms and 7 investments related to energy projects. In particular for investments, 2 are on Energy efficiency in buildings (renovation), 0 on Energy efficiency in industry and other, 1 on Renewable energy production, 0 on Hydrogen, 1 on Energy infrastructure and 5 on Sustainable transport. The highest NRRP funding is dedicated to Sustainable transport (EUR 1.6 billion). Our findings highlight that some key energy categories are neglected or only superficially covered in the NRRP, and the effective impacts of the included investments on energy-related projects are not clearly defined.

In regard to financial instruments, the NRRP mentions that additional financial instruments could be used when RRF funds will not be enough to support the intended projects, but does not provide more detailed information. Nevertheless, the Hungarian NRRP also describes that some of the projects in Hungary will be financed not only by RRF funds, but also by domestic funds such as the KEHOP Plusz and the TOP Plusz.

Overview of energy-related targets in Hungary's National Energy and Climate Plan (NECP)

The NECP of Hungary seeks to achieve several high-level and specific objectives in line with the five dimensions of energy established by the Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action: decarbonisation, energy efficiency, energy security, internal market and research, innovation and competitiveness. Specifically, the NECP of Hungary describes a set of national objectives and targets and presents the planned policies and measures to meet such targets. Some of the specific objectives include a 40% reduction in GHG emissions by 2030 compared to 1990, a 21% minimum share of renewable energy within gross final energy consumption, a 14% renewable energy share of total energy consumption in transport by 2030, and a ceiling of 785 PJ of final energy consumption in 2030 (i.e. energy efficiency target). The European Commission assessed the targets on renewable energy as unambitious, while the energy efficiency targets on primary and final energy consumption have been judged to be very low. The Hungarian NECP was sent to the European Commission in late 2018, and Hungary published the final plan in January 2020.

Hungary's national Recovery and Resilience Plan (NRRP)

Hungary's NRRP is divided into 9 components, organised into 6 pillars: (i) Green transition, (ii) Digital transformation, (iii) Smart, sustainable and inclusive growth, including economic

cohesion, jobs, productivity, competitiveness, research, development and innovation, and a well-functioning internal market with strong SMEs, (iv) Social and territorial cohesion, (v) Health, and economic, social and institutional resilience, with the aim of, inter alia, increasing crisis preparedness and crisis response capacity, and (vi) Policies for the next generation, children and the youth, such as education and skills.

The components in the Hungarian NRRP that deal with energy-related projects are (i) Sustainable green transport, (ii) and Energy (electricity). The green investments in the area of energy projects accumulate to roughly EUR 2.56 billion in funding. They include the development of zero emission bus transport (EUR 0.15 billion), Support for residential solar systems and electrification of heating systems in combination with solar systems (EUR 0.46 billion), the renovation of social housing (0.13 billion) and Classic and intelligent network developments for transmission system operator and hubs (EUR 0.30 billion). Together, these dimensions cover more than 35% of the amount of investments foreseen in the NRRP.

Hungary submitted a revised NRRP in November 2022, but as of today the plan has not been endorsed by the European Commission or approved by the Council of the European Union.

Assessment of the topic of energy efficiency in buildings (renovation)

Our analysis of the NRRP identified two specific investments or reforms targeting energy efficiency in buildings and buildings renovation with a total financing of EUR 0.584 billion. Notable financing is dedicated to the installation of solar power and heat pumps to electrify household heating and achieve around 50 MW of electrical heating capacity. Additionally, the renovation of 1600 and construction of 400 new social housing units aims at improving energy efficiency and living standards for vulnerable populations. Furthermore, the energy efficiency aspect can be traced in some other components. For example, infrastructural development plans in the public sector include renovation of public buildings such as schools and hospitals. The impact of the mentioned interventions however remains unclear.

Assessment of the topic of energy efficiency in industry and other

Our analysis of the NRRP identified did not identify any specific investment or reform targeting energy efficiency in industry and other sectors. The measures targeting the industrial sectors are included in the Circular green economy component of the Hungarian NRRP, and focus mostly on minimising waste, water consumption, as well as digitalising the sector.

Assessment of the topic of renewable energy production

Our analysis of the NRRP identified 1 investment and 0 reforms targeting renewable energy production, for a total of (EUR 0.46 billion) (HUF 158.76 billion) allocated to the different measures. The measures focusing on renewable energy in the Hungarian NRRP are centred around developing carbon free electricity generation to achieve 175 MW new built in renewable energy production capacity with household-size small power plants (<50 kW). The excess electricity could then be injected into the national electricity grid to help cope

with demand during peak times. According to the NRRP, this would result in GHG emissions reductions of approximately 54,760 tons per year (0.1% of national emissions).

Assessment of the topic of hydrogen

Our analysis of the NRRP did not identify any investment or reform targeting hydrogen.

Assessment of the topic of energy infrastructure

Our analysis of the NRRP identified 1 investment and 0 reforms targeting energy infrastructure, for a total of (EUR 0.30 billion) (HUF 103.73 billion) allocated to the different measures. The NRRP introduces an investment to reinforce and expand the national transmission and distribution networks in view of the increasing installation and connection of new small-scale renewable capacity (see the previous assessment on renewable energy production). Measures aimed at network development include the establishment of new 132/22 kV substations supply installations and expansions to connect an increasing number of renewable power plants, digitalisation developments to increase the ability to collect information, monitor and intervene (control and regulate), and high voltage new traceable network establishments. The expected interventions will allow the connection of 2,034 MW of renewable installed capacity to be connected to the grid by the end of 2026.

Assessment of the topic of sustainable transport

Our analysis of the NRRP identified 5 investments and 0 reforms targeting sustainable transport and sustainable green transport in general, for a total of (EUR 1.72 billion) (HUF 631 billion) allocated to the different measures. The proposed measures aim at supporting modal shift to more sustainable means of transport as well as to electrify the fleet of public transport vehicles. In this sense, the investments presented in the plan target the modernisation and capacity expansion of the suburban railway line in Budapest, the development of bicycle paths, and the acquisition of zero-emission/electric vehicles for the public fleet of buses.

Use of financial instruments in Hungary's NRRP

Our analysis of the NRRP did not identify any specific financial instrument to be used for energy-related projects. Nevertheless, the Hungarian NRRP mentions that some of the projects in Hungary will be financed not only by RRF funds, but also by domestic funds. As an example, renovation and energy efficiency interventions will benefit from the KEHOP Plusz (2021 – 2027) fund (residential sector) which will be opened as a continuation of the previous Energy Efficiency Operational Programme (KEHOP, 2014 – 2020), as well as from the TOP Plusz (municipal buildings).

Conclusion on Hungary's NRRP

The Hungarian NRRP integrates interventions in many (but not all) categories of energy projects, but does not clearly indicate the extent to which these measures will help the country to achieve more ambitious energy and climate targets. While the NRRP seems to build on the previously published NECP, the assessment results challenging as some intervention categories such as energy efficiency in industry or hydrogen are missing.

Energy efficiency in buildings: Hungary's NRRP improves the energy performance and energy source of residential buildings. This addresses important needs to reduce the dependency of fossil fuels in heating. In this context, the ambition is highly needed but assessed as medium in relation to the baseline and the existing climate and energy targets.

Energy efficiency in industry and other: The NRRP of Hungary does not include any measure targeting energy efficiency in industry and other sectors.

Renewable energy production: The NECP of Hungary already set the renewable share and photovoltaic installation targets as described in the NRRP: solar PV capacity should exceed 6,000 MW by 2030 and approach 12,000 MW by 2040 from the current 1,800 MW installed. The Hungarian NRRP includes an additional measure aimed at fostering the installation of household-size small solar PV (175 MW) and explicates the expected GHG emission reductions (54,760 tons per year). Nevertheless, this reduction is small as it represents less than 0.09% of Hungary's total GHG emission in 2019.

Hydrogen: The NRRP of Hungary does not include any measure targeting hydrogen.

Energy infrastructure: Hungary's NRRP includes one investment aimed at reinforcing and preparing the transmission and distribution grids to the increasing penetration of renewable sources of energy in the power supply mix (and their connection to the grid). The listed measures that are part of this investment go in the direction set by the Hungarian NECP, which calls for the preparation of the grid for the growing spread of decentralised capacities. In this sense, the NRRP proposed some concrete measures which are in addition to the recommendations expressed in the NECP.

Sustainable transport: The NRRP of Hungary includes additional measures compared to the NECP to promote modal shift via the extension and improvement of the suburban railway lines in Budapest, but it is hard to quantify the expected impact of such measures. The Hungarian NRRP also includes an investment for the acquisition of zero or low-emission buses to decarbonise the public buses fleet, but this measure seems to be part of the Green Bus Programme, described in the NECP, which will see 1,300 environmentally friendly local buses entering into service by 2029.

Ireland

Total budget of the NRRP	EUR 989 million
Grants	EUR 989 million
Loans	N/A
% supporting climate objectives	42%

Overview - The NRRP of Ireland contains 2 reforms and 4 investments related to energy projects. Regarding investments, 2 are on Energy efficiency in buildings (renovation), 1 on Energy efficiency in industry and other, 0 on Renewable energy production, 0 on Hydrogen, 0 on Energy infrastructure and 1 on Sustainable Transport. The highest NRRP funding is dedicated to Sustainable Transport (EUR 164 million). Our findings highlight that Ireland's NRRP is not focused on renewable energy, but rather on sustainable transport and built infrastructure efficiency. However, the plan lacks depth and insight into the measures and how they will contribute to the country's emission reduction goals.

Details concerning financial instruments are limited, however the NRRP alludes to fiscal incentives as the main driver for achieving policy objectives.

Overview of energy-related targets in Ireland's National Energy and Climate Plan (NECP)

The NECP of Ireland seeks to achieve several high-level and specific objectives in line with the five dimensions of energy established by the Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action: decarbonisation, energy efficiency, energy security, internal market and research, innovation and competitiveness. The NECP outlines a set of key climate and energy targets and describes a set of policies and measures to achieve such targets. For example, these include new capacity installation for renewable sources of electricity such as offshore (3.5GW) and onshore (8.2GW) wind and grid scale solar energy (1.5GW) with the aim of increasing electricity generated from renewable sources to 70% and achieving a 34% share of renewable energy in energy consumption by 2030. To contribute towards the EU target of achieving at least 32.5% improvement in energy efficiency by 2030, the Irish NECP proposes a list of measures centred on public buildings (e.g. public sector buildings to have a B Building Energy Rating by 2030), commercial buildings (one third of commercial buildings to have a B rating by 2030), as well as on the installation of heat pumps to replace fossil fuel heating systems in old and new dwellings. Ireland notified its final NECP to the European Commission in August 2020.

Ireland's national Recovery and Resilience Plan (NRRP)

Ireland's NRRP is rather short compared to the NRRPs of other Member States and is divided into three priorities: 1) Advancing the green transition (EUR 518 million); 2) Accelerating and expanding digital reforms and transformation (EUR 291 million); 3) Social and economic recovery and job creation (EUR 181 million). The plan includes 25 measures, of which 9 are reforms and the remaining 16 are investments.

The RRF funding is increased with further EUR 84 million from REACT-EU as additional funding to help with the country's recovery. To advance the green transition, the Irish NRRP proposes numerous investments aimed at improving the energy efficiency of residential buildings, industry and other sectors, as well as some investments to promote electro mobility, and some reforms for renewable energy production. Notably, the plan does not present any investment or reform towards energy infrastructure and hydrogen.

The Irish NRRP was submitted in May 2021 and has been endorsed by the European Commission in July 2021, with an approval of the assessment from the European Council in September of the same year.

Assessment of the topic of energy efficiency in buildings (renovation)

Our analysis of the NRRP identified 2 investments targeting energy efficiency in buildings, for a total of EUR 115 million allocated between the measures. The first measure includes de-risking a low-cost residential retrofit loan scheme, where EUR 40 million are from RRF funds, and an additional EUR 20 million from Exchequer to provide an upfront payment for losses expected during the lifetime of the guarantee scheme. The second measure is a public sector retrofit and energy retrofit program, in line with the Irish government's public buildings 2030 carbon reduction targets. These measures contribute towards the EU wide target of achieving at least 32.5% improvement in energy efficiency by 2030. The plan does not provide an estimate for the intended impact of these measures.

Assessment of the topic of energy efficiency in industry and other

Our analysis of the NRRP identified 1 investment targeting energy efficiency in industry and other purposes. The purpose of the measure is to decarbonise the enterprise sector, for a total of EUR 55 million. The objective of the measure is to support decarbonisation by incentivising the installation of Energy Metering and Monitoring Control Systems, in addition to increasing the uptake of efficient space heating. The plan does not provide an estimate for the intended impact of these measures.

Assessment of the topic of renewable energy production

Our analysis of the NRRP identified no investments for renewable energy production. The two reforms included within green transition priority of the plan could indirectly influence the uptake of renewable energy. The first reform is an amendment to the Climate Action and Low Carbon Development Bill (021), with the purpose to provide the primary legislation to strengthen the statutory framework for more effective governance of Ireland's climate objectives. The bill would set a target for 2030 of a 51% reduction in emissions, which could indirectly influence the uptake of renewable energy production. The second reform is an amendment to the Base Broadening Carbon Tax. This entails a trajectory of rate increases

to the carbon tax. The increasing rates will encourage heavy polluters to adopt more sustainable practices. The plan does not provide an estimate for the intended impact of these measures.

Assessment of the topic of hydrogen

There are no investments or reforms pertaining to hydrogen in Ireland's NRRP.

Assessment of the topic of energy infrastructure

There are no investments or reforms pertaining to energy infrastructure in Ireland's NRRP.

Assessment of the topic of sustainable transport

Our analysis of the NRRP identified 1 investment targeting sustainable transport, for a total of EUR 164 million. The measure seeks to enable future electrification through targeted investment in Cork commuter rail. The aim of the investment is to expand Cork metropolitan area's sustainable mobility capacity, while also contributing to the city's long-term objective to provide electrified rail services. The plan does not provide an estimate for the intended impact of these measures.

Use of financial instruments in Ireland's NRRP

The Irish NRRP does not provide information on the financial instruments dedicated to green investments, but only presents a summary of the EU funds that the country will receive and how much of this funding will be dedicated to advance the green transition. Ireland will receive EUR 989 billion in grants from the RRF, and the Irish NRRP is aligned with domestic policies such as the Economic Recovery Plan (ERP) and the review of the National Development Plan (NDP) which entails a EUR 116 billion capital investment up to the year 2027.

Conclusion on Ireland's NRRP

The level of ambition of the energy measures included in the Irish NRRP compared to the measures in the NECP is difficult to assess across the considered categories of energy projects, especially since the two plans are organised differently and the level of detail is significantly less in the NRRP than in the NECP. The former is a 32 pages document with only few sections dedicated to the green transition, while the latter has 273 pages all centred around climate and energy targets and measures. Nevertheless, the Irish NRRP complements Ireland's broader climate ambition and paves the way for an accelerated decarbonisation of the country's economy by proposing a reform aimed at progressing the Climate Action and Low Carbon Development (Amendment) Bill. This reform provides the primary legislation to strengthen the statutory framework for more effective governance of the country's climate objectives.

Few months after the endorsement of the Irish NRRP in July 2021, the Irish Climate Action Plan 2021 was published to set a path towards a 51% GHG emission reduction by 2030 and net-zero emissions by 2050. This plan lists the measures required to achieve these targets and will be updated annually.

Energy efficiency in buildings: The measures included in the Irish NRRP (e.g. public sector buildings' energy retrofit programme) will likely contribute to the achievement of the energy efficiency target set in the Irish NECP (i.e. contribute towards the EU-wide target of achieving at least 32.5% improvement in energy efficiency by 2030), but the plan does not provide information on the expected impacts of such measures.

Energy efficiency in industry and other: The NRRP allocates EUR 55 million to support the decarbonisation of enterprises by incentivising the installation of Energy Metering and Monitoring Control Systems, but the effective impact of this measure remains unclear.

Renewable energy production: The NECP includes several high-level targets for renewable energy production. However, it is unclear how the reform of the Climate Action and Low Carbon Development (Amendment) Bill included in the Irish NRRP will impact renewable energy production.

Hydrogen: The NRRP does not provide information on any measure or target related to the development of the hydrogen economy in Ireland. Nevertheless, the Irish Government is currently undergoing a public consultation on developing a hydrogen strategy for Ireland which will outline the pathways towards the production of green hydrogen and its use in Ireland's energy mix.

Energy infrastructure: No energy infrastructure-related measures have been identified in the Irish NRRP. Some references to developing storage capacity to demonstrate long duration and seasonal storage of renewable energy are present in the Irish Climate Action Plan 2021.

Sustainable transport: The NRRP does not provide information on investments or reforms aimed at improving the climate impact of transport and mobility, with the only exception being the targeted investments in the electrification of the Cork Commuter Rail. This will come in addition to the electrification of Commuter Urban Rails projects already included in the Irish NECP.

Italy

Total budget of the NRRP	EUR 191.5 billion
Grants	EUR 68.9 billion
Loans	EUR 122.6 billion
% supporting climate objectives	37%

Overview - The NRRP of Italy contains 6 reforms and 30 investments related to energy projects. For investments, 7 are on Energy efficiency in buildings (renovation), 9 on Energy efficiency in industry and other, 7 on Renewable energy production, 5 on Hydrogen, 4 on Energy infrastructure and 5 on Sustainable transport. The highest NRRP funding is dedicated to Energy efficiency in buildings (renovation) (EUR 6.0 billion). Our findings highlight that out of the six strategic missions of the NRRP, "Green revolution and ecological transition" is the mission with the largest dedicated funding (EUR 59.46 billion). This mission is pursued through several investments and reforms, from Smart grid strengthening (accounting for EUR 3.6 billion of funding) to Simplification of authorisation procedures for onshore and offshore renewable plants. In regard to financial instruments, the NRRP does not provide detailed information on the financial instruments dedicated to green investments. However, the NRRP makes clear that fiscal incentives to enterprises and transfers of money to households are the two key financial instruments accounting for a sizable share of the RRF resources.

Overview of energy-related targets in Italy's National Energy and Climate Plan (NECP)

The NECP of Italy seeks to achieve several high-level and specific objectives in line with the five dimensions of energy established by the Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action: decarbonisation, energy efficiency, energy security, internal market and research, innovation and competitiveness. The NECP outlines a set of climate and energy targets and describes a set of economic, regulatory and planning instruments to achieve such targets. The NECP lists a total of 106 instruments classified within 13 broad scopes, namely "Emissions", "Electricity RES", "Electricity RES and thermal RES", "Thermal RES efficiency", "RES in the transport sector", "Efficiency in the transport sector", "Efficiency in non-transport sectors", "Electricity security", "Gas security", "Electricity market", "Electricity and gas market", "Gas market", "Research, innovation and competitiveness". Notably, the NECP was sent to the European Commission in late 2018 and a new NECP is currently under definition.

Italy's national Recovery and Resilience Plan (NRRP)

Italy's NRRP is divided into sixteen components, grouped into six missions: (i) Digitisation, Innovation, Competitiveness, Culture and Tourism (EUR 40.29 billion); (ii) Green revolution and ecological transition (EUR 59.46 billion), (iii) Infrastructures for sustainable mobility

(EUR 25.40 billion); (iv) Education and research (EUR 30.88); (v) Cohesion and inclusion (EUR 19.85 billion); (vi) Health (EUR 15.63 billion).

The RRF funding is topped up with additional budget from REACT – EU and national funds: these resources amount to an extra EUR 43.6 billion allocated to the different components of the NRRP. The green investments in the area of energy projects accumulate to roughly EUR 36.5 billion in funding. They include Interventions for the resilience, the enhancement of the territory and the energy efficiency of the municipalities (EUR 6 billion), Safety plan and redevelopment of school buildings (EUR 3.9 billion), Renewal of bus fleets, green trains (EUR 3.6 billion), Smart grid strengthening (EUR 3.6 billion), Renewable energy promotion for energy communities and self-consumption (EUR 2.2 billion). As key reforms are identified the following: Simplification of authorisation procedures for onshore and offshore renewable plants, new legal framework to support production from renewable sources and extension of the timing and eligibility of current support schemes; Simplification and acceleration of procedures for carrying out interventions for energy efficiency; Administrative simplification and reduction of regulatory obstacles to the diffusion of hydrogen.

Assessment of the topic of energy efficiency in buildings (renovation)

Our analysis of the NRRP identified 7 investments and 1 reform targeting energy efficiency in buildings, for a total of roughly EUR 13 billion allocated to the different measures. These measures, contributing to the long-term goal of achieving complete decarbonisation of the civil sector in 2050, aim to overcome the non-economic barriers that reduce investment choices in interventions of energy requalification of buildings, or that slow down the execution of the works. The objectives of these measures are the improvement of energy classes (with consequent reduction of consumption and CO_2 emissions) and the increased structural safety of buildings. Overall, these measures aim to intervene on the renovation of over 100,000 buildings, (a total redeveloped area of over 36 million square meters). The intended impact of these measures is also a reduction in annual greenhouse gas emissions of approximately 672.84Kton CO_2 per year.

Assessment of the topic of energy efficiency in industry and other

Our analysis of the NRRP identified 9 investments and 1 reform targeting energy efficiency in industry and other purposes, for a total of roughly EUR 10.15 billion allocated to the different measures. The proposed measures aim to fill Italy's gap in terms of infrastructure competitiveness by intervening on different economic sectors, notably on the logistics of the agri-food, fishing and aquaculture, forestry, floriculture and nursery sectors, characterised by strong specificities along the entire supply chain. The intended impacts of these measures are a reduction of 95% of emissions for the agricultural and food sectors thanks to the replacement of more polluting vehicles used for industrial purposes, a reduction of GHG emissions estimated at around 0.8 million tons of CO_2 thanks to agro-voltaic development, and overall saving of GHG between 80 and 85 percent thanks to the use of biomethane in the gas network.

Assessment of the topic of renewable energy production

Our analysis of the NRRP identified 7 investments and 2 reforms targeting renewable energy production, for a total of roughly EUR 7.7 billion allocated to the different measures. The proposed measures aim to address the main challenges of the ecological transition in an integrated way, focusing in particular on those areas characterised by a high potential improvement in environmental/energy terms, such as small islands, rural communities rural and mountain areas. These areas are often characterised by an unbalanced exploit of their resources, including, first of all, water, woods and landscape. Therefore, on one hand renewable energy production is fostered in terms of technical innovation and regulatory reforms, on the other hand these measures aim to sustain the creation and growth of local communities by supporting the development, financing and implementation of sustainable development plans from an energy point of view, environmental, economic and social. The intended impact of these measures in terms of reduction of emissions is estimated in savings of around 2.58 million tons of CO_2.

Assessment of the topic of hydrogen

Our analysis of the NRRP identified 7 investments and 2 reforms targeting hydrogen, for a total of roughly EUR 7.3 billion allocated to the different measures. The proposed measures aim to improve knowledge of hydrogen-related technologies in all phases: production, storage and distribution. The experimentation and the creation of prototypes for the industrialisation phase is aimed at increasing competitiveness of the economy by means of a progressive reduction in costs. On one hand, the proposed measures aim to develop a hydrogen network for mobility purposes (e.g. trucks or local public transport), on the other hand the measures aim to promote the local production and use of hydrogen in industry, with the creation of the so-called "hydrogen valleys" (i.e. industrial areas with an economy partly based on hydrogen). The intended impact of these measures is the development of the hydrogen market, with approximately 5 GW of electrolysis capacity expected to be installed in Italy by 2030.

Assessment of the topic of energy infrastructure

Our analysis of the NRRP identified 4 investments targeting energy infrastructures, for a total of roughly EUR 4.4 billion allocated to the different measures. The proposed measures aim to increase the degree of reliability, safety, flexibility and climate resilience of the national energy system, increasing the amount of energy produced from RES fed into the distribution network and promoting greater electrification of consumption. On one hand, the proposed measures aim to increase the grid capacity to host and integrate further distributed generation from renewable sources for 4,000 MW, also through the implementation of smart grid interventions. On the other hand, the measures are expected to increase capacity and power available to users to facilitate the electrification of energy consumption (e.g. electric mobility, heating with heat pumps), with an impact on approximately 1,850,000 users who will therefore have a greater connection capacity of the distributed generation in highly concentrated areas such as large metropolitan cities.

Assessment of the topic of sustainable transport

Our analysis of the NRRP identified 3 investments targeting sustainable transport, for a total of roughly EUR 4.7 billion allocated to the different measures. The proposed measures aim on one hand to build enabling infrastructures in order to promote the development of

sustainable mobility and accelerate the transition from the traditional model of fuel-based refueling stations to refueling points for electric vehicles. On the other hand, the measures target the gradual replacement of buses and public transport vehicles with new, less polluting vehicles, in particular electric vehicles. The intended impacts of these measures are the development of 7,500 fast charging points on the motorway and 13,755 in urban centers, the creation of 100 experimental charging stations with energy storage technologies, and the purchase by 2026 of approximately 3,360 low-emission buses.

Use of financial instruments in Italy's NRRP

Italy's NRRP does not provide detailed information on the financial instruments dedicated to green investments. However, the NRRP makes clear that fiscal incentives to enterprises (e.g. on measures to promote competitiveness of hydrogen) and transfers of money to households (e.g. fiscal detractions linked to renovation of buildings improving the energy efficiency) are the two financial instruments accounting for a sizable share of the RRF resources. Tax credit to enterprises account for 40.6% of the RRF resources allocated to Mission 1: Digitisation, Innovation, Competitiveness, Culture and Tourism, 23.3% of the resources allocated to Mission 2: Green revolution and ecological transition and 11.5% of of the resources allocated to Mission 4: Education and research. Transfers to households account for 16.4% of the resources allocated to Mission 2: Green revolution and ecological transition and 5.2% of the resources allocated to Mission 4: Education and research.

Conclusion on Italy's NRRP

The comparability between the NRRP and the NECP is somewhat limited by the lack of a systematic correspondence between the measures proposed in the NRRP and the environmental targets of the NECP: overall, the NRRP explicitly mentions that all the measures outlined in the plan will contribute to the achievement and the overcoming of the objectives defined by the NECP in force, however it is unclear in most cases how and to what extent the NECP's objectives are met or overcome.

Energy efficiency in buildings: the RRP matches the current primary and final energy consumption targets for 2030 foreseen by the NECP: 103.8 Mtoe of final energy (0.8 percent of annual efficiency), with a trajectory that foresees about 35 percent of savings in the buildings sector. The NECP specifies that the final energy target is based on a trajectory calculated to achieve the attainment of the savings obligations defined pursuant to Article 7 of the Energy Efficiency Directive (EED) of 11 December 2018, which provides for a minimum target reduction in final consumption of 0.8% per year for the period 2021-2030. The trajectory calculated in Italy (0.927% per year), based on the average final energy consumption during the three-year period 2016-2018, also works on the assumption that the targets relating to renewable sources and decarbonisation will be attained.

Energy efficiency in industry and other: the RRP mentions that the GHG emissions of the energy sector represent about 22% of the total, whilst those of the transport sector account for 25% and those of civil (residential, services and energy consumption agriculture) represent about 19%. Therefore, the RRP objective of strategic decarbonisation is centred around these three sectors. The NECP comes up with a similar conclusion, noting that the civil sector, along with transport, is identified as the

main sector for efficiency improvement measures, with a reduction in energy consumption of approximately 5.7 Mtoe compared with the base scenario for 2030 and a commitment to gradually eliminate oil for heating purposes.

Renewable energy production: the RRP notes that the target set by the NECP (an increase of 15 GW by 2025 compared to 2017) is revised upwards. However, it is unclear from the measures described in the RRP the extent to which this target is higher than the NECP one.

Hydrogen: the NECP vaguely hints at the importance of feeding hydrogen into the energy mix and notes that it will be necessary to lay the groundwork for the integration of hydrogen into networks. The NECP also notes that hydrogen can be obtained using technologies already available on the market and enables the development of innovative storage solutions such as power-to-gas. In addition, the injection of hydrogen to the network without a specific designated use could help exploit the natural gas infrastructure. The RRP seems to build on these generic considerations proposing a set of four more concrete actions to invest in hydrogen. However, the RRP also notes that a forthcoming Hydrogen Strategy will define detailed targets for this energy category.

Energy infrastructure: the RRP seems to follow closely the measures proposed in the NECP, notably on renewable energy communities to be promoted primarily by utilising the existing electricity network. The RRP measures designed to support the economies of the smaller regions, promoting local production and self-consumption aim to match the targets outlined in the NECP mandated by the Renewable Energy Directive, but they do not seem to aim at higher targets.

Sustainable transport: the RRP specifies that the planned investments are in line with the provisions of the NECP, which provides that "*For transport, priority is given to policies for limiting the need for mobility and increasing collective mobility, in particular by rail, including the shift of freight transport from road to rail*". As foreseen by the NECP, "*it is necessary to integrate the so-called" improve "measures (relating to vehicle efficiency and emissions) with tools aimed at reducing the need for mobility (" avoid "measures) and the efficiency of travel (measures "Shift")*." Based on the available description of the measures for sustainable transport, the RRP does not seem to set higher targets than the one of the NECP. Besides the overlaps between the RRP and the NECP, the RRP also specifies that the planned investments are consistent with the national mobility strategy of the Ministry of Sustainable Infrastructure and Mobility (MIMS).

Latvia

Total budget of the NRRP	EUR 1.8 billion
Grants	EUR 1.8 billion
Loans	-
% supporting climate objectives	37.6%

Overview - The NRRP of Latvia finances energy projects mainly under Component 1 'Climate change and environmental sustainability'. The total amount of funding for the component is 676.2 million EUR, corresponding to 37.6% of the total RRF funding. With respect to the Climate change and environmental sustainability, the Plan foresees eight investments and one reform relevant to energy projects, with corresponding RRF funding of EUR 497 million.

In regard to financial instruments, the NRRP includes two financial instruments with a focus

Overview of energy and climate targets of Latvia and relevant policy initiatives

The NECP of Latvia sets targets, among others, for GHG emissions, share of renewable energy in final energy consumption and energy efficiency. The amount of investments needed to implement the measures in the plan is EUR 8.2 billion from 2021 to 2030. Biggest shares of needed investment are on energy efficiency in buildings (EUR 1.7 billion), energy efficiency and deployment of renewables in district heating and cooling (1.6 billion) and decarbonisation of the energy sector (EUR 1 billion).

The NECP lists measures in several different areas, including energy efficiency in buildings and industry, promotion of renewable energy sources, and zero-emission technologies in electricity generation.

Latvia's national Recovery and resilience plan (NRRP)

Latvia's RRP includes all the six pillars: (i) Green transition (EUR 676.2 million); (ii) digital transition; (iii) smart, sustainable and inclusive growth; (iv) social and territorial cohesion; (v) health, economic, social and institutional resilience; and (vi) next generation, children and youth. It consist totally of 6 components and 85 measures, of which 25 are reforms and 60 investments. The key component is 'Climate change and environmental sustainability' and it includes measures covering Energy efficiency in buildings, energy efficiency in industry and other, renewable energy production and electromobility. Some of the measures are related to several energy categories.

Assessment of the topic of energy efficiency in buildings (renovation)

Our analysis of the NRRP identified three investments covering the topic of energy efficiency in buildings. The investments ('Improving the energy efficiency of multi-apartment buildings and transition to renewable energy technologies', 'Improving municipal buildings

and infrastructure by promoting the transition to renewable energy technologies and improving energy efficiency' and 'Improving the energy efficiency of public sector buildings, including historical buildings') aim to 14,423 MWh, 4544 MWh respective 4456 MWh yearly reductions in primary energy consumption. The total funding from RRF is EUR 110.5 million, of which the biggest share of EUR 57.3 million is targeted to energy efficiency in apartment buildings and transition to renewable energy technologies. The investment on apartment buildings is planned to be implemented as a financial instrument.

Assessment of the topic of energy efficiency in industry and other

According to our analysis, the NRRP mentions one investment ('Increasing energy efficiency in business) with an objective of improving the energy efficiency in industry. The investment consists of two financial measures, i) Energy efficiency improvement measures, deployment of renewable energy technologies and R & D activities and support for the purchase of sustainable transport, and ii) Measures for the development of innovative products and technologies related to the low carbon economy, climate resilience and adaptation. The first measure is a financial instrument offering capital rebates and loans, and the latter one is providing grants. The investment is funded from RFF with EUR 120.6 million while the investment volume in total is expected to be EUR 190.3 million.

Assessment of the topic of renewable energy production

Our analysis identified two investments ('Increasing energy efficiency in business' and 'Modernisation of electricity transmission and distribution networks') related to the topic of renewable energy production. Funding from RRF for the investments are EUR 120.6 respective EUR 80 million. Both of the measures cover broad energy areas and neither is particularly focused on renewable energy sources. The first one includes a financial instrument that aims to support companies with, among others, deployment of renewable energy technologies.

Assessment of the topic of hydrogen

Our analysis did not identify any particular measures on the topic of hydrogen.

Assessment of the topic of energy infrastructure

We identified one investment in the area of energy infrastructure, 'Modernisation of electricity transmission and distribution networks'. RRF funding for the measure is EUR 80 million. It aims to implement regulatory changes and provide financial support in the key areas of electricity sector. Biggest share of funding (EUR 37 million) is planned to be directed in modernisation of the electricity grid. Other focus areas include, for example, dispatcher and data centre (EUR 27 million), and development of IT solutions for increasing the flexibility and security of the transmission and distribution systems, and building information system infrastructure and digitalising network management (EUR 11.9 million).

Assessment of the topic of sustainable transport

The NRRP includes one reform and four investments related to the sustainable transport. Transport Reform in Riga has an objective of modernising the transport system in the capital of Latvia, with an expected total investment volume of EUR 295.5 million. Three

planned investments (‘Competitive rail passenger transport in Riga the urban public transport system through the development of zero-emission rail infrastructure with zero-emission vehicles’, ‘Environmental improvements in the city of Riga’s public transport system’, and ‘Improving the cycling infrastructure’) fall under the reform, with the total RFF funding of EUR 293.2 million. In addition, investment ‘Modernisation of electricity transmission and distribution networks’ distributes a share of EUR 37 million to development of electricity grid infrastructure, including electric car charging infrastructure.

Moreover, there is an additional investment under component 3 ’Reducing inequality’, ‘Purchase of zero-emission vehicles for the performance of municipal functions and services’ with a RFF funding of EUR 10 million. The objective is to promote both territorial reform and climate goals.

Use of financial instruments in Latvia’s NRRP

We identified two energy-related financial instruments in the NRRP. The first one is related to the investment ‘Improving the energy efficiency of multi-apartment buildings and transition to renewable energy technologies’ and provides both loans or guarantees and capital discounts for renovation of apartment buildings, with an amount of EUR 74.8 million. Implementation is managed by a state-owned development finance institution Altum. 15% of public funding will come from Altum loans and another 15% will be from Altum guarantees. Grants can cover 49 % of the renovation costs

The second one is part of the investment ‘Increasing energy efficiency in business’, with a funding of total of EUR 190.3 million. The investment is divided to two parts, according to the support mechanism. Financial instrument includes a grant element in the form of a capital rebate, and loans. Loans are again managed by Altum. The aim is to encourage companies to invest in energy efficiency improvement, deployment of renewable technologies, R&D activities and purchase of sustainable transport. Such investments require long-term investments, and companies have insufficient financial resources and limited possibilities to get loans from commercial banks, which requires a specific instrument to fund such projects.

Conclusion on Latvia’s NRRP

The measures in the Latvia's NRRP have the potential to support the achievement of the decarbonisation and energy transition objectives, as set out in Latvia's NECP.

Regarding **energy efficiency in buildings**, the NRRP provides concrete measures with objectives of improving the energy efficiency in apartment buildings and public buildings. The measures are in line with the NECP that also addresses energy efficiency in general and in buildings in several measures.

Energy efficiency in industry is addressed in the NRRP, as well as in the NECP. One RRP investment, consisting of two financial measures, aims to directly improve the energy efficiency by investing to energy efficiency measures, technologies and innovations.

Regarding **renewable energy production**, two measures in the NRRP cover the topic, but none of the measures are directly aiming to support the renewable energy production.

In terms of the NECP, Latvia has an ambitious target of 50% share of renewable energy in sources in gross final energy consumption and several measures supporting the achievement of the target.

In terms of **hydrogen**, we did not identify any measures in the NRRP. In the NECP, hydrogen was mentioned in a measure aiming to promote the use of alternative energy sources.

For **energy infrastructure**, the NRRP aims to modernise the electricity transmission and distribution networks with several concrete measures, falling into the scope of the NECP.

Sustainable transport is addressed in several reforms under different components of the NRRP. The NRRP is more ambitious in its number of measures compared to the NECP, which has targets regarding the share of renewable energy sources in transport sector. The NRRP does not have its focus solely on renewables but includes measures developing the transport sector in other ways, for example by development of railways..

Lithuania

Total budget of the NRRP	EUR 2.2 billion
Grants	EUR 2.2 billion
Loans	-
% supporting climate objectives	37.8%

Overview - The NRRP of Lithuania contains three reforms and nine measures under them under Component 2 'Green transition'. In particular for reforms, one is on Energy efficiency in buildings (renovation), two on Renewable energy production, one on Hydrogen, one on Energy infrastructure and one on Electro mobility. Some reforms and measures are overlapping on several energy categories. The highest NRRP funding, for reform 'Moving without polluting the environment', covers areas Electromobility, Renewable energy production, Hydrogen (EUR 341 million).

In regard to financial instruments, the plan does not include any related to energy-related areas.

Overview of energy and climate targets of Lithuania and relevant policy initiatives

The NECP of Lithuania seeks to achieve several climate objectives in accordance with the requirements in the Governance of the Energy Union. The main documents related to the NECP are National Energy Independence Plan from 2018, National Strategy for the Climate Change Management Policy from 2012 and 2019, and National Air Pollution Reduction Plan from 2019. The targets include reduction in GHG emissions (not covered by the EU ETS) from 2005 to 2030 9%, the EU-level target of 45% of renewable energy in the gross final energy consumption by 2030, as well as energy efficiency target of 5.5 Mtoe for primary energy and 4.5 Mtoe for final energy consumption.

The NECP lists measures in several different areas, including renewable energy sources in the electricity sector and, energy efficiency and electricity and gas transmission networks.

Lithuania's national Recovery and resilience plan (NRRP)

The NRRP of Lithuania contributes to all six pillars with seven components, comprising in total, 30 measures, both reforms and investments. The green transition pillar has a RRF budget of EUR 841 million. The most relevant component for energy-related measures is component 1 'Green transition'.

The green investments in the area of energy projects include reforms 'More sustainable electricity', 'Moving without polluting the environment' and 'Accelerated renovation of buildings and a sustainable urban environment', and are allocated approximately EUR 801 million from RFF. They cover the following categories: energy efficiency in buildings,

renewable energy production, hydrogen, energy infrastructure and electro mobility. Some measures cover several categories.

Most of the measures in NRRP are also covered in the NECP. However, a measure for promoting hydrogen technologies is additional to the NECP measures and targets.

Assessment of the topic of energy efficiency in buildings (renovation)

Our analysis on the NRRP identified one reform ('Accelerated renovation of buildings and a sustainable urban environment') and two measures ('A renovation information system and pilot experimental demonstration projects for the modernisation of 4 multi-apartment and 4 public buildings' and 'Smart and faster modernisation of multi-apartment buildings') under it aiming to improve the energy efficiency in buildings. The reform is funded by EUR 217.8 million from RFF and EUR 51.6 million from national budget.

The aim of the reform is to speed up the renovation processes, improve the energy efficiency and boost the replacement of fossil fuels for renewable energy sources.

Assessment of the topic of energy efficiency in industry and other

Our analysis did not identify any particular reforms of investments targeted to energy efficiency in industry or other.

Assessment of the topic of renewable energy production

Our analysis identified two reforms and four measures under them related to renewable energy production. First reform is 'More sustainable electricity produced in the country' with EUR 242.39 million funding from RFF and EUR 55.716 million from national budget. The aim of the reform is to promote the production, transmission and consumption of electricity from renewable sources using the most cost-effective technologies, improving institutional and legal mechanisms and providing incentives for businesses and residents to invest.

Second identified reform is more focused on transport, 'Moving without polluting environment', but includes a measure of increasing the production of local renewable energy source fuels and thus can be considered as linked to renewable energy production. The funding for transport reform is EUR 341 million from RFF while for the mentioned measure it is EUR 51 million EUR.

Assessment of the topic of hydrogen

Reform 'Moving without polluting the environment' includes a measure that aims to promote the development of hydrogen technologies and their use. The objective is to implement efficient green hydrogen production equipment and technologies that support the growth of hydrogen sector in Lithuania. The RRP sets a target on minimum of a minimum of 560 000 m3 green hydrogen production capacity per year. In comparison with the targets and measures set out in the NECP, the hydrogen measure is the only measure in the RRP which is completely additional to the NECP.

Assessment of the topic of energy infrastructure

Our analysis identified one reform and with two measure under it related to renewable energy production. The reform is ‘More sustainable electricity produced in the country’ with EUR 242.39 million funding from RFF and EUR 55.716 million from national budget. The aim of the reform is to promote the production, transmission and consumption of electricity from renewable sources using the most cost-effective technologies, improving institutional and legal mechanisms and providing incentives for businesses and residents to invest. It includes a measure ‘Preparations for the development of wind turbine infrastructure’ that is funded by RFF with EUR 8.786 million and EUR 3.9 from national budget. This measure is overlapping with renewable energy production. Another measure under the same reform is 'Direct public investment to install 200 MW electricity storage facilities’, with EUR 100 million from the RRF funding.

Assessment of the topic of sustainable transport

The reform ‘Moving without polluting the environment’ mentions is very much linked to sustainable transport: it mentions two measures (‘Refurbishment of public transport vehicles’ and ‘Development of refuelling/charging infrastructure’) with objectives to increase electromobility in Lithuania, and two measures (‘Promoting the production and use of biomethane gas in transport’ and ‘Promoting the production and use of second generation liquid biofuels in transport’) directed at using more sustainable fuels in transport. In addition, the hydrogen measure has connection to sustainable transport, as one aspect of it is use of hydrogen in transport. The measures under the transport reform have allocated EUR 341 million funding from RRF.

Use of financial instruments in Lithuania’s NRRP

Lithuania’s RRP does not include any financial instruments aimed to energy projects. However, for most measure the public aid share is only partial and thus also private investments are required. Reasons for not including financial instruments could be, for example, strong preference for subsidies and no direct demand for financial instruments.

Conclusion on Lithuania’s NRRP

The measures in the Lithuania's NRRP have the potential to support the achievements of the decarbonisation and energy objectives, as set out in Lithuania's NECP. The NRRP is mostly following the principles and targets set out in the NECP, and for some topic areas the NECP measures are more comprehensive compared to the NRRP.

Regarding **energy efficiency in buildings**, the NRRP provides one reform with an objective to speed up the renovation processes, improve the energy efficiency and boost the replacement of fossil fuels for renewable energy sources. The NECP

For **energy efficiency in industry** our analysis did not identify any particular measures in the NRRP. However, the NECP includes existing and planned measures and targets in the topic area.

Regarding **renewable energy production**, one reform in the NRRP aims to promote the production, transmission and consumption of electricity from renewable sources. In addition, the transport reform has measures with objective to increase renewable energy production. The RRP will implement the measures in line with the principles

mentioned in the NECP. The NECP sets a target of 45% share of renewables in gross final energy consumption by 2030, and lists multiple existing and planned measures supporting the objective by both promoting the renewable energy sources and increasing the production capacity. Both plans link the renewable energy closely to sustainable transport measures.

In terms of **hydrogen**, the NRRP includes a measure under the transport reform, aiming to promote the use and development of hydrogen technologies. Regarding the NECP, we did not identify any measures in the area of hydrogen.

For **energy infrastructure**, the identified NRRP measures are overlapping with the measures under the category of renewable energy production. The NECP provides several measures in the same topic areas.

Sustainable transport is addressed mainly in the transport reform of the NRRP, with the objectives of increasing the electro mobility and the use of sustainable fuels in transport in Lithuania. The NECP provides multiple measures with objectives to electrify the transport system and promoting cleaner vehicles as well as promoting the use of more sustainable fuels in transport.

Luxembourg

Total budget of the NRRP	EUR 93.4 million
Grants	EUR 93.4 million
Loans	n/a

Overview - The NRRP of Luxembourg contains 1 reform and 2 investments related to energy projects. In particular for investments, 1 is on Energy efficiency in buildings (renovation), 0 on Energy efficiency in industry and other, 0 on Renewable energy production, 0 on Hydrogen, 0 on Energy infrastructure and 1 on Sustainable transport. The highest NRRP funding is dedicated to Sustainable transport (EUR 30.5 million), followed by the renovation of the "Neischmelz" project in Dudelange (EUR 24 million)

In regard to financial instruments, the NRRP includes financial instruments aimed at covering parts of the costs of installing recharging stations for legal entities across the Country.

Overview of energy-related targets in Luxembourg's National Energy and Climate Plan (NECP)

The NECP of Luxembourg covers six dimensions: 1) decarbonisation; 2) renewable energy; 3) energy efficiency; 4) energy security 5) internal energy markets; 6) research innovation and competitiveness. Across these dimensions, Luxembourg has set itself various targets. For one, the country aims to increase the share of renewable energy in gross final energy consumption to at least 25% by 2030 by consistently developing wind and solar energy and heat pumps. Furthermore, the NECP outlines a target of final energy consumption of 35,568 GWh compared to the final energy consumption of 50.5 TWh in the reference scenario, which correspond to energy savings of 40% to 44% in 2030. This will be achieved through ambitious renovation of existing housing stock (3% renovation rate at 72% renovation depth on average), the massive expansion of public transport and 49% share of electro mobility by 2030. To improve energy security and the internal energy market Luxembourg plans to increase regional cooperation in the field of security of supply for gas and electricity, avoid the further development of gas infrastructure, and upgrade electricity grids to meet the needs of existing routes. Finally, the aim is for Luxembourg's financial centre to switch 20% of all cash flows to green finance by 2025 and become a globally recognised financial centre for investments in energy efficiency, renewable energy, electro- and hydrogen mobility.

Luxembourg's national Recovery and Resilience Plan (NRRP)

The three pillars of the Luxembourgish RRP are (i) cohesion and social resilience, (EUR 31.7 million); (ii) green transition (EUR 36.5 million); (iii) digitalisation, innovation and governance (EUR 25.2 million). These three pillars are divided into eight components which comprise a total of 20, of which nine are reforms and 11 investments.

Measures relevant to energy projects fall under the green transition pillar. Furthermore, an investment under cohesion and social resilience covers the energy component of a renovation project. The green investments in the area of energy projects accumulate EUR 54.5 million in RRF funding. The majority is dedicated to sustainable transport.

Assessment of the topic of energy efficiency in buildings (renovation)

Our analysis of the NRRP identified1 investment targeting energy efficiency in buildings, for a total of roughly EUR 24 million. This measure aims to revitalise industrial wasteland, to encourage sustainable development by establishing a CO2-neutral neighbourhood and to guarantee the quality of living spaces. It includes the installation of 8 000 sqm of photovoltaic panels by 2025. It is estimated that 80% of energy needs of the projects should be covered autonomously with home production and efficiency gains.

Assessment of the topic of sustainable transport

Our analysis of the NRRP identified 1 reform and 1 investment targeting sustainable transport, for a total investment of EUR 40 million. The proposed measures increase energy efficiency in the transport sector through traffic reduction, expansion of public transport and rapid development of electromobility in different vehicle categories.

The proposed measures promote the acquisition of low or zero emission vehicles for all public authorities in the Country. The support scheme for electric charging points is one of the flagship projects of the Recovery and Resilience Plan. The project is set to ensure adequate charging infrastructure coverage for companies and complements the support scheme for private households. The measure further promotes the adoption of electric vehicles to make them a viable alternative to internal combustion engine vehicles.

Use of financial instruments in Luxembourg's NRRP

Luxembourg's NRRP does not provide detailed information on the financial instruments dedicated to green investments. However, the NRRP makes clear that aid measures to enterprises will complement existing measures for households. The NRRP states that the design of the financial instruments will depend on the results of a preparatory study.

Conclusion on Luxembourg's NRRP

The comparability between the NRRP and the NECP is somewhat limited by the lack of a systematic correspondence between the measures proposed in the NRRP and the environmental targets of the NECP: overall, the NRRP explicitly mentions that all the measures outlined in the plan will contribute to the achievement of the objectives defined by the NECP in force. However, given the limited financial contribution of the NRRP for Luxembourg, it is unclear in most cases how and to what extent the NECP's objectives are met or overcome.

Energy efficiency in buildings: the RRP presents a single renovation project for a former industrial area. No reference to the NECP or its targets is mentioned in the NRRP.

Sustainable transport: the RRP specifies that the planned investments are in line with the provisions of the NECP, which provides that "To contribute to the achievement of this

objective at the national level, the Government has adopted an ambitious strategy within the framework of its Integrated National Energy and Climate Plan (NECP) with a greenhouse gas reduction target of around -55% by 2030. The decarbonisation of transport (component 2A) is one of the priority areas in this context and the measures in the RRP aim to increase energy efficiency in this sector by promoting the acquisition of low- or zero-emission vehicles and the implementation of alternative fuel infrastructures while encouraging the rapid development of electromobility in the various categories of vehicles. The support scheme for electric charging points is one of the flagship projects of the Recovery and Resilience Plan."

Malta

Total budget of the NRRP	EUR 344.9 million
Grants	EUR 344.9 million
Loans	EUR 0
% supporting climate objectives	53.8%

Overview - The NRRP of Malta contains 5 reforms and 9 investments related to energy projects. In particular for investments, 3 are on Energy efficiency in buildings (renovation), 1 on Energy efficiency in industry and other, 1 on Renewable energy production and 4 on Sustainable transport. The highest NRRP funding is dedicated to Sustainable transport (EUR 110.4 million). No financial instruments are reported in the NRPP, however it is notable that the government provides financial incentives to the private sector through grant schemes.

From our analysis it is highlighted that the NRRP is not entirely aligned with the NECP since the NRRP mainly focuses on Sustainable transport and energy efficiency in buildings while the NECP provides measures that apply to all examined categories.

Overview of energy and climate targets of Malta and relevant policy initiatives

The NECP of Malta specifies several high-level and specific objectives in line with the five dimensions of energy established by the Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action: “decarbonisation”, “energy efficiency”, “energy security”, “internal energy markets” and “research, innovation and competitiveness”. Additionally, the NCEP of Malta specifies two additional dimensions: “renewable energy” and “GHG emissions and removals”. The NECP outlines a set of climate and energy targets and describes a set of economic, regulatory and planning instruments to achieve such targets. The NECP lists a total of 21 instruments classified within 11 broad scopes, namely “RES in Electricity”, “RES in Heating and Cooling”, “RES in the transport”, “Low emission mobility”, “RES in the transport sector”, “Efficiency in the transport sector”, “Efficiency in industry and services sectors”, “Efficiency in Household sector”, “Gas security”, “Efficiency in buildings”, “Efficiency in the water sector”. Notably, the NECP was published in December 2019.

Malta’s national Recovery and resilience plan (NRRP)

The NRRP of Malta provides measures for energy related issues under Component 1 - Addressing climate neutrality through enhanced energy efficiency, clean energy and circular economy and Component 2 - Addressing carbon-neutrality by decarbonising transport. The total amount of funding for these components is EUR 188.3 million, corresponding to 55% of the total RRF funding, while the total amount for supporting climate objectives is equal to EUR 170.1 million. With respect to Component 1, the Plan foresees 1 energy related reform (out of 2) and 5 investments (out of 5) relevant to energy projects, with RRF funding of EUR 77.9 million. Component 2 comprises 4 energy related reforms (out of 6) and 4 energy related investments (out of 4), with corresponding funding of EUR 110.9 million. The NRRP does not provide quantifiable benefits apart of the

reduction in primary energy demand. However according to a 2021 Analysis of the recovery and resilience plan produced by EU commission staff, the policies could support Malta achieve its NECP target of 19% reduction in GHG emissions from 2005 levels by 2030. The relevant measures outlined in the NECP were not deemed sufficient by the EC to reach that target.

Assessment of the topic of energy efficiency in buildings (renovation)

In our analysis, 3 investments and 1 reform are identified, with a total of EUR 60 million allocated to the investments. These measures, aim to renovate Malta's building stock by enhancing their energy performance, increase the use of renewable energy, reduce emissions and achieve complete decarbonisation of the building stock by 2050 as part of the long-term renovation strategy. The measures aim to enhance and accelerate energy efficiency interventions by supporting private investments with applied grant schemes. On top of that, the NRRP foresees energy efficiency investments for public buildings. Overall, these measures aim to renovate 9,232 m^2 of public buildings and at least 40,605m^2 of private buildings, including commercial and non-residential buildings. Additional investments comprise the renovation of a public hospital (9,167 m^2) and two public schools (9,710m^2). The intended impact for each investment is a 30% reduction in primary energy demand related to the buildings.

Assessment of the topic of energy efficiency in industry and other

In our analysis 1 investment and 1 reform are identified, with a total of EUR 14.4 million allocated to the investment. The investment aims to promote energy efficiency in buildings with the construction of a "near carbon neutral school" with a total area of 14,499m^2 labelled as pilot project, while the reform intends to safeguard the increase of remote working habits in the public sector with the establishment of remote working facilities. The intended impact for the reform is not quantified. On the other hand, it is expected that the construction of the near carbon neutral school shall ensure primary energy demand at least 20% lower than the requirements applied for Nearly-Zero Buildings.

Assessment of the topic of renewable energy production

Our analysis of the NRRP identified 1 investment targeting renewable energy production, for a total of EUR 3 million. The proposed measure aims to initiate the installation of photovoltaic infrastructure in roads, footpaths and other public open spaces. The energy produced shall be used, inter allia, to supply renewable energy for street lighting as well as pedestrian crossings, charging points for electric cars and e-bikes. It is intended to install a total capacity of 143 kW, however the report does not provide any quantifiable benefits with respect to the impact of this investment.

Assessment of the topic of hydrogen

Hydrogen related measures are not included in the NRRP.

Assessment of the topic of energy infrastructure

Energy infrastructure related measures are not included in the NRRP.

Assessment of the topic of sustainable transport

In our analysis sustainable transport is the most impacted sector of the RRF. Our analysis identified 4 reforms and 3 investments, for a total of EUR 110.4 million. The analysis

concerns measures promoting sustainable transport in general and measures focusing on the deployment of electric vehicles. The measures concerning sustainable transport aim to promote collective and multimodal transport (e.g., public transport, car sharing). The relevant objectives are planned to be achieved through the completion of the "National Household Travel Survey", sustainable transport awareness raising campaigns, provision of free access to public transport for 103,000 people, the implementation of the recently developed Sustainable Urban Mobility Plan (SUMP) as well as the construction of a new ferry landing place. The measures focused on electromobility, include investments and relevant grant schemes aiming to enhance the purchase of new electric vehicles for the private sector as well as the gradual replacement of buses and public transport vehicles. These measures aim to achieve the purchase of 6,500 private vehicles by 2024, the purchase of 102 Euro 5 buses and the increased share of electric vehicles in the public service fleet used by the government up to 38%. It should be noted that the formulation of the grant scheme is based on providing a subsidy that covers the price differential between electric vehicles and comparable combustion engine vehicles.

Use of financial instruments in Malta's NRRP

Malta's NRRP does not mention the use of financial instruments dedicated to green investments. The NRRP stresses the need for the government to provide financial incentives, and enhance the development of private investments, through grant schemes, which aim to fund part of the investments in the field of energy efficiency in buildings and electro mobility.

Conclusion on Malta's NRRP

The comparability between the NRRP and the NECP is somewhat limited by the lack of a systematic correspondence between the measures proposed in the NRRP and the environmental targets of the NECP. The NRRP does not quantify specific targets. However according to the 2021 Analysis of the recovery and resilience plan produced by EU commission staff, the policies could support Malta to achieve its NECP of 19% reduction from 2005 in GHG emission levels by 2030, since the relevant measures implemented in the NECP are not considered as sufficient to reach the target. It should also be stated that in the NRRP there is no clear correlation between the NRRP and the NECP. Nevertheless, it is unclear how and to what extent the NECP's objectives are met or overcome.

Energy efficiency in buildings: The reduction of energy demand through energy efficiency measures in private and buildings is one of the two (along with sustainable transport) primary targets of the RRP based on the cost allocation and number of measures. However, the RRP does not provide quantifiable benefits with respect to GHG emission reduction. It is not possible to provide a direct comparison of RRP with the NECP, since the latter does not contain detailed information on measures. The NECP makes reference to another document, the long-term Renovation Strategy 2050, where. it is projected that a reduction 150,000 tons of CO2 will be achieved by 2030. However, this reduction cannot be attributed only to the NECP since it contains measures and data from other reports/plans.

Energy efficiency in industry and other: The NECP includes measures aiming to enhance the energy efficient operation of various sectors and thus reduce energy consumption. The objective of the NECP translated into the provision of financial incentives for industries to undertake energy efficiency projects (i.e., Introduction of

Energy Management Systems). Additionally, it foresees investments for the installation of energy efficient street lighting and wastewater treatment. Finally, the reduction of energy consumption is expected, under several infrastructure projects taking place on highways, triggered from the minimization of traffic congestions and increase of average speed. The RRP applied measures that follow the objective of the NECP regarding the reduction of energy consumption, however, it is expected that these measures will not provide any substantial impact.

Renewable energy production: NECP promotes a strategy that accelerates the deployment of RES, either by dedicated legislative reforms or by special grant schemes. The expected contribution of RES in the energy sector is targeted to be 11.6% by 2030, which is considered unambitious. However, the RRP is not aligned even with the conservative target of the NECP, since it contains only one type of investment aiming to install photovoltaic in roads, footpaths and other public open spaces with an installed capacity of 143kW.

Hydrogen: the NECP highlights the importance of the gas pipeline construction which will connect Malta to Italy. Apart from the energy security element, the NECP points out the key role of the pipeline, in line with the commitment of Malta to decarbonize the economy, as the pipeline is to be designed to carry out biogas and hydrogen. However, in the RRP, Hydrogen is not part of Malta's strategy to decarbonize the energy sector, as evidenced from the absence of any relevant measures.

Energy infrastructure: In the NECP there is a notable absence of major infrastructure projects (apart from the gas pipeline mentioned in the Hydrogen topic). Malta's electricity system already underwent an extensive reinforcement program, and although relevant measures are not included in the NECP, it is nevertheless projected that further investments will be necessary with respect to continuous deployment of renewables (e.g., batteries). The low level of investment related to energy infrastructure is also evident in the RRP, since no relevant measures are assigned.

Sustainable transport: The RRP as well as the NECP highlight the importance of sustainable transport in general with electrification as the main element promoted by the dedicated investments to the deployment of electric vehicles along with the installation of relevant charge station. The estimated trajectory according to the NECP is an increase for the transport share in Malt's RES deployment from 11% in 2021 to 15% in 2030. In both documents, several grant schemes are envisioned. In the NECP a base grant of EUR 6,000 per vehicle is provided in addition to tax exemptions and registration fees. In the RRP the base grant is equal to EUR 11,000 per vehicle. Both documents forecasted a radical increase of electric vehicles, with the RRP projecting the purchase of 5,600 vehicles until 2024 while according to the NECP until 2030, 26,000 vehicles will be purchased. In both plans, mobility electrification is accompanied by other sustainable transport measures including public transport utilization (free pass for teenagers), the exploitation of alternative transportation modes (e.g., ferry) and the development of local transportation hubs which promote the modal shift with car, cycle and scooter sharing infrastructure. Although there is no direct comparison between the two documents it is obvious that they are both part of a consistent strategy to increase electromobility and reduce energy consumption. Finally, it should be noted that the NECP foresees the use of biofuels as RES for the transport sector. However, biofuels are not part of the RRP.

Netherlands

Total budget of the NRRP	EUR 4.7 billion
Grants	EUR 4.7 billion
Loans	-

Overview - The NRRP of the Netherlands consists of an ambitious package of in total 21 reforms and 28 investment measures. The plan contributes to the ambition of the Dutch Government in the green transition and includes measures in the areas of energy efficiency in the current building stock, and various Dutch industries, smart mobility and the production of renewable energy. The total budget of the Dutch RRP is roughly EUR 4.7 billion, equal to the EUR 4.7 billion made available from the RRF. Roughly EUR 982 million is made available for the production of renewable energy, of which EUR 68.5 million is reserved for investment measures related to the production and development of hydrogen. Additionally, roughly EUR 1 billion is made available for measures targeting sustainable transport. Next to this, EUR 275 million is made available for investment measures related to the energy efficiency of Dutch industries and roughly EUR 850 million for the energy efficiency in buildings.

The Dutch Integrated National Energy and Climate Plan (NECP) for 2021-2030 stipulates the main priorities of the Dutch climate and energy policies. These priorities and policies have predominantly been determined by the Dutch Climate Agreement (Klimaat Akkoord) in 2019. The development of the Climate Agreement opted for an inclusive approach by involving various relevant stakeholders, such as governmental organisations and businesses. As this Climate Agreement already contains various measures targeting the reduction of CO2 emissions, the Dutch NECP builds on these policies by integrating policies that arose from European Obligations, ongoing policies and policies in the Dutch Coalition Agreement that were not included or part of the Climate Agreement.

The Dutch NECP includes a national greenhouse gas emission target of 49% by 2030 compared to 1990. This translates to an approximate reduction of 49Mton of CO2 equivalents by 2030. The NECP presents various key national objectives and targets. Related to greenhouse gas emissions, the Dutch national targets stipulate a national reduction requirement of 36% by 2030 compared with 2005 in non-ETS sectors. Additional targets include energy efficiency in which the Netherlands aims to achieve the efficiency target of the EU of at least 32.5% by 2030.

Dutch national Recovery and resilience plan (NRRP)

The Government of the Netherlands has been engaged in major emergency support measurements to mitigate the direct consequences of the Covid-19 pandemic. As these consequences are anticipated to have long lasting economic and societal impacts in the

Netherlands and the re-opening of the Dutch economy will have dire impacts on the environmental, most notably CO2 emissions, the investments made in the Dutch economy are substantially targeted on important sustainability and climate goals set on a national and international level (Paris Agreement).

Assessment of the topic of energy efficiency in buildings (renovation)

Our assessment identifies two investment measures related to the topic of energy efficiency in buildings through renovations. The Dutch recovery and resilience plan contains important building blocks to accelerate sustainability, namely by stimulating, among other things, hybrid heat pumps under the Investment grant for renewable energy and energy savings (ISDE). This measure comprises of investments in the form of a subsidy scheme to increase the stock of sustainable social real estate. This sustainability measure ensures more energy-efficient buildings and aims at reducing greenhouse gas emissions.

The aim of the measures is to make the built stock of the Netherlands more sustainable, to achieve CO2 reduction in line with European and Dutch climate targets and to become less dependent on fossil fuels. This priority includes a package of investments that will not only ensure that more housing can be built faster but will also make sustainability in the housing market fairer and more accessible to all. This is done through the sustainability of social real estate and through subsidies that stimulate green energy methods with the main objective of encouraging social real estate owners to invest in sustainability measures to improve energy performance and reduce CO2 emissions. The new scheme reimburses part of the project costs of the sustainability measures. For these investments, roughly EUR 850 million has been made available under the NRRP.

Assessment of the topic of energy efficiency in industry and other

Our analysis of the Dutch RRP has identified two relevant measures towards the topic of energy efficiency in industry and other in the forms of one investment and one reform measure. The investment measure aims at lowering nitrogen emissions and odour pollution. The measure prominently targets the significant pig farm industry, which has been identified as a considerable emitter of CO2. This investment finances a subsidy scheme allowing pig farmers to receive support to end their pig farming sites definitively and irrevocably. Under this support mechanisms, pig farmers can receive a market-based remuneration for the definitive removal of their production right for pigs. This measure is estimated to result in a reduction of the pig population in the Netherlands by approximately 6 to 7%.

In the second measurement related to energy efficiency in the industry is a reform which introduces and tightens the CO2 levy in the Dutch industry. The main focus of this reform is to reduce the amount of nitrogen by the Dutch industry. As the Netherlands is facing significant challenges for the amount of nitrogen in its atmosphere, it has been made a priority in the Coalition Agreement of the former Dutch Government. The Government has set itself the goal of protecting Dutch nature, restoring the loss of biodiversity and providing perspective for the agricultural sector. For these measures, roughly EUR 275 million has been made available under the NRRP.

Assessment of the topic of renewable energy production

The analysis of the Dutch RRP has identified three relevant measures related to the topic of renewable energy production. These measurements consist of two reforms and one investment scheme. The first reform is related to the Dutch Energy Tax and aims to make the use of non-renewable energy sources, most prominently targeted to limit the usage of natural gas in the Dutch context by making it more expensive and the use of electricity cheaper. As a result, the measure aims at stimulating efficient energy consumption and promoting the transition to more sustainable energy sources, in particular solar and wind energy. The second reform consists of the Energy Law, which itself is composed of a Climate Fund (Klimaat Fonds) to invest on a large scale in the energy transition of the Netherlands and thus attain important climate goals, as set out in the Climate Law. The coalition agreement announced an amount of EUR 35 billion for this fund which is planned to invest in sustainable transition projects until 2030. The fund is designed to be complementary to already existing climate measures, such as the aforementioned ISDE and other subsidies to promote sustainability in the Netherlands.

Lastly, the Netherlands has increased its aimed (off shore) wind energy production capacities with the investment measure for Wind on Sea. The first priority in the plan is to promote the green transition and reduce nitrogen emissions. With the investment *''Wind op Zee''*, more sustainable energy sources are stimulated. More specifically, the investment measure will aim to increase the energy production of offshore wind farms by 10.7 GW, bringing the Dutch capacity to a total of 21 GW by 2030. For this investment measure, roughly EUR 917 million has been allocated.

Assessment of the topic of hydrogen

One investment measure relevant to the topic of hydrogen has been identified in our analysis of the Dutch RRP. The Green power hydrogen investment measure is With the Green Power Hydrogen investment. EUR 68.5 million will be made available to attain the goal of achieving 10 million tonnes of domestic hydrogen production by 2030. The importance of these investments and domestic production goals is argued to be twofold. First, the envisaged increase in domestic hydrogen production capacity is aimed at reducing the Dutch energy dependency. Secondly, it is argued in the Dutch RRP that, as the first priority of the presented plan is to promote the green transition and reduce nitrogen emissions, hydrogen will be the core sustainable energy source for investments next to offshore-wind energy production.

Assessment of the topic of energy infrastructure

Our analysis of the Dutch RRP has identified one reform measure that is, to some extent, relevant to the topic of energy infrastructure. While it has been included in the previous section of the assessment of the topic of renewable energy production, the Energy Law includes a specific provision which aims at accelerating the realisation of large-scale energy infrastructure works and is therefore deemed appropriate to be included in this sub-section. This provision of the Energy Law on the topic of energy infrastructure includes a revised basis for interventions conducted by (local) governments in energy infrastructure projects in order to optimise the permit granting

and realisation of energy infrastructure projects. This measure is prominently aimed at improving the electricity transmission and distribution infrastructure in the Netherlands. This is a key pillar of the Climate Law as the NRRP argues that in an increasing number of areas, the available network capacity no longer corresponds to the current demand.

Assessment of the topic of sustainable transport

Our analysis of the NRRP has identified 7 measures related to sustainable transport. Of those 7 measures, 2 reforms and 5 investment measures have been found. The transport sector is thoroughly addressed, with substantial investments leading to increased energy efficiency, security, and digitalisation in infrastructure. Accordingly, the majority of the mobility-related measures and investments are described under the Accelerating Climate and Energy Transition Framework of the NRRP and cover nearly all forms of transport, including aviation, road transport (passenger and freight), railway, and waterway transport. This framework includes a preliminary estimate that the measures can generate 2.5 Mtonnes of CO2 reduction by 2030. Roughly EUR 854 million has been allocated to these investments.

Use of financial instruments in the Dutch NRRP

No financial instruments have been identified in the Dutch NRRP. While the Dutch NRRP hints at the possible use of financial instruments within the Dutch Climate Law (Klimaat Wet) under a Climate Fund which is currently in development, no further information on its development or design could be found.

Conclusion on the Dutch NRRP

The Dutch NRRP corresponds in various key assessment topics to the measures and goals set in the country's NECP. However, some measures and key energy categories fall short of the envisaged goals and objectives of the NECP. These findings are discussed below in more detail.

- **Energy efficiency in buildings (renovation**): While the Dutch NECP predominantly presents reforms on energy efficiency reforms related to renovations of the existing building stock, the NRRP describes more tangible investment measures complemented with clear goals and CO2 saving targets. Nevertheless, the NECP provides a more extensive overview of the different challenges and pathways to increase the energy efficiency in buildings through renovations. The NECP however, fails to describe these measures in detail while the investment measures in the RRP goes through great length to present the investment measures in a clear way. While various targets related to CO2 emission reductions are expanded in the RRP, various measures that are discussed in the NECP are not mentioned in the RRP. Resulting to some extent, a lack of cohesiveness between the two policy documents.
- **Energy efficiency in the industry and other:** the Dutch NRRP builds on and expands the set goals in the NECP, most notably for the envisaged CO2 reductions, but comes short in describing the presented reform and investment measures in more detail vis-à-vis the NECP.

- **Renewable energy production:** The RRP expands the targets and goals set in the NECP. Most notably on topics related to off-shore wind energy production. While the NECP predominantly composes of energy related reform measures, the RRP proposes various investment schemes for the increase in capacity of renewable energy. While revisiting previous objectives and targets, the RRP builds upon these in a clear and constructive manner, giving ample consideration to the challenges, approaches, stakeholders and objectives of meeting various sustainability related topics. More specifically, the Energy Law reform and the Energy Act it encompasses aims to provide a modernized and updated framework for the energy systems of both gas and electricity. This bill provides a modernised legal framework in which the energy transition is co-supported and stimulated and contributes to the goal of a clean and low carbon dioxide energy supply, which is spatially adaptable, safe, reliable and affordable.

- **Hydrogen:** While the NECP briefly touches upon the importance of the development of hydrogen, it lacks clarity and tangible objectives for this particular energy source. The RRP builds on these set goals and proposes a clear pathway to develop the hydrogen industry and implementation in the Netherlands.

- **Energy infrastructure:** While the Climate Law mentions various measures for the enhancement of the energy infrastructure of the Netherlands, it comes short of the various investment and reforms measures presented in the NECP. Accordingly, while the NECP presented relevant energy infrastructure measures in great detail, the RRP does not build on these set objectives or targets for the Dutch energy infrastructure. While various energy infrastructure objectives are described under various Renewable energy production measures, (mostly related to the infrastructure requirements for increased off-shore wind capacity) they do not target the key challenges and objectives that are set out in the NECP.

- **Sustainable transport**: While the NECP mostly presents reforms and investment measures related to increasing the sustainability of road transport, the RRP builds on these objectives and targets and expands these further to other means of transport. These include various reforms and investment regarding the aviation, rail and shipping sectors

Poland

Total budget of the NRRP	EUR 35.9 billion
Grants	EUR 23.7 billion
Loans	EUR 12.2 billion
% supporting climate objectives	42.7%

Overview - The NRRP of Poland contains 5 reforms and 15 investments related to energy projects. For investments, 4 are on Energy efficiency in buildings (renovation), 1 on Energy efficiency in industry and other, 2 on Renewable energy production, 1 on Hydrogen, 2 on Energy infrastructure and 5 on Sustainable Transport. The highest NRRP funding is dedicated to sustainable transport (EUR 7.5 billion). Our findings highlight that out of the 6 strategic missions of the NRRP, “Green Energy and Energy Saving” is the mission with the largest dedicated funding (EUR 14.3 billion). This mission is pursued through several investments and reforms, from improvement of energy efficiency in residential and public buildings to the construction of offshore terminal infrastructures. In regard to financial instruments, the NRRP provides information about one financial instrument dedicated to sustainable transport. The plan foresees the creation of a fund for sustainable mobility technologies, but the exact definition is not yet presented in the NRRP and will be decide at a later stage based on the ad-hoc needs.

Overview of energy-related targets in Poland’s National Energy and Climate Plan (NECP)

The NECP of Poland seeks to achieve ambitious and specific objectives in line with the five dimensions of energy established by the Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action: decarbonisation, energy efficiency, energy security, internal market and research, innovation, and competitiveness. The NECP outlines a set of climate and energy targets and describes a set of economic, regulatory, and planning instruments to achieve such targets. The NECP lists a total of 72 instruments classified within 9 broad scopes, namely “Greenhouse gas emission and removal”, “Renewable energy”, “Energy efficiency”, “Energy security”, “Electricity interconnectivity”, “Energy transmission infrastructure”, “Market Integration”, “Energy Poverty”, “Research, Innovation and Competitiveness”. The NECP was sent to the European Commission in late 2019.

Poland’s national Recovery and Resilience Plan (NRRP)

Poland’s NRRP is divided into five components: Green and Smart Mobility (EUR 7.5 billion), Resilience and Competitiveness of the Economy (EUR 4.7 billion), Efficiency and Quality of the Health System (EUR 4.5 billion), Digital Transformation (EUR 4.8 EUR billion) Green Energy and Energy Reduction (EUR 14.3 billion).

The green investments in the area of energy projects accumulate to roughly EUR 20 billion in funding. Key reforms, such as “Improving conditions for the development of renewable energy sources” pave the way for a new legal framework to support production from renewable sources and extension of the timing and eligibility of current support schemes.

Assessment of the topic of energy efficiency in buildings (renovation)

Our analysis of the NRRP identified 4 investments targeting energy efficiency in buildings, for a total of roughly EUR 4 billion allocated to the different measures. These measures aim to replace heat sources and improve energy efficiency in residential and public buildings. Overall, these measures aim to intervene on the renovation of over 1,300,000 square meters of public buildings and replace 860,000 ineffective solid fuel heating sources with standard-compliant modern heating sources.

Assessment of the topic of energy efficiency in industry and other

Our analysis of the NRRP identified 2 investments and 1 reform targeting energy efficiency in industry and other purposes, for a total of roughly EUR 612 million allocated to the different measures. The proposed measures aim to fill Poland's gap in terms of industry competitiveness by intervening on different economic sectors, notably robotization, innovation, and circular economy. The intended impacts of these measures are the adoption of a tax relief to support the digitisation of enterprises by 2022 and to enhance competitiveness (although no specific targets are set).

Assessment of the topic of renewable energy production

Our analysis of the NRRP identified 2 investments and 1 reform targeting renewable energy production, for a total of roughly EUR 2 billion allocated to the different measures. The proposed measures aim to address the main challenges of the energy transition in an integrated way, focusing in particular on offshore wind energy. An effort is made in ensuring a just transition of coal-dependent regions. Moreover, 139 energy communities will be supported by the fund.

Assessment of the topic of hydrogen

Our analysis of the NRRP identified 1 investment targeting hydrogen, for a total of roughly EUR 800 million. The proposed measure ("Investments in hydrogen technologies, production, storage and transport of hydrogen") aims to develop hydrogen-related technologies in all phases: production, storage, and transport. The intended impact of these measures is a plant capacity for the production of low-emission and renewable hydrogen of 320 MW by 2026. Also, 25 refuelling stations will be installed in the country, and 3 innovative hydrogen-powered transport units will be created by 2026.

Assessment of the topic of energy infrastructure

Our analysis of the NRRP identified 2 investments targeting energy infrastructures, for a total of roughly EUR 2 billion. The proposed measures aim to develop transmission networks and smart electricity infrastructure increasing the amount of energy produced from renewable energy sources fed into the distribution network and promoting greater electrification of consumption. Through these measures, 379 km of newly built or modernized power transmission networks are expected by 2026.

Assessment of the topic of sustainable transport

Our analysis of the NRRP identified 5 investments and 1 reform targeting sustainable transport, for a total of roughly EUR 7.5 billion allocated to the different measures. The proposed measures aim to build enabling infrastructures to promote the development of sustainable mobility (notably trains and electric buses). The intended impacts of these

measures are an annual reduction of CO_2 emissions of over 142,000 tonnes, the complete elimination of non-electric buses in main Polish cities by 2030, the delivery of 1580 zero and low-emission buses by 2026, the electrification of approximately 114 km of rail lines and the creation of 35 multimodal digital transport hubs.

Use of financial instruments in Poland's NRRP

Poland's NRRP defines one financial instrument dedicated to green investment on the topic of sustainable mobility. It foresees establishing a fund which will provide capital or debt support for corporate investment projects related to the development of industry in Poland for low and zero-emission solutions in the field of sustainable mobility and energy. For this, a volume of EUR 1.11 billion is included, financed by Poland's grant allocation of the RRF. The exact use of financial equities such as loans, guarantees or equity as well as the targeted technologies will be decided following an investment strategy that is still to be developed level by the fund's investment committee.

Conclusion on Poland's NRRP

The comparability between the NRRP and the NECP is limited by the lack of a systematic correspondence between the measures proposed in the NRRP and the environmental targets of the NECP.

Energy efficiency in buildings: While the NECP contains ambitious targets in energy savings in private buildings, the NRRP also includes targets for public buildings (such as schools, libraries, and local social activity facilities). Moreover, measures such as investments in heat sources in heating systems are reinforced with further EUR 50 million and supported by relevant reforms. For this reason, the measures contained in the NRRP seem to go beyond those contained in the NECP.

Energy efficiency in industry and other: The NRRP mainly contains measures to support enterprises' investments in innovation, robotisation and (to a lesser extent) circular economy. No specific measures to improve energy efficiency are foreseen. On the other hand, the NECP contains few measures to improve businesses' energy efficiency. It is then unlikely that the measures contained in the NRRP will lead to more ambitious targets.

Renewable energy production: The target of 32% of renewable energy share in Poland by 2030 is included in both the NECP and the NRRP. No higher targets are set in the NRRP, although the implementation of renewable energy installations by energy communities is foreseen. Overall, the NRRP does not seem to aim at higher targets.

Hydrogen: The NECP lacks a comprehensive hydrogen development strategy. On the other hand, through the RRF EUR 800 million are made available to increase plant capacity, develop hydrogen-use technology and install refuelling stations. For this reason, the NRRP seems to set higher targets than the NECP. The NRRP is also in line with the "Polish Hydrogen Strategy until 2030", published in 2020, one year after the NECP.

Energy infrastructure: The complementarity between the two plans is not assessable, because of the inconsistency of targets, indicators, and measures (which are globally limited in number and resources).

Sustainable transport: The NECP and the NRRP contain complementary targets. On the one hand, the NECP focuses on alternative fuels and provides support to Sustainable Urban Mobility Plans (SUMPS). On the other hand, the NRRP provides support for railway lines, intermodal transport, and digitalisation. Measures contained in the NRRP might lead to more ambitious targets.

Portugal

Total budget of the NRRP	EUR 16.6 billion
Grants	EUR 13.9 billion
Loans	EUR 2.7 billion
% supporting climate objectives	38%

Overview - The NRRP of Portugal contains 6 reforms and 12 investments related to energy projects. In particular for investments, 3 are on Energy efficiency in buildings (renovation), 1 on Energy efficiency in industry and other, 2 on Renewable energy production, 1 on Hydrogen, 0 on Energy infrastructure and 5 on Electro mobility. The highest NRRP funding is dedicated to Sustainable transport (EUR 967 million)]. Our findings highlight that the Portuguese NRRP often includes additional measures compared to the NECP, but these measures are often limited in scale and their impacts are not clearly quantified.

In regard to financial instruments, the NRRP does not provide detailed information on the financial instruments dedicated to green investments, but the NRRP is only one of the many funding mechanisms that will fund a broader country's strategy to 2030. It emerges from the plan that the loan component of the NRRP will be used to finance investments in the Resilience dimension. In this sense, the Portuguese NRRP makes clear that the support component in the form of loans may be increased by an additional EUR 2.3 billion depending on the level of demand generated in the NRRP for measures to support companies in the field of Capitalization and Business Innovation and depending on the dynamics of finance public.

Overview of energy-related targets in Portugal's National Energy and Climate Plan (NECP)

The NECP of Portugal is framed within the obligations arising from the Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action, and includes an assessment of the current state in Portugal with respect to the following five dimensions: decarbonisation, energy efficiency, energy security, internal market and research, innovation and competitiveness. Specifically, the NECP describes a set of national objectives and targets and presents the planned policies and measures to meet such targets. In total, the plan proposed 8 targets and 206 associated measures classified into 58 lines of action. The European Commission assessed the targets on GHG emission reductions and increasing share of energy from renewable sources as sufficiently ambitious, while the energy efficiency targets have been judged to be modest. Notably, the Portuguese NECP was sent to the European Commission in late 2018, and Portugal submitted the final plan in December 2019.

Portugal's national Recovery and Resilience Plan (NRRP)

Portugal's NRRP is divided into 20 components, grouped into 3 dimensions of structural intervention: Resilience (EUR 11.125 billion), Climate Transition (EUR 3.059 billion), and Digital Transition (EUR 2.460 billion). A total of 37 reforms and 83 investments are identified in the plan to achieve the targets in each of the 3 dimensions.

The Climate Transition component of the Portuguese NRRP is divided into 6 components: (i) Sea (EUR 252 million), (ii) Decarbonisation of Industry (EUR 715 million), (iii) Sustainable Bioeconomy (EUR 145 million), (iv) Energy Efficiency in Buildings (EUR 610 million), (v) Hydrogen and Renewables (EUR 370 million), and (vi) Sustainable Mobility (EUR 967 million). Together, these dimensions cover 18% of the amount of investments foreseen in the NRRP.

Portugal submitted its NRRP in April 2021, which was then endorsed by the European Commission in June of the same year. Following Portugal first payment request in January 2022, the European Commission has disbursed EUR 1.16 billion to Portugal in May 2022.

Assessment of the topic of energy efficiency in buildings (renovation)

Our analysis of the NRRP identified 3 investments and 3 reforms targeting energy efficiency in buildings, for a total of EUR 610 million allocated to the different measures. The target of these measures is to rehabilitate and make buildings more energy efficient with the idea of achieving additional social, environmental and economic benefits for households and enterprises. Multiple goals that stand out from the implementation of the listed measures include the reduction in energy consumption levels and associated energy bills and import dependency, the reduction in energy poverty, the improvement of indoor air quality and comfort levels, as well as positive employment effects. Overall, the intended interventions are aimed at starting a significant wave of energy renovation of public administration buildings, educational institutions, commercial and residential buildings. The intended impacts include a 40% reduction in primary energy consumption and a 10% share of energy consumption in buildings from own-produced renewable energy (i.e. self-consumption).

Assessment of the topic of energy efficiency in industry and other

Our analysis of the NRRP identified 1 investment and 1 reform targeting energy efficiency in industry and other sectors, for a total of EUR 715 million allocated to the different measures. The proposed measures aim to accelerate the transition to a carbon neutral economy while promoting the competitiveness of industry and companies, and are centred on the electrification of industrial processes, a more efficient use of energy and resources, and the promotion of the circular economy in industry. Additional interventions also include the incorporation of renewable sources and storage technologies in industry such as renewable gases and hydrogen. The intended impacts of these measures however are not quantified in the Portuguese NRRP.

Assessment of the topic of renewable energy production

Our analysis of the NRRP identified 2 investments and 0 reforms targeting renewable energy production, for a total of EUR 185 million allocated to the different measures. The

proposed measures aim to develop a power supply sector heavily based on renewable sources such as hydro and geothermal in the Madeira Autonomous Region and in the Autonomous Region of the Azores, therefore reducing the depending of these regions on imported fossil fuels for thermoelectric power plants. Besides the support to expand the renewable installed capacity in these regions (17 MW of geothermal energy to be installed), the NRRP lists measures to promote the integration of distributed energy storage systems to guarantee flexibility in energy management and the production of decentralised energy (12.6 MW).

Assessment of the topic of hydrogen

Our analysis of the NRRP identified 1 investment and 1 reform targeting hydrogen, for a total of EUR 185 million allocated to the different measures. The Portuguese NRRP has a significant focus on the production of hydrogen and other gases or renewable origin, and strongly builds on the already published National Hydrogen Strategy of Portugal. Specifically, targets for hydrogen are incorporated in various sectors of the economy for the 2030 horizon, including 2.5 GW of installed capacity of electrolysers, 5% green hydrogen consumption in the industry, road and marine transport sectors, and a 15% blending target for hydrogen in the natural gas network. In addition, the hydrogen and renewable gases investment is intended to support the installation of 264MW of additional capacity for the production of hydrogen and other renewable gases using technologies such as electrolysis, methanation, and anaerobic digestion.

Assessment of the topic of energy infrastructure

Our analysis of the NRRP did not identify any investment or reform targeting energy infrastructure. Nevertheless, the renewable investments for the Madeira and Azores archipelagos explicitly mention the promotion of distributed storage systems and smart networks to allow for self-consumption and more decentralised production of energy. Other important energy infrastructure investments are also included in the measures to foster sustainable transport, for example for the realisation of charging/supply stations.

Assessment of the topic of sustainable transport

Our analysis of the NRRP identified 5 investments and 1 reform targeting sustainable transpoort, for a total of EUR 967 million allocated to the different measures. Portugal's NRRP in particular focuses on improving public transport systems to reduce dependence on individual road transport and decarbonise the sector. In this sense, investments are directed towards extending existing subway networks and building new stations, for example in Lisbon and Porto, or creating new light rail transit systems to reduce traffic congestion problems. Additionally, the NRRP promotes the launch of a program to support the purchase of 145 clean buses to accelerate fleet renewal and the realisation of the required recharging stations.

Use of financial instruments in Portugal's NRRP

Portugal's NRRP does not provide information on the financial instruments dedicated to energy-related investments, and only reports the NRRP funding dedicated to the 6

components of the Climate Transition dimension. What the NRRP reports is the fact that the NRRP is one of the many funding mechanisms that will fund a broader strategy aimed at bringing the country to its 2030 economic, social, and environmental objectives. Besides the major contribution of the NRRP, financial means will also be provided by sources such as the Multiannual Financial Framework 2021-2027, other Next Generation EU funds, REACT-EU, the Just Transition Fund, the different centrally managed European funding programmes, such as Horizon Europe, the Connecting Europe Facility, InvestEU or EIB/EIF funding, public funds such as the Environmental Fund (*Fundo Ambiental*) and structuring private investments.

Conclusion on Portugal's NRRP

The Portuguese NRRP presents investments and reforms in all the considered energy categories with the only exception of energy infrastructure, although some energy storage and recharging initiatives are included in the investments for renewable energy production and sustainable transport. While for some energy categories the expected impacts of the measures are generic and it is not clear whether the measures are in addition to those already included in the NECP, for other energy categories, such as renewable energy, hydrogen, and sustainable transport, the listed measures are clearly new compared to the NECP and, in the case of hydrogen, the expected outcomes are clearly described.

Energy efficiency in buildings: It is difficult to determine whether the RRP measures will contribute to additional emission reductions and energy efficiency uptake since the NRRP reports limited information on the expected impact of these measures. Nevertheless, the Portuguese NRRP includes reforms which were enacted after the publication of the NECP such as the Resource Efficiency Program in Public Administration 2030, therefore providing an indication of potentially more ambitious targets.

Energy efficiency in industry and other: While no specific sectoral emission reduction target has been defined in the NECP for industry, the NRRP introduces measures aimed at strengthening the capacity for structural change in the field of decarbonisation of industry. Likely, the measures in the NRRP will accelerate the progress in the industry sector, but since there is no clarity on the effective impacts of the measures presented, it is hard to assess how much more ambitious the NRRP is compared to the NECP.

Renewable energy production: Portugal's NRRP allocates funds for the development of renewable energy sources in the archipelagos of Azores and Madeira. While being small, these investments were not included in the country's NECP, therefore we can expect increased chances of reaching a higher renewable energy production target.

Hydrogen: With the proposed reform centred on the National Hydrogen Strategy and on the investment for the production of renewable gases, Portugal's NRRP introduces clear targets for the development of the hydrogen economy to the year 2030. On the contrary, the NECP only includes action strategies without clear targets for promoting the production and consumption of green hydrogen.

Energy infrastructure: The Portuguese NRRP includes some references to energy infrastructure investments in archipelagos (energy storage and distributed energy) and recharging infrastructure for buses, but these investments seem marginal compared to the investments required to achieve the energy infrastructure targets in the NECP.

Sustainable transport: The Portuguese NRRP lists 5 investments for the extension of existing metro infrastructures, for the realisation of new light rail lines, and for the decarbonisation of public transport with the acquisition of 145 clean buses. These measures are new compared to what proposed in the NECP, although it is hard to judge how significant the additional impact of these measures on decarbonisation targets will be.

Romania

Total budget of the NRRP	EUR 27 billion
Grants	EUR 12.1 billion1
Loans	EUR 14.9 billion
% supporting climate objectives	41%

Overview - The NRRP of Romania contains 6 reforms and 19 investments related to energy projects. In particular for investments, 6 are on Energy efficiency in buildings (renovation), 3 on Energy efficiency in industry and other, 3 on Renewable energy production, 1 on Hydrogen, 2 on Energy infrastructure and 5 on Sustainable transport. The highest NRRP funding is dedicated to sustainable transport with EUR 8.336 billion followed by the implementation of the renovation wave with EUR 2.287 billion.

In regard to financial instruments, the NRRP includes 3 financial instruments with a focus on energy efficiency in industry and energy efficiency in buildings and the aim to facilitate industry and citizens access to loans and financial instruments for energy efficiency as well as the overall development of green financial instruments.

Overview of energy-related targets in Romania's National Energy and Climate Plan (NECP)

The NECP of Romania covers five dimensions: 1) decarbonisation (separated into GHG emissions and removals and renewable energy); 2) energy efficiency; 3) research innovation and competitiveness; 4) internal energy markets; and 5) energy security. Across these dimensions, Romania has set itself various targets. For one, the country aims to increase the share of renewable energy in gross final energy consumption to at least 30.7% by 2030 by developing 6.9 GW of additional capacity compared to 2015. Furthermore, the NECP outlines a target of primary energy consumption of 32.3 Mtoe (final energy consumption: 25.7 Mtoe) in 2030 leading to energy savings of 45.1%. This will be achieved through implementing Romania's Long-Term Renovation Strategy. To improve energy security and Romania's internal energy market, the NECP foresees reforms to facilitate the exploitation of natural gas, adopting a decarbonisation plan for coal power, diversifying sources, building up renewable production and storage capacities, developing and modernising existing electricity and gas infrastructure and liberalising the wholesale and retail energy markets. The ambition is to achieve 15.4% interconnectivity by 2030. Finally, research and innovation should lead to the integration of new technologies (e.g. promoting the use of hydrogen) and more energy efficiency.

Romania's national Recovery and Resilience Plan (NRRP)

The six pillars of the Romanian RRP plan are (i) green transition (EUR 15.31 billion); (ii) digital transformation (EUR 1.88 billion); (iii) smart, sustainable and inclusive growth (EUR 3.02 billion); (iv) social and territorial cohesion (EUR 2.55 billion); (v) health and economic, social and institutional resilience (EUR 1.65 billion); and (vi) policies for the new generation

(EUR 3.61 billion). These six pillars are further subdivided into 15 components which comprise a total of 171 measures, of which 64 are reforms and 107 investments.

The majority of measures relevant to energy projects fall under the green transition pillar, in particular the components of sustainable transport, renovation wave and energy. Beyond these, the digital transformation component also includes one relevant measure, the private sector support, research, development and innovation component includes three relevant financial instruments, and the local fund component includes two measures related to sustainable transport. The green investments in the area of energy projects accumulate to EUR 12.743 billion in RRF funding (total funding of EUR 17.844 billion). The majority of RRF funding is dedicated to sustainable transport (in particular railway projects), followed by energy efficiency in buildings and energy infrastructure.

It is unclear how the downward revision of Romania's grant compartment will affect the proposed measures in Romania's NRRP.

Assessment of the topic of energy efficiency in buildings (renovation)

Our analysis of the NRRP identified 5 investments and 1 reform targeting energy efficiency in buildings, for a total of roughly EUR 2.287 billion allocated to the different measures. These measures fall under the Renovation Wave component, which aims to improve the built environment through an integrated approach to energy efficiency, seismic consolidation, fire risk reduction and the transition to green and smart buildings. In particular regarding energy efficiency, the NRRP notes that Romania's buildings segment accounts for 45% of total energy consumption. Romania has about 5.6 million buildings with 90% of them being residential buildings. In recent years, Romania's final energy consumption of residential buildings decreased by only 8.4%, while for public and commercial buildings the reduction was 3.7%. To speed up renovation and meet the NCEP targets, various measures are proposed in the NRRP.

Chief among these measures is the establishment of a Renovation Wave Fund, which will be financed by an RRF loan of EUR 2.17 billion and provide grants for moderate and deep energy renovation of approx. 4.3 million m^2 of multi-family residential buildings and 2.3 million m^2 of public buildings. The measure contributes to the EUR 13 billion needed for the renovation of Romania's building stock by 2030, which was identified in Romania's National Long Term Renovation Strategy. As a flanking measure, the NRRP proposes a EUR 5 million investment to develop a National Register of Buildings, georeferenced information system and to gradual implement the energy passport for buildings. This is also complemented by an investment of EUR 10 million to strengthen the professional capacity of construction specialists through training in energy efficiency in construction. Beyond this, a reform also aims to simplify the regulatory framework to support the implementation of investment in the transition to green and resilient buildings. Finally, a smaller investment measure of EUR 14.85 million complements the Renovation Wave Fund by targeting the circular economy and energy efficiency aspects of historic buildings. The investment will provide training and set up a pilot centre.

Less relevant, but adding to the renovation ambitions is an investment under the digital transformation component to fund schemes for libraries to become digital skills development hubs, which will modernise 105 libraries. Beyond grant funding, the NRRP

also proposes a financial instrument for investments in energy efficiency in the residential and buildings sector, which has a EUR 50 million fund to provide loans and portfolio guarantees for renovation work.

Assessment of the topic of energy efficiency in industry and other

Our analysis of the NRRP identified 3 investments and 2 reforms targeting energy efficiency in industry and other purposes, for a total of roughly EUR 564 million allocated to the different measures. Romania's ambition is to move away from lignite-based electricity generation by closing power plants with a cumulative capacity of 3,780 MW and replacing them with more efficient gas power plants. To do so, the proposed reform of the electricity market will introduce a Decarbonisation Act which will provide a timetable for phasing out coal and lignite. Similar, a reform is proposed that would introduce by end of 2023 measures to decarbonise the heating and cooling sector. Beyond the energy, heating and cooling sectors, measures also target energy efficiency in other industries to complete at least 50 energy efficiency projects with at least a 30% reduction in GHG emissions. For this purpose, a targeted investment will provide EUR 64 million in funding to be distributed through competitive calls covering 30% (50% for small enterprises) of the cost of energy efficiency projects.

Further to these reforms and investments, the NRRP foresees two relevant financial instruments, a portfolio guarantee for climate action and a fund of funds for digitalisation, climate action and other areas of interest. Together these will have a total volume of EUR 500 million distributed as guarantees and debt for energy efficiency projects. They are further detailed in the section on financial instruments.

Assessment of the topic of renewable energy production

Our analysis of the NRRP identified 3 investments and 2 reforms targeting renewable energy production, for a total of roughly EUR 810 million allocated to the different measures. The previously mentioned electricity market proposes also a new Energy Law, which would introduce Contracts for Difference (CfD) as the main support mechanism for investments in renewable energy production and establish the possibility of direct negotiation of Power purchase agreements (PPAs) by all renewable energy producers. The NRRP estimates a total capacity of 3.000 MW of renewable electricity generation (wind and solar) to be installed and connected to the grid by 30 June 2026, due to this reform. Another reform aims to improve the corporate governance of state-owned enterprises and among others list 15% of shares of Hidroelectrica on the stock exchange to collect funds. This reform is also expected to contribute to the development of renewable energy production but aims more at improving the transparency and competitiveness of the companies.

Next to these two reforms, a grant from the RRF would be used to launch a competitive and technology-neutral public tender to build additional renewable electricity generation capacity. It is estimated that it will lead to an installed capacity of around 950 MW (solar and/or wind energy), which will generate about 1700 GWh/a, representing around 3 % of annual consumption. This would be complemented by a measure proposing an open call to construct photovoltaic cells and panels (production, assembly and recycling) with a total annual capacity of at least 200 MW. Finally, an RRF loan is used to launch an open call for constructing high-efficiency cogeneration plants using gas with a capacity of at least 300

MW, ready for renewable and low-carbon gases. This measure also addresses some of the shortfalls from the closing of coal power plants described in the previous section.

Assessment of the topic of hydrogen

Our analysis of the NRRP identified 1 investment and 1 reform targeting hydrogen, for a total of roughly EUR 116 million allocated to the different measures. The proposed reform aims to develop a legislative and regulatory framework conducive to future technologies and in particular to hydrogen. Romania intends to develop a National Hydrogen Strategy, a strategic document that will underpin the revision of the energy legislation, to meet both the current needs and the present and future objectives at the national and European levels. An RRF loan will be used for a technical assistance project to set up the Hydrogen Strategy. Beyond this, the investment measures target not just hydrogen, but also renewable energy production and energy infrastructure. It uses EUR 400 million from an RRF loan for a new distribution network for green hydrogen and EUR 115 million for green hydrogen production to construct. The ambition is to build 1.870 km of infrastructure for the distribution of green hydrogen in the Oltenia region and capacities of at least 100 MW in electrolysers, producing at least 10,000 tonnes of renewable hydrogen by Q4 2025. Beyond this one investment and reform, the aforementioned investment for renewable energy production on developing flexible and high-efficiency gas production capacities for cogeneration of electricity and heat will be developed in a way to be ready to take over green hydrogen. It foresees EUR 300 million in investment volume, which has been allocated however to the Renewable energy production category. Finally, the sustainable transport component also foresees to modernise two railway corridors for operation with hydrogen or battery trains and the purchase of 12 hydrogen-electric trains plus their hydrogen supply station.

Assessment of the topic of energy infrastructure

Our analysis of the NRRP identified 2 investments targeting energy infrastructures, for a total of roughly EUR 630 million, however, all three measures also target other aspects such as sustainable transport, renewable energy production and hydrogen. The proposed measures aim to increase the flexibility of the electricity grid, commission charging points for electric vehicles and set up hydrogen infrastructure. For the first, an investment into the production and/or assembly and/or recycling of batteries, cells and photovoltaic panels and new electricity storage capacities is proposed. For electricity storage, EUR 130 million are set aside to be used for open calls for projects to deploy an electricity storage capacity of at least 240 MW (or 480 MWh) as well as to set up an annual total battery manufacturing and assembly capacity of at least 2 GW by Q4 2025. In terms of charging points, an investment of EUR 165 million is proposed to provide infrastructure for green transport and build 13,200 charging points by Q2/2026. Finally, as mentioned previously, it is foreseen to build 1.870 km of infrastructure for green hydrogen.

Assessment of the topic of sustainable transport

Our analysis of the NRRP identified 6 investments targeting sustainable transport, for a total of roughly EUR 13.5 billion (8.3 billion from the RRF) allocated to the different measures. The proposed measures aim on one hand to build enabling infrastructures (charging, railway and metro infrastructure) to promote the development of sustainable

mobility and on the other hand target the gradual renewal of vehicle fleets. The majority of investments go to the modernisation and renewal of railway infrastructure. EUR 4.17 billion (EUR 3.48 billion from the RRF) will be used for infrastructure projects to electrify existing railway tracks and install ERTMS as well as to renew the existing railway corridor. In addition, two projects are planned to be operated on hydrogen or battery trains (Bucharest - Pitesti and Resita – Voiteni). Additionally, another investment will be used to purchase new environmentally friendly rolling stock for rail passenger transport operators as well as to modernise electric locomotives and convert hydraulic diesel locomotives to plug-in battery electric locomotives. Finally, funding is allocated to develop the metro transport network in Bucharest and Cluj-Napoca (Transport capacity: 50000 passengers/h).

For road transport and electric vehicles, a major investment of EUR 3.095 billion from the RFF complemented by EUR 2.727 billion from the national level is planned to develop sustainable road infrastructure on the TEN-T network. This investment will also include setting up 52 charging stations with 264 charging points to increase the use of e-vehicles. Further funding comes from the local fund component which provides through one investment a total of EUR 580 million to municipalities to purchase zero-emission vehicles (buses, trolleybuses, trams and minibuses). This is complemented by the funding for 13,200 charging points mentioned in the previous sections.

Use of financial instruments in Romania's NRRP

Romania's NRRP contains 5 financial instruments, which are all grouped under Component 9 – Support for the private sector, research, development and innovation. The total RRF contribution to financial instruments EUR 1250 million in loans. Three of these financial instruments (or EUR 550 million) are relevant in regard to energy projects. Two of the relevant financial instruments with EUR 500 million of RRF contribution target energy efficiency in the industry among others ('Portfolio guarantee for climate action' and a 'Fund of funds for digitalisation, climate action and other areas of interest'), while a smaller one worth EUR 50 million targets energy efficiency in buildings ('Financial instrument for investments in energy efficiency in residential and buildings sector'). Implementing bodies involved are the European Investment Fund and the European Investment Bank in the former two cases and in the latter case, the European Bank for Reconstruction and Development. These will select financial intermediaries. For the financial instrument targeting energy efficiency in buildings, the aim is to expand financial intermediation and risk-sharing, which were highlighted as key priorities in the EBRD Country Strategy for Romania 2020-2025. Both the 'Portfolio guarantee for climate action' and the 'Fund of funds for digitalisation, climate action' aims to address through guarantees and loans the financing gap for Romanian companies that are considered financially constrained particularly because of collateral requirements. In particular, the 'Fund of funds' envisages also the possibility to combine loans with grants as identified during market testing. The aim of these financial instruments is to improve access to finance, improve projects in climate action, among others, and strengthen financial intermediaries' capacity to finance these projects as well as widen the market. Advisory support will be offered to financial intermediaries. In addition, the aim is also to gradually move away from the current grant dependency in Romania.

Beyond this, one reform under the Renovation Wave labelled 'Reducing the energy intensity of the economy by developing a sustainable mechanism to boost energy efficiency in industry and increase resilience' aims to introduce new standards for green financial instruments. While this does not constitute a financial instrument itself, this reform aims to facilitate industry access to loans and green bonds for energy efficiency and encourages the development of green financial instruments. While this is mentioned in the NRRP, it was pointed out in an interview that the introduction of new standards for green financial instruments is outside the NRRP with Romanian authorities working to facilitate and incentivise the use of green financial instruments and improve institutional capacity of financial intermediaries and project promoters.

Conclusion on Romania's NRRP

The measures in the NRRP of Romania have the potential to accelerate the green transition and support Romania's decarbonisation and energy transition objectives, as set out in its NECP. The plan includes reforms on the phase-out of coal and lignite power production, which is crucial for the decarbonisation of the energy sector and to unlock the potential for renewables deployment. The plan also puts focuses on the energy efficiency of private and public buildings. Considerable amounts of additional funding are also foreseen to come from national and private co-financing complementing the RRF funding.

Regarding **energy efficiency in buildings**, the NRRP shows a high ambition to implement the renovation wave in particular through the Renovation Wave Fund as well as the proposed financial instrument for investments in energy efficiency in the residential and buildings sector, however, while these are certainly steps in the right direction, the measures and their foreseen impacts do not measure up to the expected needs outlined in Romania's NECP and the National Long Term Renovation Strategy. Therefore, the measures of the NRRP implement many of the foreseen measures but does not seem to go beyond them.

For **energy efficiency in industry**, there are not many targets specified in the NRRP and also Romania's draft NECP plan was criticised by the European Commission for a lack of ambition in its energy efficiency targets. The NRRP itself states that improving energy efficiency by 32.5 % by 2030 will be a challenge. While the combination of funding for 50 energy efficiency projects in the industry with the two financial instruments which target energy efficiency, among others, might lead to a modernisation of the Romanian industry, it remains unclear if this goes beyond the ambitions of the NECP.

In terms of **renewable energy production**, the NRRP estimates that 4,150 MW in production capacity will be created by June 2026, which already meets the needs of 4,178 MW that the NECP identified between 2022 and 2030. Otherwise, the NRRP puts forward many of the measures that were foreseen also in the NECP (e.g. promoting investments in new low-carbon power generation capacities, developing a support mechanism of the CfD type, concluding long-term PPA with clients outside centralised markets).

For **hydrogen**, neither the NRRP nor the NECP is very ambitious considering that the NECP did not specify any targets regarding hydrogen and only had one measure addressing hydrogen. However, the NRRP measures go beyond the NECP, with the

NRRP proposing several measures to develop hydrogen infrastructure and production and considers also the future reuse of gas infrastructure for hydrogen.

Energy infrastructure is only a minor topic in the Romanian NRRP, focusing mainly on gas (and hydrogen) infrastructure, electricity storage capacities and electric charging points. Therefore, the NRRP is unlikely to contribute to higher targets in terms of electricity and the interconnection rate.

Regarding **sustainable transport**, the NRRP provides concrete measures compared to the generic measures of the NECP to encourage the deployment of charging stations, rail electrification, etc. However, it is not clear if these go beyond NECP targets. Moreover, the NECP targets for charging points and electric vehicles, seem to be rather ambitious compared to what is in the NRRP..

Slovakia

Total budget of the NRRP	EUR 6.3 billion
Grants	EUR 6.3 billion
Loans	EUR 0 billion
% supporting climate objectives	43%

Overview - The NRRP of Slovakia contains 11 reforms and 11 investments related to energy projects. In particular for investments, 2 are on Energy efficiency in buildings (renovation), 2 on Energy efficiency in industry and other, 3 on Renewable energy production, 1 on Hydrogen, 2 on Energy infrastructure and 4 on Sustainable transport. The highest NRRP funding is dedicated to Sustainable transport or more generally low-carbon transport (EUR 774.5 million with some funding being split with Hydrogen) and Energy efficiency in buildings (EUR 741.5 million). Our findings highlight that, although there are several new measures in the NRRP, they are often generic and without specific targets. Insights from the interview revealed that most of the measures in the NRRP were designed to help Slovakia achieve the targets already set in the NECP, with some measures preparing the regulation for more ambitious long-term targets.

Regarding financial instruments, the NRRP mentions that part of the funds can be implemented through financial instruments. However, the financial instruments have no allocation under the recovery plan, therefore, they are not specified.

Overview of energy and climate targets of Slovakia and relevant policy initiatives

The NECP of Slovakia seeks to achieve several high-level and specific objectives in line with the five dimensions of energy established by the Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action: decarbonisation, energy efficiency, energy security, internal market and research, innovation and competitiveness. The NECP outlines a set of climate and energy targets and describes a set of economic, regulatory and planning instruments to achieve such targets. The national targets for 2030 include a 20% reduction in non-ETS greenhouse gas (GHG) emissions (compared to a 30% EU target), 19.2% share of RES (compared to a 32% EU target), a 14% share of RES in transport (compared to a 14% EU target), a 30.3% increase in energy efficiency (compared to a 32.5% EU target) and a 52% interconnection of electricity systems (compared to a 15% EU target). The Slovak ambitions are lower than those of the EU in 3 out of 5 national targets.

Slovak’s national Recovery and resilience plan (NRRP)

The five pillars of the Slovak RRP plan are (i) Green economy (EUR 2 301 million); (ii) Education (EUR 892 million); (iii) Science, research and innovation (EUR 739 million); and (iv) Health (EUR 1 533 million) and (v) Effective public administration and digitization (EUR 1 110 million), comprising in total 116 measures, of which 58 reforms and 58 investments divided into 18 components.

The NRRP of Slovakia finances energy projects under Component 1 - Renewable energy sources and energy infrastructure, Component 2 - Restoration of buildings, Component 3 – Low-carbon transport and Component 4 - Decarbonization of industry. The total amount of funding for these components is EUR 2 301 million (made out of EUR 170 million from the digital component and EUR 2 199 million from the green component), corresponding to 35% of the total RRF funding.

For the green economy pillar, apart from the RRF budget mentioned above, the Slovak authorities are expecting additional resources coming from the Modernisation fund, the European Structural and Investment Funds (ESIF), the Connecting Europe Facility (CEF) and the Fair Transformation Fund.

Assessment of the topic of energy efficiency in buildings (renovation)

Our analysis of the NRRP identified 2 investments and 2 reforms targeting energy efficiency in buildings, for a total of roughly EUR 741.5 million allocated to the different measures. By increasing the energy efficiency of buildings (family houses and public historical buildings), these measures aim to reduce energy consumption and thus contribute to the reduction of CO_2 emissions and air pollution. In this way, they contribute to the overall aim of reducing GHG emissions by 55% by 2030 compared to 1990. Energy savings of at least 30% for both family houses and public buildings are estimated.

Assessment of the topic of energy efficiency in industry and other

Our analysis of the NRRP identified 2 investments and 3 reforms targeting energy efficiency in industry and other purposes, for a total of roughly EUR 368 million allocated to the different measures.

The reforms are ensuring that energy efficiency improvements will need to be pursued whenever they are more cost-effective than equivalent solutions on the supply side. Additionally, the public sector will set up assessments in terms of mitigation and adaptation to climate change and will increase the level of control which is expected to lead to a direct and indirect reduction of environmental pollution.

Regarding the investments, the main goal is to ensure the reduction of GHG emissions through project support for the industry so that the maximum possible contribution to the Slovak and European climate goals is achieved. Therefore, it will be ensured that the amount of GHGs emitted (in $eqCO_2$ units) in the given companies will decrease by at least 30% on average. The set of projects has the potential to reduce total emissions by 3 million tons of $eqCO_2$ per year with the state's participation in the amount of 340 million EUR (363 million at current prices). During the expected 30-year life of the projects, and taking into account the discount rate of 5%, emission savings of min. 38-million-ton $eqCO_2$. After the investments are made, the GHG emissions in the given plants are expected to decrease by more than a third. The potential cost of reducing emissions in the case of support for specific projects under the model example would be € 8.9 per ton $eqCO_2$ over the lifetime of the project (min. 30 years), taking into account a 5% discount rate. This amount considers the increase in secondary emissions.

Assessment of the topic of renewable energy production

Our analysis of the NRRP identified 3 investments and 3 reforms targeting renewable energy production, for a total of roughly EUR 252.35 million allocated to the different measures. The proposed measures aim to increase the share of renewable energy sources in the energy mix.

The reforms aim to support a more massive integration of new renewable energy sources into the electricity grid, to contribute to the stability of the business environment and better predictability of the increment of newly installed renewable capacities in the electricity sector.

The investments intend to support the construction of new production capacities of electricity from renewables and to increase the flexibility of the electricity system or support complex solutions for variable renewable energy projects that do not cause the need for regulatory power in order to enable a higher share of electricity production from renewables. By the modernization of existing electricity generation capacities, they aim at extending their technological life and increasing the efficiency of electricity generation. Furthermore, they want to ensure the technological renewal of existing production capacities for the production of electricity from biogas, for which the operational support ends by 2026. Additionally, transforming biogas plants into biomethane plants should enable the share of renewable energy production to be maintained by replacing natural gas with biomethane in existing heat and power plants, making full use of the heat produced as well as decarbonising industrial processes and transport.

Assessment of the topic of hydrogen

Our analysis of the NRRP identified 1 investment targeting energy storage projects (battery systems), including hydrogen production by electrolysis and the transport, distribution and storage of hydrogen using existing infrastructure.

Assessment of the topic of energy infrastructure

Our analysis of the NRRP identified 1 reform and 1 investment targeting energy infrastructures, for a total of roughly EUR 87 million allocated to the different measures. The investment is aimed at increasing the flexibility of the electricity system or supporting complex solutions for variable renewable projects that do not cause the need for regulatory power in order to enable a higher share of electricity production from renewables.

In addition, the goal of the reform is to decommission coal by ending the support for lignite combustion in Nováky power plants and transforming the electricity system in the Upper Nitra region. The ultimate goal of the reform is for the share of fossil fuels in the energy mix to fall by more than 5%.

Assessment of the topic of sustainable transport

Our analysis of the NRRP identified 4 investments and 3 reforms targeting sustainable transport, or more broadly low-carbon mobility, for a total of roughly EUR 801.1 million allocated to the different measures.

The aim of the reforms is to take measures that increase the use of public transport and non-motorized transport at the expense of private cars with a direct positive impact on GHG emissions and air quality, as well as efficiency in the use of the transport system.

The proposed investments aim at increasing efficiency and optimizing public passenger transport and intermodal transport by applying the results of science and research in conjunction with intelligent mobility or by introducing new alternative drives for transport. Specifically, the electrification of the sections with the largest volume of traffic or missing end sections aims to reduce diesel consumption in rail transport. Faster development of passenger and freight transport on alternative propulsion will lead to the modernization of the vehicle fleet in order to reduce total emissions from road transport.

Use of financial instruments in Slovakia's NRRP

Part of the funds from the mechanism to support recovery and resilience can be implemented through financial instruments with a repayable nature of assistance under the administration of Slovak Investment Holding. These could be loans, guarantees, equity, quasi-equity or their combination with non-repayable grant support in one operation (if the grant part does not exceed half of the combined amount). The use of financial instruments under the recovery plan is voluntary and is at the discretion of individual executors. The financial instruments have no allocation under the recovery plan, therefore, the implementation procedure, the structure of the financial instrument and the costing itself are not specified. If the financial instruments have a dedicated allocation under the recovery plan, then the part for costing and implementation will be finalized.

Conclusion on Slovakia's NRRP

The comparability between the NRRP and the NECP is somewhat limited by the lack of a systematic correspondence between the measures proposed in the NRRP and the environmental targets of the NECP: overall, the NRRP mentions that all the measures outlined in the plan will contribute to the achievement and the overcoming of the objectives defined by the NECP, however, it is unclear in most cases how and to what extent the NECP's objectives are met or overcome.

Energy efficiency in buildings: Improving the energy efficiency of buildings, residential and non-residential, was already part of the NECP (e.g. changing electricity and heat power generators as well as improving thermal and technological characteristics). Energy savings of 30% proposed in the NRRP are in line with the overall target of improving energy efficiency by 30.3% mentioned in the NECP. A higher ambition of the NRRP compared to the NECP is not evident.

Energy efficiency in industry and other: The overall target in the NECP of GHG emissions reduction by 2030 was 40% for the EU. There are no specific national targets, besides for the non-ETS GHG emissions which is 20% for Slovakia, 10 ppts lower than 30% proposed by the EU. In the NRRP, the expected reduction in GHG emissions by companies and plants targeted by the measures is 30%. Although not directly comparable, it indicates an increase in ambition in the NRRP. The NRRP measures overall also seem more directed at the industry overall while the measures in the NECP

concentrate on smaller enterprises and the public sector. Therefore, the scope of the NRRP measures is believed to have expanded.

Renewable energy production: The NECP target for the share of renewable energy sources in the energy mix is 19.2% by 2030, and the measures includes in the NRRP contribute to reaching this target.

Hydrogen: The NECP vaguely mentions the use of hydrogen and the promotion of its production. The NRRP seems to build on these generic considerations, although only slightly, by mentioning hydrogen specifically in a measure aimed at supporting energy storage projects.

Energy infrastructure: The NRRP of Slovakia includes some additional measures to improve the flexibility of the electricity system for the connection of more renewable energy sources and to reduce the use of fossil fuels in the energy mix, while the NECP focuses on building new sources of electricity generation and improving the interconnection of the electricity grid to 52% by 2030.

Sustainable transport: The NECP proposes a target of 14% share of renewable energy sources in transport by 2030. The measures almost solely concentrate on biofuels; therefore, the category for comparison was expanded to low-carbon mobility more broadly. The measures in the NRRP, however, have specific mentions of electrification, primarily in rail transport. Therefore, the NRRP is believed to have expanded the scope of the NECP to other forms of low-carbon transport.

Slovenia

Total budget of the NRRP	EUR 2.48 billion
Grants	EUR 1.77 billion
Loans	EUR 0.71 billion
% supporting climate objectives	42.45%

Overview - The NRRP of Slovenia contains 12 investments and 7 reforms related to energy projects. In particular for investments, 2 are on Energy efficiency in buildings (renovation), 4 on Energy efficiency in industry and other, 2 on Renewable energy production, 0 on Hydrogen, 1 on Energy infrastructure and 3 on Sustainable Transport. The highest NRRP funding is dedicated to sustainable transport (EUR 311 million). Our findings highlight that a large share of the investment amount is dedicated to the public sector for investments in rail infrastructure and building renovation. The energy transition of households and private entities is advanced by some of the reforms and otherwise left to NECP measures.

In regard to financial instruments, the NRRP does not include specific instruments beyond grants and tax reductions. The RRF funds are meant to complement measures funded by the national budget, the Cohesion Fund, and the Just Transition Fund.

Overview of energy-related targets in Slovenia's National Energy and Climate Plan (NECP)

The NECP of Slovenia seeks to achieve several high-level and specific objectives in line with the five dimensions of energy established by the Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action: decarbonisation, energy efficiency, energy security, internal market and research, innovation and competitiveness. The NECP outlines a series of climate and energy targets and defines 135 existing and planned instruments to achieve these targets. The instruments are grouped in the required dimensions similar to the targets and are summarised in a series of tables without going into detail. Still, a sub-division per sector gives structure to the plan and allows for high-level comparison with the NRRP measures.

Slovenia's national Recovery and Resilience Plan (NRRP)

The 6 pillars of the Slovenian RRP plan are (i) climate strategy and energy transition (EUR 1,05 billion); (ii) digital transformation (EUR 317 million); (iii) smart, sustainable and inclusive growth (EUR 737 million); and (iv) health, and social security (EUR 364 million). Together, these pillars comprise a total of 88 measures, of which 55 investments and 33 reforms. The NRRP rarely specifies quantified targets for energy impacts of measures. Therefore, an assessment and comparison with the NECP targets has to remain highly qualitative. As progress is still needed to achieve the existing energy and climate targets in Slovenia, the RRP will likely help reach current targets, rather than enable higher ones.

Assessment of the topic of energy efficiency in buildings (renovation)

The NRRP contains 3 measures explicitly dedicated to energy efficiency in buildings, 1 reform and 2 investments. Together, the RRF funding of these amounts to EUR 231 million of grants and loans. The entirety of these funds and all three measures are directed at public buildings of different types: 155,000m^2 of public buildings of administrative or social importance as well as publicly owned residential buildings are to be renovated to upgrade their energy efficiency. A larger budget is foreseen for the construction of new educational buildings. The objective is stated at 73,200m^2 of energy-efficient education infrastructure. This is intended to help reach the required renovation rate of public buildings. Privately owned buildings are not eligible to any RRF funding, but have specific instruments in the NECP laid out for which the financing comes from the national budget and the Cohesion Fund for larger apartment buildings.

Assessment of the topic of energy efficiency in industry and other

Our analysis of the NRRP identified 4 investments and 2 reforms targeting energy efficiency in industry and other purposes, for a total of EUR 118 million. The reforms largely transpose and implement EU legislation such as the Energy Efficiency Directive. A small amount (EUR 5 million) of grants are foreseen for the adaptation process in the industry. Another focus area is the use of waste for resource-efficient energy production. EUR 20 million are dedicated to the expansion of waste-to-energy facilities for the co-generation of heat and electricity. Furthermore, a research funding programme is part of the NRRP, which contributes to the national Smart Specialisation Strategy. This has an explicit aim to increase energy efficiency but primarily targets digitalisation topics such as automation and artificial intelligence. In comparison with the NECP targets and measures, an impact on energy efficiency through waste-to-energy expansion can be expected, which represents specific steps rather than a widespread contribution.

Assessment of the topic of renewable energy production

Our analysis of the NRRP identified 2 investments and 2 reforms targeting renewable energy production. A total of EUR 61 million is split between the two investment instruments to increase the share of renewable energy sources in district heating and in electricity generation. For the former, EUR 11 million of grants for the optimisation and expansion of heating networks operated on biomass is mentioned explicitly alongside geothermal energy and solar collectors. A larger investment of EUR 50 million of loans is dedicated to increasing the electricity generation capacity from hydropower, geothermal energy and solar power (on free surfaces of public buildings). A steady increase of renewable energy in final energy consumption is foreseen in the NECP, which the NRRP measures can be expected to advance more rapidly than previously intended.

Assessment of the topic of hydrogen

Our analysis of the NRRP identified no investments in the area of hydrogen. As the NRRP does not contain specific measures for the expansion of hydrogen, no substantial contribution is expected. Instead, financing is expected with EU support through the Cohesion Fund and Just Transition Fund.

Assessment of the topic of energy infrastructure

One measure in the NRRP relates to energy infrastructure, more precisely to the future-proofing of electricity infrastructure to increased demand from e.g. electric vehicles. An amount of EUR 80 million is dedicated to this issue which had been identified as critical in

the NECP. The details remain unclear in the NRRP presentation but if implemented as intended, it will have an enabling and securing effect for the integration of renewables as well as on the decarbonisation of sectors such as transport.

Assessment of the topic of sustainable transport

The NRRP contains 3 investments and 2 reforms targeting sustainable transport explicitly. The investments amount to EUR 312 million and represent the highest energy-related portion of the NRPP. The majority of measures and of funding volume are earmarked for public transport to improve its reliability, integration and accessibility. Specific lines and stations are to be upgraded in addition to the ones foreseen by the NECP. Further measures relate to electric charging infrastructure which is expected to reduce GHG emissions in the long run. A reform is likely to have a larger impact than the investment of EUR 7.75 million in this domain.

Use of financial instruments in Slovenia's NRRP

Slovenia's NRRP does not include financial instruments beyond the grants and loans. For some of the measures, including sustainable building renovation, the RRF funding complements existing or foreseen instruments and budgets from the Cohesion Fund and the Just Transition Fund.

Conclusion on Slovenia's NRRP

The NRRP and the NECP pursue different objectives and mostly do not use the same indicators for the measures. For example, Slovenia's NECP only in very few instances specifies monetary commitments, while the NRRP uses high-level objectives without going into details about the energy implications. This limits the comparison between the two. With an extensive list of measures in the NECP, most NRRP instruments overlap with the previous plan and can be expected to help reach the targets previously defined. However, the additional funds are used for other specific projects, mostly as investments in public institutions.

- **Energy efficiency in buildings**: the NRRP includes several measures to increase the energy efficiency of buildings. However, these all relate to public buildings, ranging from administrative ones to educational ones and also to publicly owned residential housing. Incentives or support for private buildings is not foreseen in the plan. This gap limits the energy efficiency gains and leaves private owners unsupported.
- **Energy efficiency in industry and other**: the reforms in this category primarily implement EU energy efficiency legislation. These are complemented by small but specific investments, mainly in the circular economy (waste to energy). Research funding is also available but shared over a larger pool of eligible topics which also includes digitalisation.
- **Renewable energy production**: two reforms and two investments for renewable sources in district heating and in electricity generation can be expected to increase the share of renewable energy supply in Slovenia faster than intended in the NECP.
- **Hydrogen**: hydrogen is not part of the NRRP and therefore not expected to have an impact on Slovenia's NECP targets.
- **Energy infrastructure**: one specific measure aims at futureproofing the electricity infrastructure for the integration of renewable energy sources and the predicted

increased demand. This addresses a gap identified in the NECP and has the potential to contribute to the long-term energy transition.

Sustainable transport: the majority of measures and of funding volume address public transport to improve its reliability, integration and accessibility. Further measures relate to electric charging infrastructure which is expected to reduce GHG emissions in the long run. These objectives were also defined in the NECP, and several measures have already been in place. However, the NRRP measures target several specific rail infrastructure projects. The added impact in this category can be expected to be high. For road transport, only a minor impact is expected.

Spain

Total budget of the NRRP	EUR 69.5 billion
Grants	EUR 69.5 billion
Loans	-
% supporting climate objectives	40%

Overview - The NRRP of Spain contains 19 reforms and 20 investments related to energy projects. In particular for investments, six are on Energy efficiency in buildings (renovation), zero on Energy efficiency in industry and other, two on Renewable energy production, one on Hydrogen, five on Energy infrastructure and seven on Sustainable transport. The highest NRRP funding is dedicated to Sustainable transport (EUR 13.2 billion)], follow by the renovation of public and private buildings (EUR 7.8 billion).

Overview of energy-related targets in Spain's National Energy and Climate Plan (NECP)

The NECP of Spain covers five dimensions: 1) decarbonisation; 2) energy efficiency; 3) energy security; 4) internal energy market; 5) research, innovation, and competitiveness. Across these dimensions, Spain has set itself various targets. For one, the country aims to increase the share of renewable energies to account for 42% of final energy demand and 74% of production in the electricity system by 2030. Furthermore, the NECP outline a target of 23% reduction in greenhouse gases by 2030 compared to 1990 levels. The ETS sectors contribute with a reduction of approximately 60% while the non-ETS sectors as a whole will have to contribute a reduction of approximately 39%. The NECP also aims at a primary energy consumption target by 2030 which corresponds to a reduction of 98.2 Mtoe compared to baseline projections (39.2%). These targets will be achieved through the promotion of electric vehicles and energy efficiency measures across housing and industries. Energy security will be achieved via the development of renewable energies sources. To improves Spain's internal energy market, the NECP foresees reforms and investments to increase electricity connectivity with France and Portugal. Finally, research and innovation should lead to the integration of new technologies (e.g. promoting the use of hydrogen) and more energy efficiency.

Spain's national Recovery and Resilience Plan (NRRP)

The 10 pillars of the Spanish RRP plan are (i) urban and rural agenda (EUR 1.4 billion); (ii) infrastructures and resilient ecosystems (EUR10.4 billion); (iii) just and inclusive energy transition (EUR 6.4 billion); (iv) an administration for the XXI century (EUR 4.2 billion); (v) modernisation and digitisation of the industrial and SME fabric, recovery of tourism and boosting an entrepreneurial Spain (EUR 16.1 billion); (vi) science and Innovation Pact. Strengthening the capacities of the National Health System (EUR 5 billion); (vii) education and knowledge, lifelong learning and capacity building (EUR 7.3 billion); (viii) new care economy and employment policies (EUR 4.9 billion); (ix) boosting the culture and sports industry (EUR 825 million); (x) modernising the tax system for inclusive and sustainable growth (EUR 0). These 10 pillars are further subdivided into 30 components which comprise a total of 102 reforms and 112 investments.

The majority of measures relevant to energy projects fall under the urban and rural agenda, infrastructures and resilient ecosystems, and just and inclusive energy transition, in particular the components on mobility, housing renovation, renewable energies and hydrogen. Beyond these, the administration for the XXI century pillar includes measures for the renovation and energy efficiency of public buildings. The green investments in the area of energy projects amounts to EUR 27.2 billion in RRF funding, which corresponds to 39% of total RRF funding.

The Spanish NRRP stated that the green target described in the NECP to be reached by 2025 will be moved to 2023 thanks to the investments provided for by the NRRP funds.

Assessment of the topic of energy efficiency in buildings (renovation)

Our analysis of the NRRP identified 6 investments and 1 reform targeting energy efficiency in buildings, for a total of roughly EUR 7.8 billion allocated to the different measures. In particular, it is estimated that in the field of housing, the impact of the measures to promote renovation will allow an average reduction in non-renewable primary energy consumption of over 40%, thus advancing towards the target of reducing final energy consumption by 26,394 GWh (excluding non-energy uses) in 2030, and ensuring a reduction of 6,319 thousand tonnes of CO2 by the same year 2030, all according to the basis of the Long-Term Strategy for a Modern, Competitive and Competitive Spanish Economy. Overall, these measures aim at substantially increasing the pace of renovation: which has experienced notable growth between 2017 and 2019, with growth in the number of buildings renovated of around 10% and in budget of around 35%, but is still significantly lower than in neighbouring countries, and insufficient to meet the objectives set out in the NECP.

Assessment of the topic of renewable energy production

Our analysis of the NRRP identified 2 investments and 4 reforms targeting renewable energy production, for a total of roughly EUR 3.2 billion allocated to the different measures. With the implementation of the reforms and investments contained in the NRRP, the first steps will be taken to reach the targets set in the NECP for 2030, stimulating high investment in the short term to compensate for the slowdown in the economy resulting from the COVID-19 crisis and laying the regulatory and technological foundations for continued deployment during the rest of the decade. The decarbonisation contained in the NECP for this decade is, in turn, essential to achieve a near 100% share of renewable energies in final energy consumption by mid-century.

Assessment of the topic of hydrogen

Our analysis of the NRRP identified 1 investment and 1 reforms targeting hydrogen, for a total of roughly EUR 1.6 billion allocated to the different measures. The proposed measures run along the following lines:1) boosting the innovation and knowledge value chain (e.g. supporting SMEs and technology centres to enable them to improve their productive capacities and technology transfer); 2) creation of a renewable hydrogen cluster for sectoral integration that spatially concentrates large-scale production, transformation and consumption, displacing fossil materials; 3) Development of pioneering Singular projects that allow the introduction of renewable hydrogen, among others, in other industrial poles different from the one included in the cluster and in isolated energy systems, as well as the integration of renewable hydrogen supply in transport, electricity generation and thermal uses; 4) support actions to integrate the national value chain into the EU value chain,

through support lines for the participation of national companies in European projects and consortia, including a contribution for participation in the IPCEI hydrogen project.

Assessment of the topic of energy infrastructure

Our analysis of the NRRP identified 4 investments and 6 reforms targeting energy infrastructures, for a total of roughly EUR 1.4 billion allocated to the different measures. The proposed measures aim to favor the deployment of energy storage necessary for the development of large-scale storage, boosting behind-the-meter and sectorally integrated storage, public initiative for the creation of a green cluster for the technological and industrial development of storage in Spain, digitalize distribution networks, and support new business models in the energy transition. Among the goals is that at least 5 innovative projects related to the deployment of storage, or with an aggregate capacity of at least 600 MW, or the equivalent in delivered energy (MWh), are operational before the end of 2023 and at least 5 innovative projects related to the deployment of storage, or with an aggregate capacity of at least 600 MW, or the equivalent in delivered energy (MWh), are operational before the end of 2026.

Assessment of the topic of sustainable transport

Our analysis of the NRRP identified 7 investments and 4 reforms targeting sustainable transport, for a total of roughly EUR 13.2 billion allocated to the different measures. The proposed measures aim on one hand to build enabling infrastructures in order to promote the development of sustainable mobility and accelerate the transition from the traditional model of fuel-based refueling stations to refueling points for electric vehicles. On the other hand, the measures target the gradual replacement of buses and public transport vehicles with new, less polluting vehicles, in particular electric vehicles, together with a more efficient use of intermodal mobility, notably railroad. These investments take the form of support for the purchase of plug-in electric vehicles to reach a fleet of at least 250,000 in 2023 - as a milestone to achieve 5 million electric vehicles by 2030, between 80,000 and 110,000 recharging points deployed both in car parks and on road corridors to ensure full availability and an important pulling effect on the national value chain (up to 90% of the charging infrastructure is domestically manufactured).

Use of financial instruments in Spain’s NRRP

Spain’s NRRP does not provide information on financial instruments dedicated to green investments. On the contrary, the NRRP makes clear that subsidies and aid programmes will be put forward, e.g. for the installation of recharging stations or the acquisition of electric vehicles. On housing renovation and urban regeneration, the NRPP estimates that 40% of the total investment (EUR 4.5 billion) would come from private financing, complementary to the financing offered by the RRF in the forms of subsidies. On sustainable mobility, the Plan notes that public funding would act a driving force for the unlocking of additional EUR 1.2 billion in private funding.

Conclusion on Spain’s NRRP

The comparability between the NRRP and the NECP is somewhat limited by the lack of a systematic correspondence between the measures proposed in the NRRP and the environmental targets of the NECP: overall, the NRRP explicitly mentions that all the measures outlined in the plan will contribute to the achievement and the overcoming of the

objectives defined by the NECP in force, however it is unclear in most cases how and to what extent the NECP's objectives are met or overcome.

- **Energy efficiency in buildings**: the RRP estimates that in the field of housing, the impact of the measures to promote renovation will allow an average reduction in non-renewable primary energy consumption of over 40%, in 2030. The NECP forecasts a cumulative final energy saving by the residential sector at 6,732 ktoe over the period 201-2030 (which equals 18% of total energy savings).

- **Energy efficiency in industry and other**: the RRP reports the NECP targets that the GHG emissions should be cut by 23% by 2030. Therefore, the RRP objective of strategic decarbonisation is centred around transport and mobility, building efficiency and renovation, and efficient storage of energy.

- **Renewable energy production**: the RRP notes that the target set by the NECP (42% penetration of renewable in final energy use by 2030) is ambitious and above the 32% target set for the whole EU in the Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources. The NRRP maintains that the proposed measures will facilitate achieving such target.

- **Hydrogen**: the NECP vaguely hints at the importance of feeding hydrogen into the energy mix, but does not propose measures directly targeting hydrogen production, apart from a measure on the production on renewable gases. The RRP builds on that general considerations and allocate roughly EUR 1.5 billion to the development of hydrogen capabilities in the Country. However, the RRP also includes reforms on the Hydrogen roadmap, which sets targets for 2030 such as 4 GW of electrolysers installed in Spain, minimum contribution of renewable hydrogen of 25% of the total hydrogen consumed in Spain in 2030, and the introduction of hydrogen powered buses, trains, and around 5000-7000 light and heavy duty vehicles.

- **Energy infrastructure**: the RRP seems to follow closely the measures proposed in the NECP, notably on storage capacity and for the integration of renewable energy into the energy The RRP measures designed to support the islands, promoting local production, self-consumption and storage also correspond to those included in the NECP.

- **Sustainable transport**: the RRP specifies that the planned investments are in line with the provisions of the NECP. Strong attention is put to the promotion of electric vehicles, which should reach 5 million by 2030, the development of recharging stations across the country, and measure aimed and increase the efficiency of public transportation across rural communities and long distance travel, so to reduce further the use of private vehicles. Based on the available description of the measures for sustainable transport, the RRP does not seem to set higher targets than the one of the NECP. Besides the overlaps between the RRP and the NECP, the RRP and NECP also specify that the planned investments are consistent with the Spanish Sustainable Mobility Strategy (EEMS).

Sweden

Total budget of the NRRP	EUR 3.28 billion (SEK 33.3 billion)
Grants	EUR 3.28 billion (SEK 33.3 billion)
Loans	EUR 0 (SEK 0)
% supporting climate objectives	44%

Overview - The NRRP of Sweden contains 3 reforms and 6 investments related to energy projects. In particular for investments, 2 are on Energy efficiency in buildings (renovation), 2 on Energy efficiency in industry and other, 0 on Renewable energy production, 0 on Hydrogen, 0 on Energy infrastructure and 1 on Sustainable mobility. The highest NRRP funding is dedicated to Energy efficiency in industry and other (EUR 1.17 billion). Our findings highlight that important shares of the national RRF funding target the demand side for energy efficiency in buildings, industry and other, while renewable energy production, hydrogen and energy infrastructure are not part of the focus.

In regard to financial instruments, the NRRP includes no financial related to energy investments.

Overview of energy-related targets in Sweden's National Energy and Climate Plan (NECP)

The NECP of Sweden seeks to achieve several high-level and specific objectives in line with the five dimensions of energy established by the Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action: decarbonisation, energy efficiency, energy security, internal market and research, innovation and competitiveness. The NECP outlines a series of climate and energy targets and defines instruments to pursue these targets. The instruments are grouped in the required dimensions and include taxation, funding programmes, as well as regulatory and soft measures. Measures are divided by sectors complemented by cross-sectoral initiatives. Industry and transport have the highest number of dedicated measures for reduction of fossil energy consumption and GHG emissions.

Sweden's National Recovery and Resilience Plan (NRRP)

The five pillars of the Swedish NRRP plan are (i) green recovery (EUR 1.5 billion); (ii) education and adjustment (EUR 0.5 billion); (iii) Better conditions for meeting the demographic challenge and ensuring the integrity of the financial system (EUR 0.4 billion); (iv) expansion of broadband, digitalisation of public administration and research (EUR 0.5 billion), and (v) investments for growth and housing construction (EUR 0.3 billion) comprising in total 26 measures, of which 14 reforms and 12 investments.

Assessment of the topic of energy efficiency in buildings (renovation)

The NRRP contains 2 measures explicitly dedicated to energy efficiency in buildings. Together, these amount to EUR 355 million of grants for multi-family houses and rental or student housing more explicitly. The objectives of these measures are the construction of new, energy-efficient homes (22,000 homes) and the renovation of existing apartment buildings (600,000 m2). According to the Swedish Long-Term Renovation Strategy, several

incentives for energy efficiency in single-family houses and owner-occupied homes are already in place. Therefore, the focus of the NRRP measures is placed on multi-family buildings. Further energy or climate-related targets are not quantified, but a contribution to the overall NECP target of 50% increase in energy efficiency in 2030 compared to 2005 is expected.

Assessment of the topic of energy efficiency in industry and other

Our analysis of the NRRP identified 2 investments and 1 reform targeting energy efficiency in industry and other purposes, for a total of roughly EUR 1.17 billion allocated to the different measures. The proposed investments expand two existing national initiatives *Industriklivet (Industrial evolution)* and *Klimatklivet (Local and regional climate investments)* with substantial additional funding between 2021 and 2025. Both measures aim at reducing market barriers to low-carbon technologies on the demand side. This may relate to energy-efficient production but also enabling the use of renewable energy sources in industrial processes. In particular, *Klimatklivet* has however a broader eligibility which includes renewable energy production and low-carbon mobility projects.

Assessment of the topic of renewable energy production

Our analysis of the NRRP identified no dedicated investments or reforms targeting renewable energy production. In the NECP description of *Klimatklivet*, biogas installations are explicitly mentioned as part of the targeted areas. However, the focus of the measure as described in the NRRP clearly lies on the demand side. The supply side contribution to Sweden's target of 100% renewable electricity generation in 2040 and an indicative objective of 65% RES in gross final energy consumption in 2030 is difficult to assess but expected to be low.

Assessment of the topic of hydrogen

Our analysis of the NRRP identified no dedicated investments or reforms in the area of hydrogen. The NECP description of *Industriklivet* describes the national HYBRIT project to be funded through this programme. However, the RRP does not specify if grants are intended for this project. Therefore, a contribution to the advancement of hydrogen cannot be assessed.

Assessment of the topic of energy infrastructure

No measures of Sweden's NRRP target energy infrastructures. Therefore, no change compared to the previous policies and plans is expected.

Assessment of the topic of sustainable transport

The NRRP contains 3 reforms and 1 investment targeting sustainable transport explicitly. However, these measures are more accurately described as targeting low-carbon mobility, because the reforms relate to the emissions footprint of means of transport, not specifically EVs. The investment measure foresees improving the rail network with grants of EUR 147 million. This is expected to enable the upgrade of 100km of tracks and 160 railroad connection facilities, as well as construct a new bridge. Low-carbon transport and mobility projects are also eligible for the *Klimatklivet* programme. Therefore, an unquantified additional amount of investments could be made available for electromobility (e.g. EV charging infrastructure.

Use of financial instruments in Sweden's NRRP

Sweden's NRRP does not provide detailed information on the financial instruments dedicated to green investments. All investments are intended to be direct grants that either expand the budget of existing instruments in the NECP or re-instate instruments which had previously been discontinued due to budget restraints.

Conclusion on Sweden's NRRP

The NRRP and the NECP pursue different objectives and mostly do not use the same indicators for measures. This limits the comparison between the two. However, many of the NRRP measures can also be found in the NECP and were part of the policy landscape for energy and climate before the COVID-19 pandemic. These have either been extended in time or in funding volume. It remains unclear in most cases if a quantifiable contribution or increase to the NECP targets is envisaged.

Energy efficiency in buildings: the RRF funding allows to continue the previous programme for energy-efficient apartments with EUR 295 million over the period between 2021 and 2025. Sweden's LTRS envisages high renovation rates because the buildings from the Million Programme (1961-1975) are assumed to be renovated over the next 10-year period. This represents a large share of existing buildings. Therefore, a qualitative assessment indicates that a substantial contribution to energy efficiency and decarbonisation of the building stock can be expected.

Energy efficiency in industry and other: the 2 investment measures were already included in the NECP to enable wide-scale investments in decarbonisation in the industry and beyond. With the RRF funding, the total volume for the next years is expanded substantially. In the Swedish context, the measures for energy efficiency in the industry are particularly relevant for the reduction of energy demand, in particular of fossil fuel intensive processes, but also electricity-intensive sectors such as server parks. All this points to a substantial contribution to the NECP targets.

Renewable energy production: the NRRP measures focus on the demand side but may include renewable energy production through the *Klimatklivet* programme. However, this represents uncertainty or only indirect effects.

Hydrogen: Hydrogen is not part of the focus of the NRRP. Therefore, substantial contributions are not expected.

Energy infrastructure: No measures relate to energy infrastructure.

- **Sustainable transport**: several reforms aim at reducing the carbon intensity of transport, but all of them were already foreseen in the NECP. The dedicated investment aims to increase the attractiveness of public rail transport through better infrastructure. In this respect, the measures could incentivise the necessary behavioural change described in the national fossil-free transport strategy. However, a possible increase in electric road mobility is not assessable as dedicated funding information is lacking.

Annex C – Detailed assessment of the energy measures in the RRPs and the NECPs

A separate Excel file presenting the assessment of the energy related measures across the 27 NRRPs and their comparison with the measure within the NECPs. The file has been submitted separately labelleded ‘Combined RRP and NECP Assessment EU27’.

This annex can be obtained on request to ENER-A4-RECOVERY-FI-TEAM@ec.europa.eu

Annex D – Detailed assessment of the identified financial instruments

A separate Excel file presenting the detailled assessment of the identified financial instruments related to energy projects across the 27 NRRPs. The file has been submitted separately labelleded ‘Combined FI Assessment EU27’.

This annex can be obtained on request to ENER-A4-RECOVERY-FI-TEAM@ec.europa.eu

MJ-04-23-152-EN-N

Publications Office
of the European Union

ISBN 978-92-68-00226-1