Support to REPowerEU

Final synthesis report

Technical Support Instrument

Supporting reforms in 27 Member States

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1 Introduction

This report constitutes the final synthesis report for the Technical Service Instrument (TSI) project 'REFORM/SC2022/052 – Support to REPowerEU', which provided technical support to 15 Member States[1] to help identify suitable reforms and investments to phase out their dependency on Russian fossil fuels. Through the course of the project, progress was reported through weekly progress calls between the contractor and the European Commission, biweekly progress reports and frequent bilateral calls between the contractor's country teams and the beneficiary authorities. This report concludes the progress reporting of the project. This final synthesis report consists of the following elements:

- A review of the project background
- Non-technical summary of project activities and results, including:
    - Discussion of EU-level analyses
    - Identification of reforms and investments
    - Review of in-depth and hands-on support
- Conclusions, and discussion of the project's expected impact and results

The analysis and recommendations provided through this support provide an input to the Member States' decision makers. However, they do not in any way bind either the Member States to include such measures in their REPowerEU-related initiatives, nor do they bind the European Commission to positively assess, accept or otherwise advantage such measures when they are put forward by the Member States for EU funding under relevant programmes. This report also does not represent policy preferences or recommendations by the European Commission and should be understood as only the views of the contractor.

[1] Belgium, Croatia, Cyprus, Czechia, Estonia, Finland, Greece, Hungary, Ireland, Italy, Poland, Portugal, Slovenia, Slovakia, Spain

2 Background

In May 2022, the European Commission presented the REPowerEU Plan, its response to the global energy market disruption caused by Russia's invasion of Ukraine. The REPowerEU plan sets out a series of measures to rapidly reduce the EU's dependence on Russian fossil fuels and accelerate the energy transition, while increasing the resilience of the EU-wide energy system. It is based on three pillars: diversifying gas supplies; accelerating renewable energy deployment; and increasing energy efficiency measures.

In the context of the REPowerEU plan, the European Commission provided support under the Technical Support Instrument (TSI) to 17 Member States to help identify the most suitable reforms and investments to phase out their dependency on Russian fossil fuels. The technical support focused on areas such as such as diversifying energy supplies, accelerating the transition to renewable energy, and increasing energy efficiency.

DG REFORM contracted a consortium led by Trinomics to provide technical support to 15 of those Member States. The work carried out under this technical support project provided relevant analyses and elements to Member States under the REPowerEU objectives.

The work was implemented between June 2022 and February 2023 by a team of local consultants and international experts. Trinomics was responsible for overall project management and coordination and provided a pool of topic experts that assisted the teams with their work. Within each participating Member State, a local team was responsible for delivering the work and coordinating with the beneficiary authority. E3M provided modelling support to the country teams.

The work can be divided in three main elements: an analysis of energy-related dependencies, the identification and selection of reforms and investments and in-depth and hands-on support. The work delivered for each of those elements is summarised in the next sections. First, we review the expected results and impact of this work.

As regards infrastructure projects, the analysis within this technical support project was limited to the assessment of objective conditions. This technical support project could not provide an assessment of new infrastructure projects as it did not include the necessary standard for assessment, for example the regional level of assessment and discussions with Member States. The European Commission can take into account the findings of this technical support project but is not bound in any respect by them.

As regards natural gas and oil projects, the European Commission is the only entity with the power to conduct the assessment of gas infrastructure projects proposed in the context of the implementation of the REPowerEU Plan. The European Commission has included the projects indicated in Annex III of the REPowerEU Plan Communication[2] in its investment needs assessment for the REPowerEU Plan. These projects have been subject to ENTSO-G analysis and assessment, following specific criteria. This assessment has been confirmed by Member States following regional high- level discussions chaired by the European Commission. Other projects could only be taken into account if they undergo a comparable assessment and comply with similar substantive criteria.

[2] COM(2022) 230 final - https://eur-lex.europa.eu/resource.html?uri=cellar:fc930f14-d7ae-11ec-a95f-01aa75ed71a1.0001.02/DOC_2&format=PDF

3 Analysis of energy-related dependencies

3.1 Energy context and dependence analysis

For each of the 15 participating Member States, an analysis of energy-related dependencies was delivered. This focused on a mapping of the energy-related dependencies specific to the Member State, reviewing the energy demand and supply (by fuel), paying particular attention to the renewable energy supply including renewable gases. Further, it looked at specific dependencies for natural gas, oil and petroleum products, and solid fuels. The aim of this analysis was to provide a common understanding on where the most significant import dependencies exist and how the country's energy system is progressing in terms of reducing energy consumption, scaling up renewables and diversifying supply sources.

3.2 Raw material and supply chain dependencies analysis

For the EU as a whole, an analysis of key dependencies of various clean energy technologies was developed. The analysis identified where the EU has critical dependencies on external sources of supply for energy technologies whose use may grow in response to declining fossil fuel use. The ultimate aim was to evaluate whether or not such dependencies should affect the actions taken under REPowerEU, and to form some recommendations with regard to REPowerEU's main objectives.

The analysis focused on the entire supply chain (i.e. from raw materials to decommissioning) for selected energy technologies, including solar photo-voltaic panels, wind turbines, and batteries, with some discussion of electrification and electricity grid infrastructure.

The conclusions of this analysis could be summarized as follows:

- **The EU is highly dependent on non-EU sources for clean energy technologies.** This dependency is especially strong for output of countries with some political distance from the EU, especially China. The primary dependencies are within all three supply chains of solar panels (multiple stages in manufacturing), wind turbines (primarily permanent magnets and their constituent rare earth elements), and in batteries (in multiple raw materials, and in production of battery anodes and cathodes).
- **Reducing these dependencies is realistic on a mid-term horizon.** Bringing new mining and refining endeavours to capacity can take 10-15 years, while scaling up EU manufacturing for later steps of the supply chains is faster (2-5 years), but would require governmental support and can mainly become relevant for later timelines.
- **Although supply disruptions to these clean energy technologies are possible, they should not distract from further reduction in EU fossil fuel use**. The impact of fossil fuel supply disruptions is immediate and difficult to mitigate, while disruptions in clean energy supply chains take far longer to materialize as energy shortages. In addition, fossil fuel supply disruptions have proven to be rather commonly-used as geopolitical leverage, whereas disruptions in clean energy technologies have yet to materialize.
- **Installing additional capacity of clean energy technologies remains exceptionally important**, **especially for future recycling and reuse**. Newly installed stock can be used as recycling feedstock in the future and can significantly lessen the EU's foreign dependency for materials in the coming decades.

It should be noted that this analysis was conducted prior to the recent announcements from the European Commission on the EU Green Deal Industrial Plan[3], the proposed Net Zero Industry Act[4] and Critical Raw Materials Act[5]. Together, these measures bring industrial policy at the top of the EU policy agenda, with the overarching aim of enhancing domestic manufacturing capacity for strategic net zero technologies required to meet the EU's climate and energy targets.[6]

4 Identification of reforms and investments

Each of the 15 participating Member States were supported by identifying and selecting additional reforms and investments that could be undertaken to decrease the dependence on Russian fossil fuels. This work was delivered through the following three steps:

1. A **gap analysis** to identify areas where additional actions may be taken to decrease the dependency on Russian fossil fuels. The gap analysis focused on providing an overview of investment and reforms that were already part of the existing national plans, including the Recovery and Resilience Plans (RRP) and the National Energy and Climate Plans (NECP) and other relevant plans. This was followed by a review of the priorities expressed by the Member State during the inception phase, as well as other priorities that could be considered, which were identified through stakeholder consultation, literature review and data analysis. This analysis covered the relevant areas within the REPowerEU agenda, including saving energy, accelerating renewable energy deployment, diversification of energy sources and reducing fossil fuel consumption in industry. The output of this gap analysis was a longlist of potential reforms and investments that could be considered by the beneficiary Member State.
2. A **high-level qualitative impact analysis**, aiming to estimate the significance of the identified potential reforms and investments in terms of reducing the dependency on Russian fossil fuels as well as the expected timeline for the impacts to materialise. Based on this analysis a shortlist was made of the most promising potential reforms and investments that could be considered by the beneficiary Member State.
3. A more elaborate **description of the shortlisted reforms and investments**, including a quantified impact analysis where possible. In this step, the most promising reforms and investments were elaborated in more detail.

Figure 4-1 below presents an overview of the three-step process previously described, for the identification and selection of additional reforms and investments. Through this work a total of 562 potential additional reforms and investments (R&I) were identified. 199 R&I were included in the final shortlist, an average of 13 measures per Member State.

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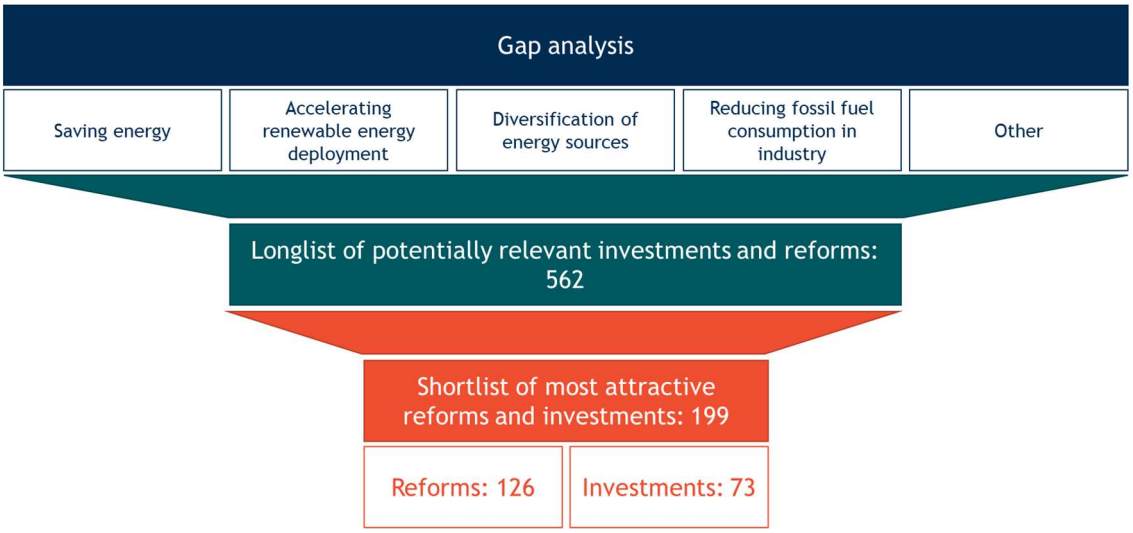
[3] COM(2023) 62 final - A Green Deal Industrial Plan for the Net-Zero Age.

[4] COM(2023) 161 - Proposal for a regulation of the European Parliament and of the Council on establishing a framework of measures for strengthening Europe's net-zero technology products manufacturing ecosystem (Net Zero Industry Act). Published on 16 March 2023.

[5] COM(2023) 160 - Proposal for a regulation of the European Parliament and of the Council establishing a framework for ensuring a secure and sustainable supply of critical raw materials and COM(2023) 165 final- A secure and sustainable supply of critical raw materials in support of the twin transition

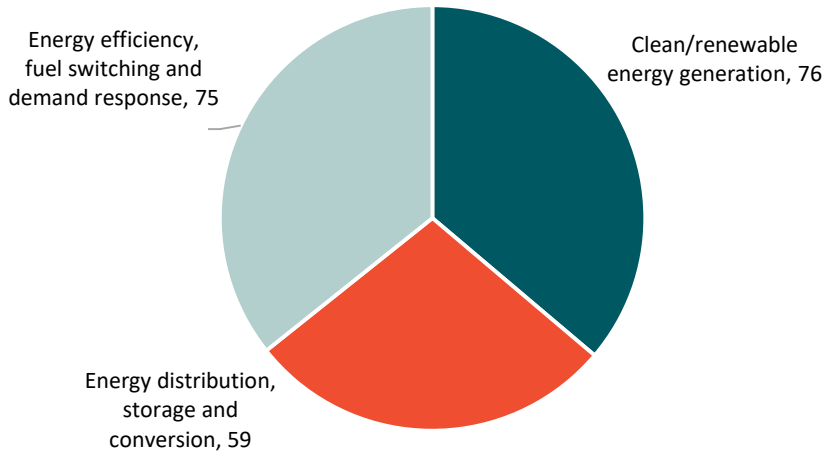
[6] The proposed Net-Zero Industry Act sets an overall headline benchmark aimed at ensuring that by 2030, the manufacturing capacity in the Union of the strategic net-zero technologies approaches or reaches at least 40% of the Union's annual deployment needs. The overall headline benchmark takes into account the need for scaling up manufacturing capacity not only for end-products but also for specific components.

Figure 4-1 Overview of the process followed in this study for the identification and selection of additional reforms and investments.



Of the 199 R&I shortlisted, there was a rather equal breakdown between three categories in the energy value chain: 1) clean/renewable energy generation, 2) energy distribution, storage, and conversion, and 3) energy efficiency, fuel switching, and demand response (Figure 4-2).

Figure 4-2: Total reforms and investments per value chain category.[7]



Within clean/renewable energy generation, most of the R&I focused on renewable power (53), many of which are about streamlining permitting for grid connections and site selection processes. The remainder of the focus was divided among bioenergy (biogas, biomethane, and biofuels), and renewable heat (including heat pumps).

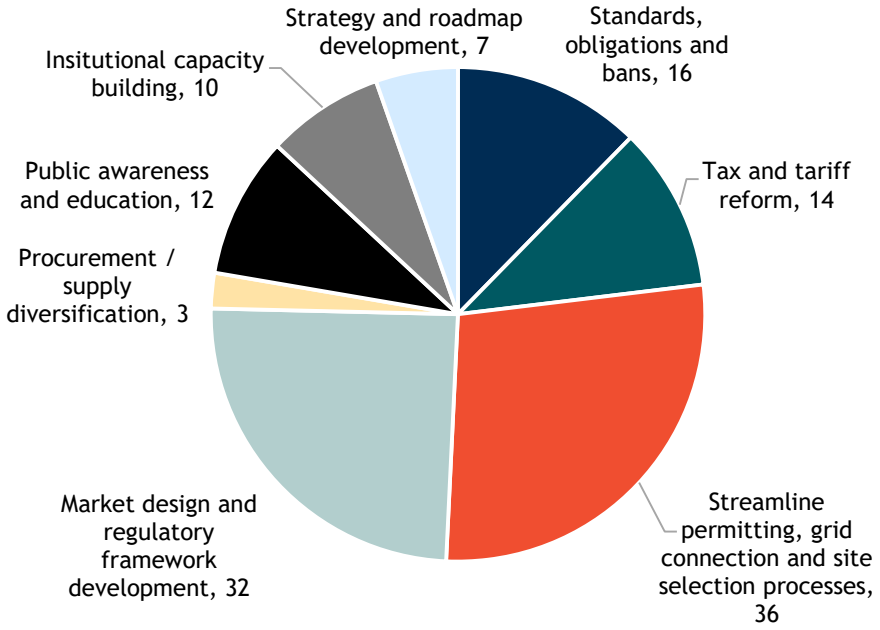
Energy distribution and storage R&I were more diverse, with much focus on the electricity grid and storage (22). Hydrogen production also received many R&I (20), while charging and refueling infrastructure (9), and LNG/gas infrastructure (8) were also recurring topics.

[7] Note that numbers do not add up to total number of reforms and investments because measures can be assigned to multiple categories.

For energy efficiency, fuel switching, and demand response, R&I were mainly focused on the residential and services sectors (51), which mainly included building renovation, switching from fossil to renewable heating systems, and demand response measures. Fewer R&I were dedicated to the industry (18) sector, which were mainly targeted at energy efficiency, electrification (and other fuel switching) measures, and demand response. Transport sector had 17 R&I, with the primary focus on electrification (i.e. the uptake of electric vehicles), modal shift, and stricter speed limits and environmental requirements.

For reforms in particular, there was a varied focus among the Member States (Figure 4-3). Most reforms were about either market design and regulatory frameworks (32), or about streamlining processes, such as project permitting and site selection (36). A few were focused on tax and tariff reforms, reforming standards, obligations, and bans, and on public awareness and education. Very few reforms focused on diversification of supply, mainly of gas (3).

Figure 4-3: Reforms categorized by topic.[8]

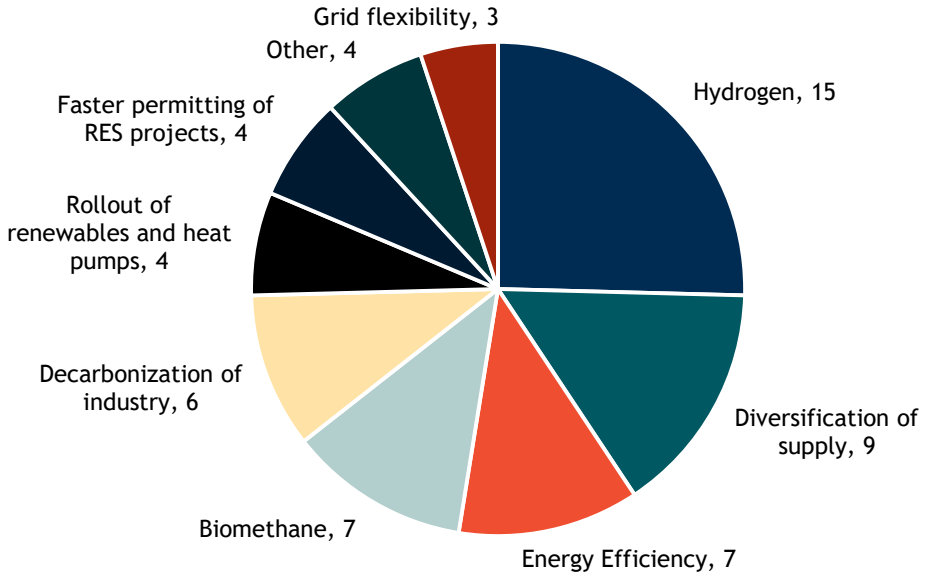


5 In-depth and hands-on support

The participating Member States could request in-depth and/or hands-on support to assist them with the development of initiatives that could reduce (Russian) fossil fuel consumption. This work ranged from very elaborate studies to very brief and practical support. Overall, 59 concrete deliverables were produced through this part of the project, in addition to the practical support.

[8] Note that a few reforms were categorized as related to multiple topics.

Figure 5-1: Topics of in-depth support for Member States.



The most requested in-depth support area was hydrogen (Figure 5-1). All 15 Member States requested support ranging from development of the national hydrogen strategy, to information on initiatives to promote renewable and low-carbon hydrogen production outside EU. An example in-depth support can be found in Box 1 below. Many hydrogen projects also focused on topics within industrial decarbonisation, for example on various topics surrounding the switch to renewable hydrogen alternatives within industry.

Box 1: Sample in-depth support: supporting renewable hydrogen consultation in Ireland

GDG supported the Irish authorities with the consultation process for the development of a hydrogen strategy for Ireland. GDG was tasked with reviewing over 120 consultation responses received across 8 themes containing a total of 49 questions. A 30-page summary report of this qualitative analysis will be published in the public domain in Q2 2023. This report provided both a summation of stakeholder views in respect to a multitude of areas relevant to the development of a hydrogen strategy in Ireland, as well as further insights and GDGs overarching view, considering these viewpoints as well as taking due consideration of any existing research and literature which could share further insights.

This report will form an important part of the evidence base for the Irish authorities in their development of a national hydrogen strategy which is planned for delivery later this year in Q2 2023.

Other popular topics for in-depth support included supply diversification (mainly for LNG and gas pipeline infrastructure, for 6 Member States), biomethane (for 6), and energy efficiency (for 5). A sample of in-depth support for the biomethane topic follows in Box 2.

Box 2: Sample in-depth support: Biomethane production via gasification of biomass in Slovenia

Slovenia has a large stock of biomass within its forests and woods. To diversify its gas supply, the beneficiary authority of this Member State requested in-depth support on how to use woody biomass as a resource for sustainable biogas production. The specific technology used in this context was biomass gasification.

The support team first collected data on the current state of biomass feedstock in Slovenia and relevant technologies for gasification. A considerable untapped stock of sustainable woody biomass was found to exist, especially in the East. Following this, a techno-economic analysis surveyed locations in Slovenia for optimal placement of gasification units.

Industrial areas could use modular units, optimally near existing sawmills, and use residues to produce biogas. Optimally, these units would produce not just electricity, but also heat. This heat can be used in the industrial park and also injected into the district heating system.

Another option explored here was the use of micro biogas plants for the slurry from farms. Slovenia has smaller farm plots, so consistent input for large biogas production is a challenge. However, micro biogas plants can be fed by the waste of 5-6 farms, creating biogas while allowing for an eco-friendly processing of waste slurry. The smaller output of these plants is less valuable for injecting into the gas grid and are better used locally.

Regulatory adjustments and financial instruments to further enhance the growth of biomass gasification in Slovenia were also discussed. Following state-of-the-art analysis on regulatory frameworks in Slovenia and other countries with high biomass stock, the support team conducted workshops with stakeholders to define proposals for these regulatory changes and financial incentives.

A few Member States also requested in-depth support on the roll-out of renewables and heat pumps (4 Member States), faster permitting for renewables (4), and grid flexibility topics (3). For example, Czechia's beneficiary requested in-depth support on using heat pumps to replace coal and gas in district heating (see Box 3).

Box 3: Sample in-depth support: heat pumps in district heating for Czechia

Czechia has a long history with district heating systems (also referred to as central heating systems, CHS), which are primarily dependent on fossil fuels. About 50% of CHS use coal for heating, and over 20% use natural gas. There is an opportunity to drastically reduce energy dependency and greenhouse gas emissions by switching to non-fossil heat sources. One of the possible options for a heat source for CHS are medium-temperature heat pumps.

In this in-depth support, the potential of heat pumps to (partially) supply heat for CHS was analysed. Overall, 5 cases were studied, including small cities and medium cities with industrial clusters. These case studies were used to calibrate a model.

The results showed that heat pumps can theoretically replace 21.6 to 43.2 PJ (6 to 12 TWh) of natural gas combusted in a CHS. If other fossil fuels are also taken into account (not only natural gas), these values of potential are even higher. However, heat pumps are capital-intensive investments and thus face much inertia to their expansion. A more realistic expectation is to get 3 PJ (830 GWh) of new heat from heat pumps by 2030. To push this new heat pump capacity, investment support will be addressed under the Modernisation Fund and other reform proposals.

Heat pumps can drastically increase electricity consumption. Here there is the opportunity for synergies with expansion of renewable energy sources. There is little synergy with solar power, as solar tends to produce most during months of low heating need (i.e. summer). A better synergy exists with wind power, which produces more energy during the colder months when heat demand is higher.

Finally, another notable example is a request from Italy's beneficiary for improving the permitting processes for offshore wind installations (see **Error! Not a valid bookmark self-reference.**).

Box 4: Sample in-depth support: Offshore wind permitting in Italy

The goal of this in-depth support was to accelerate permitting procedures for offshore wind farms in Italy. First the team performed a literature analysis of the existing regulations and projects. Second, the team performed a comparative analysis of permitting procedures and offshore wind projects in similar countries, in this case Greece and France. Lastly, the team consulted with both institutional and private stakeholders (Transmission System Operator, National energy regulatory authority, port authorities and private project developers).

The key findings of this support include:

- There are no significant differences in maritime spatial planning between Member States.
- Currently, port areas in Italy are unsuitable for the activities related to the construction and maintenance of wind farms.
- AC/DC floating substations are still in a commercially immature technology phase. It is also still not clear which type of current flow (AC vs DC) would be optimal for offshore installations.
- Some phases of the permitting procedure (e.g. national environmental assessments, receivability of environmental assessment requests, pre-screening phase, etc.) could be automated through the creation of ad hoc software
- A platform or a dedicated area of the beneficiary's website could be set up: in that section the project developers shall be registered / qualified on the basis of minimum requirements
- Local communities should be encouraged to participate in meetings aimed at explaining projects and their costs and benefits for these communities
- Cross-sectoral institutional coordination between the various relevant authorities should be enhanced in order to solve problems and conflicts, and show coherent and harmonised approach in the licensing procedures.

6 Conclusions

The aim of this project has been to provide support to 15 EU Member States related to decreasing dependence on Russian fossil fuel by 2030. The support was intended to help identify suitable reforms and investments at the national level.

The contractor considers that the identified reforms and investments could lead in the medium to long-term to the reduction of Russian fossil fuel dependence in the beneficiary Member States. Achieving this objective, however, is indeed dependent on various assumptions, but most importantly on how and to what extent the project's recommendations are implemented by the Member States, and how well subsequent regulation and follow-up is conducted by relevant entities.

Reforms and investments identified for each Member State present differing challenges for implementation. While some present rather straightforward and easy fixes, others can be difficult and demand more complex approaches.

In addition to changes at the Member State level, reforms and investments from this project are envisioned to also contribute to reducing overall EU dependence on fossil fuels and hence furthering the achievement of the objectives of the European Green Deal. Recommendations for reforms focus on national competences rather than on EU-level regulatory frameworks. The recommendations do however consider on-going developments at the EU level, such as recent approaches to electricity market reform. Nonetheless, adoption and implementation of the recommendations remains the exclusive responsibility of the beneficiary Member States.

There is also some expected impact from the in-depth support provided for each Member State. Similar to the reforms and investments, the scale of these support activities differed greatly from a detailed strategy on national hydrogen development (in Ireland and Cyprus, for example) to suggestions for reducing the number of appeals for (and thus speeding up) renewables permitting requests (in Belgium).

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