



SET Plan Interim Evaluation

Final Report

Independent
Expert
Report

Research and
Innovation

SET Plan Interim Evaluation

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edited by



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Glossary

CCS	Carbon Capture and Storage
CCU	Carbone Capture and Utilisation
CSP	Concentrated Solar Power
DG ENER	Directorate-General for Energy
DG JRC	Directorate-General Joint Research Centre (DG JRC)
DG R&I	Directorate-General for Research and Innovation
DG RTD	Directorate-General for Research and Innovation
EE	Energy Efficiency
EED	Energy Efficiency Directive
EERA	European Energy Research Alliance
ERA Forum	European Research Area Forum
ETIPs	European Technology and Innovation Platforms
EU	European Union
GHG	Greenhouse gases
IEA	International Energy Agency
IEA TCPs	Technology Collaboration Programmes of the International Energy Agency
IWGs	Implementation Working Groups
IPCEI	Important Projects of Common European Interest
KPIs	Key Performance Indicators
MS	Member State
NECPs	National Energy and Climate Plans
PV	Photovoltaics
R&D	Research and Development
R&I	Research and Innovation
RES	Renewable Energy Sources
SET	European Strategic Energy Technology Plan
ToR	Terms of Reference

1. Executive Summary

Introduction and context of the study

The Strategic Energy Technology (SET) Plan launched in 2007 as a first step to establish an energy technology policy for the EU, provides a common vision, goals, and coordination for accelerating the development and deployment of efficient and cost-competitive low-carbon energy technologies. The SET Plan has played a central role in implementing the Research, Innovation & Competitiveness dimension of the Energy Union, and in guiding national research efforts in the National Energy and Climate Plans. However, after 15 years of operation and a last update in 2015, the EU energy agenda has changed considerably. In this context, a revamp of the SET Plan, with a review of its objectives, governance, scope, and activities is required to make the SET Plan fully fit to the Green Deal and the REPowerEU objectives. This evaluation contributes to the ambitions of the European Commission to conduct a revision of the SET Plan by providing an unbiased review of the SET Plan through a structured interim evaluation.

The European Green Deal represents a step change in the EU's approach to protecting and restoring the environment and mitigating climate change. Achieving the increased ambition set out in the Green Deal 'Fit for 55 package' - including reducing GHG emissions by at least 55% by 2030 compared with 1990 levels and climate neutrality by 2050 - will require additional effort from Member States, industry and research institutions. In this context, even though the SET Plan has proved to be a strong tool for creating synergy between R&I national and European programmes and actions in energy, its revision should be considered in order to ensure it is fit for supporting the Green Deal and the European Research Area ambitions. The possible revision of the SET Plan should aim at better supporting the European Green Deal objectives, making the SET Plan fully compatible with the 'Fit for 55' proposals, the 2050 decarbonisation goal and the REPowerEU initiative while ensuring continued support to long-term research on new energy sources.

Methodology

This interim evaluation is based on a mixed qualitative approach involving a non-systematic analytical desk research, stakeholders interviews and responses from a questionnaire distributed to the wider SET Plan ecosystem to address the five evaluation criteria outlined below:

- How coherent has the SET Plan been with other EU interventions?
- How effective has the SET Plan been in achieving its objectives?
- How efficient has the SET Plan been in achieving its objectives?
- What is the EU added value of the SET Plan?

How can objectives and actions implemented under the SET Plan stay as relevant as possible in the foreseeable future?

The interviews were semi-structured to encourage an open dialogue. A total of 46 stakeholders directly involved in the SET Plan ecosystem as a member of the Steering Group (Bureau), Chair or Co-Chair of the IWG, Chairs and Vice-Chairs of ETIP, ERA-NET Coordinator, CSA or EERA representative were interviewed for this evaluation. In addition, two indirect stakeholders (the CEO of a consultancy company and a former JRC member) were also consulted. The Steering Group (Bureau) members interviewed represent 14 SET Plan Countries and the interviewed IWG, ETIP, ERA-NET and CSA members cover 11 of the

14 SET Plan R&I areas in the field of low-carbon energy technologies (representatives from energy systems, batteries and HVDC were not interviewed).

The 68 respondents to the questionnaire are involved in a very wide range of organisations, directly (e.g., ETIPs, the Steering Group, EERA, ERA-NETs and IWGs) or indirectly (i.e., industry associations, universities, national ministries, national organisations, etc.) affiliated to the SET Plan activities.

Overall, through the interviews conducted with members of the SET Plan Steering Group and Steering Group Bureau (national representatives) as well as the answers to the questionnaire provided by representatives of national ministries and national organisations (including some SET Plan Steering Group and Steering Group Bureau members), this evaluation includes insights shared by national representatives originating from 20 SET Plan Countries.

Conclusions

Conclusion 1: Position the SET Plan institutionally as the guiding instrument for EU R&I policy and funding for low-carbon energy technologies, so that it plays a key role in fostering the energy transition and strengthening the EU's strategic energy value chains for the next decade. The SET Plan should be framed as the main vehicle for national governments and the private sector to fund transnational projects in the field of European R&I for low-carbon energy technologies by bridging both energy policy and R&I/technology-objectives. Its reform should primarily aim at giving it an institutional (legally binding) role (e.g., positioning the Steering Group as a formal "high level expert group to the Commission") by at the same time articulating the specific added value of the SET Plan for national governments and R&I funding agencies of the participating countries, as well as the private sector. The revamped SET Plan should be positioned as a mission-driven (top down approach), de-siloed, holistic, technology-oriented instrument that enables R&I in cross-cutting energy transition challenges.

Conclusion 2: Include within the scope of existing IWGs additional emerging low-carbon energy technologies that are currently not addressed (e.g., for the IWG on Deep Geothermal: sub-surface seasonal thermal storage, joint-production of geothermal heat/power and minerals extraction, and greater consideration of various depths for geothermal energy production).

Conclusion 3: Strongly accelerate R&I activities in specific already-in-scope low-carbon energy technologies for which the current level of emphasis is not sufficient (e.g., for the Energy Efficiency in Buildings IWG: heat pumps, heating and cooling systems, thermal energy storage technologies).

Conclusion 4: Create a separate IWG on hydrogen focusing on the development of technologies that will spur the whole hydrogen value chain (e.g., production of renewable and low-carbon hydrogen, production of renewable ammonia and green e-methanol as a fuel, production of e-fuels/synthetic fuels, hydrogen storage and transport, etc.). To ensure no duplication in R&I activities pursued by existing EU initiatives, this additional IWG on hydrogen should focus on 1) the alignment and coordination of national hydrogen R&I strategies and the mobilisation of national R&I funding programs in the SET Plan Countries; 2) on development of hydrogen R&I initiatives for low TRL level research technologies; and 3) on the development of hydrogen R&I initiatives in countries that do not currently have a strong foothold in hydrogen technologies.

Conclusion 5: Create a new IWG focusing on critical raw materials and minerals that are essential components of low-carbon energy technologies. The focus should be put on the development of technologies enabling the substitution, extraction, refining, reuse and recycling of critical raw materials and minerals. Decreasing EU dependency on foreign

nations for the extraction, processing, shipment and recycling of these strategic materials and minerals is seen as one of the key priorities of the European Union and a prerequisite for a successful energy transition¹.

Conclusion 6: Integrate a dedicated workstream R&I activity on non-technological and cross-cutting areas in each IWG, so that the work conducted matches the practical aspects encountered by each sector. The topics which should receive special attention in the screening process include: Creating societal awareness; Improving circularity, sustainability and efficiency, including energy efficiency and efficiency of manufacturing processes; Cost reduction, market integration and user empowerment; Addressing the shortage of skills and education; Assessing and minimising the implications low-carbon energy technologies and infrastructures roll-out on biodiversity, ecosystems and human health; Enabling greater and more efficient energy system integration; Include a wider portfolio of research, including in the field of social sciences. Furthermore, the SET Plan framework could establish an overarching multi-disciplinary Centre of Excellence on Energy Transition Pathways, composed of members of the IWGs and ETIPs, as well as new members with expertise in the energy transition field from a social science and humanities perspective. This Centre of Excellence on Energy Transition Pathways would prioritise the following R&I activities: Identification and development of robust energy transition pathways as alternative strategies to dominant assumptions and policy directions; Understanding of strategic R&I energy planning requirements; Assessment of socio-economic risks and vulnerabilities.

Conclusion 7: At the moment, the SET Plan geographical coverage should not be extended, and priority should instead be given to ensuring proper functioning and coordination of the current arrangement. The focus should be put on further developing and maintaining technological advantage in key low-carbon energy technologies at the EU level, in order to position the SET Plan as a vehicle that promotes European competitiveness, leadership and strategic independence in the field of low-carbon innovation. However, the SET Plan could allow on a case-by-case basis greater participation from countries outside of the SET Plan in the following ways: collaborations and partnerships rather than formal memberships, collaboration could be pursued between the SET Plan and the Mission Innovation program, external countries wishing to participate in SET Plan activities could be associated with the SET Plan structure as 'observers'.

Conclusion 8: Strengthen the role and responsibilities of the Bureau and the Steering Group in new Terms of Reference. The Bureau should be formally positioned as a co-decision body in the governance of the SET Plan and should co-define with the Commission the strategic orientations of the SET Plan, and further communicate the agreed strategy to the Steering Group and the IWGs. The weight of the Steering Group in the framework of the SET Plan should be strengthened. The Commission should facilitate the organisation of (mainly) physical plenary Steering Group and Steering Group Bureau meetings every 4 to 6 months.

Conclusion 9: Clarify the role of the IWGs in new Terms of Reference. Composed of both national representatives from the SET Plan Countries as well as representatives from industry and academia, the IWG's main role should remain the definition a common vision for the development of R&I activities for each low-carbon energy technology relevant to the energy transition in Europe and to facilitate the development of R&I initiatives that contribute to achieving the techno-economic goals defined in the Implementation Plan. IWGs should implement actions to influence national governments on the value of providing funding to the CETP and investing in national R&I programs. All IWG should

1 Communication - Critical raw materials resilience: Charting a path towards greater sustainability and security (COM(2020) 474 final)

formalise in their revised Implementation Plans which ambitions in R&I initiative development will require the establishment of formal collaboration with other IWG(s).

Conclusion 10: Merging ETIP with their respective IWGs would allow for significant improvements in SET Plan operation efficiency and would bring the following benefits: greater buy-in and engagement from the industries, submit only one common grant application to Horizon Europe program, use CSAs to support both IWGs and ETIPs work, combine the respective financial resources, exchange information on best practices and initiatives. The former members of the ETIPs within the IWGs would act as the scientific advisor body to the IWG and would have the dual responsibility of ensuring that industries are prepared to invest in the agreed-upon R&I activities and providing very clear recommendations to the Commission on the regulations, policies, and funding needed to achieve the goals of the Implementation Plan.

Conclusion 11: Increase the weight of the (former) ETIPs and EERA in the SET Plan governance, to create a "Scientific Advisory Committee" attached to the Steering Group and composed of (former) representatives of the ETIPs and EERA, and who would act as an advisory body that will bridge the gap between the fields of energy policy and energy technology policy.

Conclusion 12: Provide relevant and harmonised secretariat support to the SET Plan by establishing a central CSA that would horizontally support all IWGs and also by providing funding for a limited number of CSAs that would support the work of specific IWGs.

Conclusion 13: Counterbalance the silo approach to development of R&I initiatives by fostering more cooperation between SET Plan stakeholders through the implementation of the following suggested actions: increase systematic exchange of information between the SET Plan governance and high-level representatives of SET Plan Countries, organise bi-annual plenary sessions during which the chairs and co-chairs of each IWGs would report to the Steering Group on the progress of the annual measurable objectives against the Implementation Plan, organise more frequent plenary meetings, organise annual specific forums/workshops between the IWGs.

Conclusion 14: Establish a compendium describing the name, title, contact information, and key responsibilities of all individuals who are composing the SET Plan-related entities.

Conclusion 15: Establish a strong connection between Horizon Europe Cluster 5, the Clean Energy Transition Partnership, Driving Urban Transition Partnership and the SET Plan (IWGs) and make clear the complementary role of these three entities in supporting energy R&I at the EU level: systematically link their calls for projects to the work of the SET Plan, appoint the same national representatives to the Horizon Europe Cluster 5 Committee, the Clean Energy Transition Partnership and the SET Plan Steering Group.

Conclusion 16: The ambitious low-carbon energy technologies roll-out targets communicated in the REPowerEU plan should translate in the frontloading of some of the existing R&I targets in the upcoming revised Implementation Plan of many IWGs. In this context, consideration should be given to increase the urgency of investment in the following low-carbon energy technologies: sustainable biogas and biomethane production, biomethane use in the building sector, renewable hydrogen value chain, hydrogen use in industries, renewable heating and cooling (storage) solutions.

Conclusion 17: Strengthen the link between the Steering Group and the ERA and define a joint programming framework with communication channels to align on priorities and targets. To do so, the following actions should be implemented: requirement for the national representatives members of the Steering Group to exchange with their ERA counterpart and to report on the outcome of their exchange to the SET Plan Bureau; participation of ERA action 11 representatives in the Steering Group meetings as

“observers”; to explain how SET Plan R&I activities are complementing or pursuing the work achieved under the ERA framework; to use the ERA framework as a channel for wider dissemination of the activities and accomplishments of the SET Plan.

Conclusion 18: The SET Plan must become the key tool to improve the updating and monitoring of the Research, Innovation and Competitiveness chapters of the Member States' NECPs in future revisions. This could be achieved by establishing a predefined prescriptive NECP structure, not only by chapters as it is today, but in more details about what exactly will be implemented and by which means: Systematically link the R&I objectives in low-carbon energy technology formulated in the NECPs with the IWG targets with clear explanation on how national R&I targets will contribute to IWG targets; Report on the comprehensive set of national R&I programmes and initiatives in place, with their associated investment allocations and time horizon, their stage of progress, and with an explanation on the link (or not) to the SET Plan objectives and targets, based on a set of basic key performance indicators applicable to each EU country; Highlight in the NECPs new R&I areas in the field of low-carbon energy technologies. In addition, directly connecting the Steering Group members with the ministries and persons responsible for drafting the NECPs in their respective countries.

Conclusion 19: Ensure that national representatives have the right profile to be nominated to the SET Plan. To do so, the nomination of national representatives should be based on a set of binding minimum criteria, formalised in Terms of Reference. These Terms of Reference should provide minimum binding requirements on the past positions, level of experience and qualifications that national representatives in the Steering Group and the IWGs need to demonstrate, as well as the specific expectations regarding the role and responsibilities of the IWG stakeholders and Steering Group members. In addition, a setting to further explore would be to make mandatory for SET Plan Countries to appoint two national representatives to the Steering Group; one representing the R&I ministry and one representing the (energy) policy ministry.

Conclusion 20: Articulate the specific added value of the SET Plan for the national governments and R&I funding agencies of the participating countries.

Conclusion 21: Make the country representative more accountable by organising regular meetings.

Conclusion 22: Organise an onboarding for new members of the Steering Group and IWGs to ensure new members have a complete understanding of the overall functioning of the SET Plan, as well as of the various provisions stated in the Terms of Reference that delineate the scope of their responsibilities.

Conclusion 23: In collaboration with national R&I agencies, the Commission should seek to standardise the rules applied by national and European R&I instruments that 1) determine whether a project is eligible to receive national and European funding (exclusion criteria) and 2) decide on the allocation of funds (selection criteria).

Conclusion 24: In collaboration with national R&I funding agencies, the Commission should seek to establish an open repository database mapping all available national and EU funding for low-carbon energy technologies in Europe. The establishment and continuous update of this open repository database could be supervised by the central CSA. Additionally, a “heat map” visually describing the geographical divergence in development and focus on R&I projects per technology for each country could be developed.

Conclusion 25: Increase the efficiency of the reporting process through the definition of the following three complementary layers of Key Performance Indicators (KPIs) for all IWGs: 1) General cross-IWG KPIs, easy to track and defined by the Commission and IWG

chars and co-chairs; 2) Specific and technical KPIs, identified by each IWG, on the outcomes of R&I projects (or R&I activities) directly linked to the activities of each IWGs; 3) Development of "success stories", highlighting the key achievements of the IWGs. The central CSA should provide the IWGs with dedicated human resources which would be in charge of collecting the relevant data to be provided to the SET Plan Information System. In addition, all SET Plan Countries should be required to use a set of common indicators to national R&I funding in low-carbon energy technologies.

Conclusion 26: Share more regularly the main results of the work of the Steering Group and the IWGs with all SET Plan stakeholders and better integrate the SET Plan reporting within a broader Commission update on the progresses made in the EU Green Deal framework.

Conclusion 27: Establish effective communication channels for the IWGs towards the Commission on policy priorities by adopting a proactive approach in engaging with the DGs and specific policy departments within the Commission in order to discuss and influence low-carbon energy technology development needs that need to be pushed to the front of the EU R&I policy agenda.

Conclusion 28: Raise the political visibility of the SET Plan and its activities at the EU, national and private sector levels.

2. Introduction

2.1 Purpose of the document

The Strategic Energy Technology (SET) Plan was launched in 2007 as a first step to establish an energy technology policy for the EU². It provides a common vision, goals, and coordination for accelerating the development and deployment of efficient and cost-competitive low-carbon energy technologies³. Under the SET Plan, 14 Implementation Working Groups (IWGs), gathering experts from governments, industry, and research institutes in the EU and Associated Countries, have developed research and innovation roadmaps for key energy technologies⁴. The SET Plan has played a central role in implementing the Research, Innovation & Competitiveness dimension of the Energy Union, and in guiding national research efforts in the National Energy and Climate Plans. It has helped federate national efforts into industrial alliances and Important Projects of Common European Interest (IPCEIs). Recently, it has also enabled its participating countries to pool more than EUR 500 million to jointly support clean energy transition projects⁵.

However, after 15 years of operation and a last update in 2015, the EU energy agenda has changed considerably. In this context, a revamp of the SET Plan, with a review its the objectives, governance, scope, and activities is required to make the SET Plan fully fit to the Green Deal and the REPowerEU objectives. A Communication on the revision of the SET Plan is being jointly prepared by DG ENER, DG R&I, and DG JRC for adoption in the last quarter of 2022.

This evaluation contributes to the ambitions of European Commission to conduct a revision of the SET Plan by providing an unbiased review of the SET Plan through a structured interim evaluation. This main objective of this assignment is thus to identify the key strengths and weaknesses of the SET Plan as well as provide input to define the future focus, structure and governance of the SET Plan.

2.2 Structure of the report

This document is structured as follows:

- **Chapter 3** introduces the general context of the SET Plan and the role of research and innovation in the energy transition as a fundamental pillar of the global effort to tackle climate change. It provides a snapshot of main developments in recent decades followed by a descriptive overview of the SET Plan framework and the rationale for revising it to achieve the European Green Deal.
- **Chapter 4** provides a detailed description of the approach and methodology applied for this evaluation. It outlines the main evaluation criteria the study looks at as the basis for the data collection process during the whole project. It provides a snapshot of the sample of SET Plan stakeholders interviewed and the sample of stakeholders that responded the questionnaire, their engagement in the SET Plan, main role(s), organisation(s), etc.

2 Source: [https://ec.europa.eu/transparency/documents-register/api/files/SEC\(2007\)1508_0/de00000000729461?rendition=false](https://ec.europa.eu/transparency/documents-register/api/files/SEC(2007)1508_0/de00000000729461?rendition=false)

3 Source : <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1411399552757&uri=CELEX:52007DC0723>

4 Norway, Iceland, and Turkey

5 Clean Energy Transition co-fund Partnership under Horizon Europe (due for launch in 2022)

- **Chapter 5** outlines main results from data collected during the desk research, the interviews and the questionnaire, and structures insights and findings around the five evaluation criteria of the study: relevance and coherence of the SET Plan, effectiveness of the SET Plan, efficiency of the SET Plan, added value of the SET Plan at the National and EU level, and future proofing of the SET Plan.
- **Chapter 6** elaborates our conclusions on: the revision of SET Plan revision and scope, strengthening the SET Plan governance structure, strengthening synergies with other EU R&I initiatives and SET Plan Countries' R&I efforts, optimisation of the monitoring and reporting process, raising the political visibility of the SET Plan and its activities.

3. Background and context

3.1 The role of research and innovation in the energy transition

The energy transition is a fundamental pillar of the global effort to tackle climate change – particularly given the energy sector has contributed almost three-quarters of the greenhouse gas (GHG) emissions that have already raised global average temperatures 1.1 °C higher than pre-industrial levels⁶. Within the energy sector, aligning to a temperature rise below 1.5 °C will require a complete transformation of the global energy system towards low-carbon sources, new technologies and enhanced energy efficiency actions. For this reason, delivering “cleaner energy and cutting-edge clean technological innovation” is a key aim of the European Green Deal⁷.

In recognition of the importance of research and innovation in delivering clean energy, a second phase of the ‘Mission Innovation’ initiative was launched in the build-up to the summit, with the aim of catalysing action and investment in the research, development and demonstration of key technologies on the pathway to net zero⁸.

Recent decades have seen significant progress in the development of such transformative technologies. For example, technological advancements and cost reductions driven by economies of scale have enabled the EU offshore wind market to grow exponentially, with offshore wind projects accounting for about 10 % of annual capacity additions in global wind energy in 2019, compared with about 1% in 2009⁹. Photovoltaic (PV) energy has also seen significant cost reductions, with market prices of PV modules decreasing by around 90% and system prices by around 80% in the 2010s¹⁰. However, the International Energy Agency (IEA)’s Net Zero roadmap forecasts that almost half of the emissions reductions needed to achieve global net zero by 2050 rely on technologies that are currently in the demonstration or prototype stages. These technologies will be particularly crucial to curbing emissions from energy-intensive industries and long-distance transport¹¹.

Two major geo-political events have created challenges and opportunities for the energy transition: the Covid-19 pandemic and Russian aggression against Ukraine.

Whilst global shutdowns in the economy during the Covid pandemic led to a sharp decrease in energy consumption and associated GHG emissions in 2020, the renewable energy market was also impacted, with disruptions experienced in the supply of renewable energy equipment and technology¹². The sharp emissions decrease also appears to have been short-lived, with 2021 seeing a bounce-back of EU’s economic activity. A continued focus on bringing new technologies to the market will be key to tackling this trend and ensuring the delivery of the EU coal phase-out as the continent emerges from the pandemic.

Energy prices have seen a sharp increase in the second quarter of 2022, driven by increased global demand. The invasion of Ukraine by Russia has further exacerbated the situation and increased market instability, driving up volatility and prices even higher. In its Communication on “REPowerEU - Joint European Action for more affordable, secure and sustainable energy”, adopted on 8 March 2022, the Commission set out a list of measures aimed at tackling price rises whilst accelerating the green transition. The SET Plan will have

6 Source: <https://www.iea.org/reports/world-energy-outlook-2021/executive-summary>

7 Source: https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

8 Source: <http://mission-innovation.net/about-mi/overview/>

9 Source: [https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/659313/EPRS_BRI\(2020\)659313_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/659313/EPRS_BRI(2020)659313_EN.pdf)

10 Source: [pv-the-cheapest-electricity-source-almost-everyw-2.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/659313/EPRS_BRI(2020)659313_EN.pdf)

11 Source: Net Zero by 2050 – Analysis - IEA

12 Source: [https://www.europarl.europa.eu/RegData/etudes/ATAG/2020/649372/EPRS_ATA\(2020\)649372_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/ATAG/2020/649372/EPRS_ATA(2020)649372_EN.pdf)

a core role to play to ensuring these objectives are achieved, including bringing Europe's dependency on imported fossil fuels from Russia to an end.

3.2 Overview of the SET Plan

The EU's Strategic Energy Technology (SET) Plan was presented in 2007 (COM(2007) 723 final) as the technology pillar of the EU's energy and climate policies. Developed alongside the pioneering EU energy policy "an Energy Policy for Europe", which set EU-wide climate and energy targets to be achieved by Member States, the SET Plan aimed intended to strengthen and give coherence to the overall European effort, with the objective of accelerating innovation in cutting edge European low-carbon technologies¹³. It proposed a three-pillar implementation structure: a Steering Group, European Industrial Initiatives (EIIIs) and the European Energy Research Alliance (EERA), all supported by an information system (SETIS).

The SET Plan 2007 impact assessment¹⁴ set out the problem statement that the strategic plan was aiming to address. Firstly, projections in 2007 showed that achieving the energy and climate 2020 targets would require a step change in the market take-up of clean energy technologies, including for improving efficiency in the conversion and final uses of energy. Projections also showed that technological breakthroughs would be needed to bring new technologies to market to achieve longer term goals. This could only be achieved by ensuring the right market incentives to drive innovation, investing in new technologies and to decreasing the EU's reliance on fossil fuels. The lack of a strategic plan to develop clean energy technology also had energy security and price implications, as the EU's reliance on imported gas and oil was projected to increase. This projection risked subjecting EU citizens to increased price volatility without generating many additional EU jobs. A number of key market barriers and failures were established in the impact assessment. These included under-investment in energy research; structural weaknesses in the energy innovation process leading to decades-long lead times to mass market take-up; the inability of Member States to compete with major global players on their own; and the lack of good, available data and information on R&D.

Taking these barriers into account, the SET Plan aimed to coordinate national research and innovation activities of Member States and associated countries in line with an overarching strategy¹⁵. Specifically, it set out to deliver the following governance and implementation outcomes¹⁶:

- **Joint strategic planning:** establishing a cooperation framework including the 'European Steering Group on Strategic Energy Technologies' and 'European Energy Technology Information System' to enable key players to work with each other and the Commission when conceiving and implementing actions.
- **More effective implementation of strategic plans:** establishing 'European industrial initiatives' to focus implementation efforts (inc. 'European Wind initiative' and 'Solar Europe Initiative'); creating a 'European Energy Research Alliance' (EERA); and helping to assess impacts of the transition on energy systems and networks.
- **An increase in resources:** increasing funding and human resources dedicated to energy research and innovation by setting out a strategic communication on the

13 Source : <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1411399552757&uri=CELEX:52007DC0723>

14 Source: [https://ec.europa.eu/transparency/documents-register/api/files/SEC\(2007\)1508_0/de00000000729461?rendition=false](https://ec.europa.eu/transparency/documents-register/api/files/SEC(2007)1508_0/de00000000729461?rendition=false)

15 Source: https://setis.ec.europa.eu/index_e

16 Source: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52007DC0723&from=EN>

potential avenues to leverage additional investment; encouraging Member States to boost investment; and enhancing training programmes.

- **A new and reinforced approach to international cooperation:** using the cooperative structures established by the SET Plan to cooperate with developed and developing third countries, with the specific aim of increasingly talking with one EU voice in international fora.

In 2013, the Communication on Energy Technologies and Innovation (COM(2013)253 final) announced the reinforcement of the structure of the SET Plan in the context of the Horizon 2020 framework¹⁷. It concluded that the SET Plan needed to revise its focus and should see stronger commitment and joint investments from SET Plan Countries (Member States and Associated Countries). The Communication also called for stronger commitment from industrial partners through the establishment of Public-Private Partnerships, while research under the EERA should be more integrated.

In response to these recommendations, the SET Plan was updated (C(2015)6317 final), further situating the SET Plan in the context of the new 'Energy Union' (linking it to the fifth pillar on 'research, innovation and competitiveness') and setting out 10 key actions¹⁸. The 10 actions are supported by the European Technology and Innovation Platforms (formerly the European Industrial Initiatives), in which industry, research organisations and academia work together on the implementation of the SET Plan priorities along the innovation chain and develop the Strategic Research and Innovation Agendas. In 2017, 14 SET Plan Implementation Plans were established – with associated Implementation Working Groups (IWGs) - to take forward the 10 key actions and accelerate the energy system transformation. However, in 2020 there was a merge of the actions of the IWG on energy consumers with the IWG on energy systems, reducing the working groups to 13. In 2021, a 14th IWG on High Voltage Direct Current (HVDC) was established. Various Coordination and Support Actions (CSAs), funded under Horizon 2020, supported the IWGs in communication, dissemination and mutual learning activities¹⁹. Finally, from 2019, a system of annual SET Plan progress reports was implemented. This described SET Plan structure is still the current configuration (see Figure 1).

17 Source: https://ec.europa.eu/energy/sites/ener/files/swf_2013_0157_en.pdf

18 Source: https://setis.ec.europa.eu/system/files/2021-03/communication_SET_Plan_15_sept_2015.pdf

19 Source : https://setis.ec.europa.eu/implementing-actions_lv

The European Strategic Energy Technology Plan

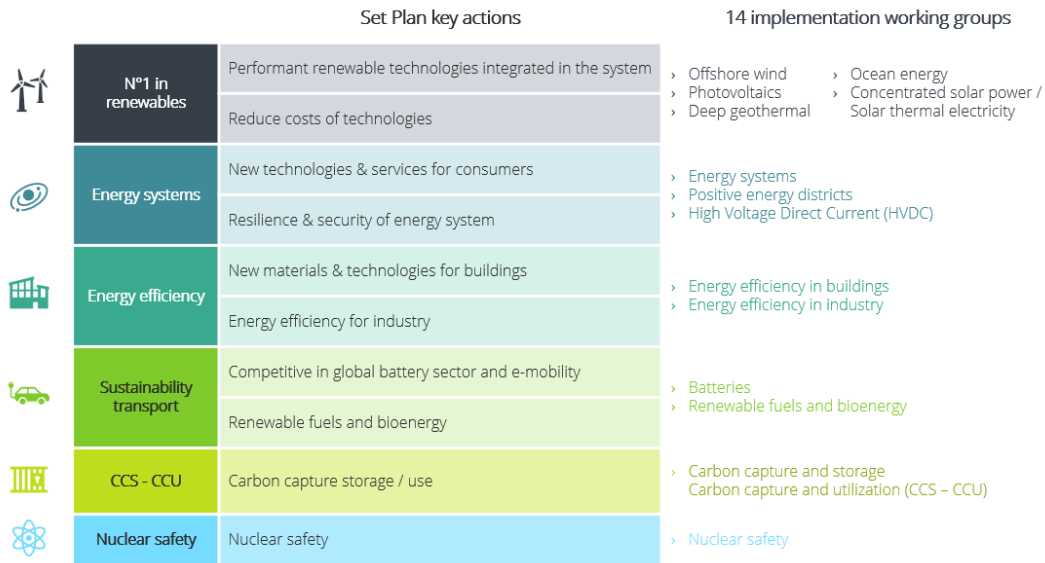


Figure 1: Overview of the SET Plan configuration²⁰

The SET Plan structure illustrated in Figure 2 provides a detailed illustration of the current landscape that the SET Plan is operating within.

The Steering Group is the decision-making body of the SET Plan, and it governs the implementation of it. It is composed of high-level representatives of the SET Plan Countries. With a mandate from the Council, its remit is to help implement a European Energy Technology Policy, aimed at an accelerated development and wide-scale application of clean, sustainable and efficient energy technologies²¹. The SET Plan Steering Group has endorsed the 14 Implementation Plans in 2018, based on their quality and the feasibility of the activities described. It aligns with the Commission on a regular basis. The Bureau supports the work of the Steering Group by preparing internal meetings and discussions.

20 Source https://setis.ec.europa.eu/implementing-actions_en#:~:text=The%20SET%20Plan%20is%20made,as%20Iceland%2C%20Norway%20and%20Turkey.

21 Source: SET Plan Agenda 2018-2023

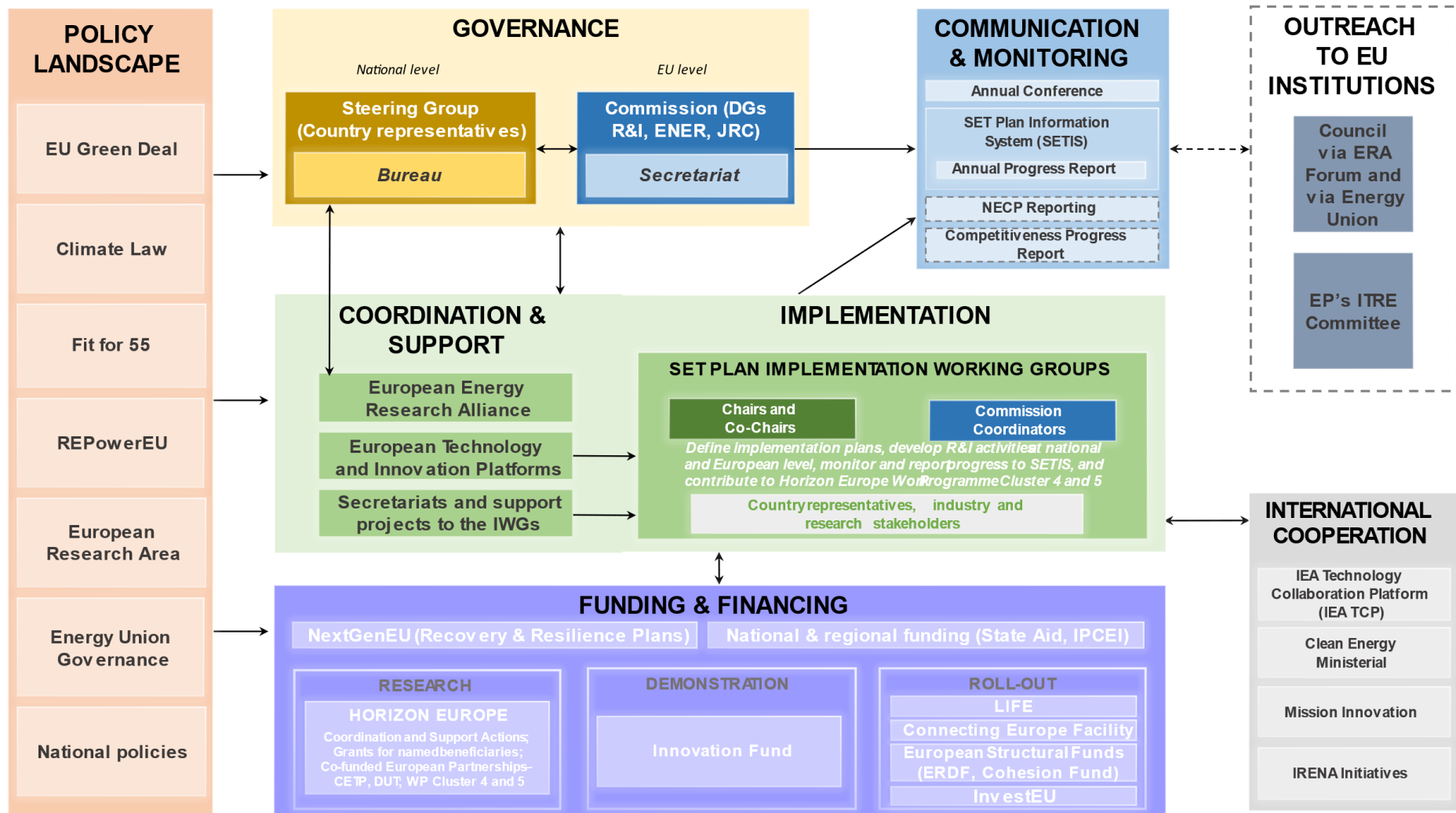


Figure 2: Current SET Plan structure

The **Implementation Working Groups (IWGs)** are chaired by one or more SET Plan Countries and co-chaired by the industry, and include representatives of other relevant stakeholders such as ETIPs and EERA²². The Implementation working groups have the task to advance the respective Implementation Plans, reaching collectively the agreed technology targets²³. The implementation working groups execute the activities identified in the respective Implementation Plans, which define the R&D activities that are needed for the achievement of the corresponding targets considered critical to meet the SET Plan 10 Key Actions²⁴. AGENDA 23 calls for “each IWG to develop a working methodology based on indicators to monitor the progress of actions under the Implementation Plans and feeding the relevant information to the Strategic Energy Technologies Information System (SETIS)”²⁵. The 14 working groups monitor and report progress to SETIS on the SET Plan targets and R&I activities carried out at national and European levels. The activities and targets, published in the working groups’ Implementation Plans, are identified in cooperation with national governments and stakeholders (industry and research bodies). The Implementation Plans represent the reference document of the SET Plan in each field and ensure that it is aligned with the key industrial developments²⁶.

Besides the Steering Group and the Implementation Working Groups, nine **European Technology and Innovation Platforms (ETIPs)** were established as the industrial pillar of the SET Plan – the outcome of merging eight pre-existing European Technological Platforms with the six European Industrial Initiatives (EII). ETIPs are industry led fora covering through their members the whole innovation chain (including research). Seven ETIPs are technology oriented (wind, PV, ocean, bioenergy, deep geothermal, zero emissions and sustainable nuclear energy) and two favour technological or system integration: renewable heating and cooling, and smart networks for energy transition²⁷.

European Energy Research Alliance (EERA) acts as the research pillar of the SET Plan. It was created to align the activities of individual research organisations with the needs of the SET Plan priorities, and to establish a joint programming framework at the EU level. EERA brings together 175 public research organisations from 27 countries.

The **Clean Energy Transition Partnership (CETP)** is a transformative research, development and innovation programme across Europe boosting and accelerating a just energy transition in all its dimensions for Europe to become the first climate-neutral continent.

Driving Urban Transitions to a Sustainable Future (DUT) is a European partnership of more than 60 partners from 27 countries, involving national and regional policy makers, funders and urban-related policy agencies to invest in urban R&I and strengthen a European innovation eco-system for urban transitions.

The SET Plan also cooperates with global forums and initiatives such as:

- **IEA Technology Collaboration Programme (TCP)**, which supports the work of independent, international groups of experts that enable governments and industries from around the world to lead programmes and projects on a wide range of energy technologies and related issues.

22 Source: The SET Plan. At the heart of Energy Research & Innovation in Europe 2007-2017 - 10th anniversary

23 Source: SET Plan Agenda 2018-2023

24 Source: SET Plan Agenda 2018-2023

25 Source: SET Plan Agenda 2018-2023

26 Source: https://setis.ec.europa.eu/implementing-actions_fr

27 Source: The SET Plan. At the heart of Energy Research & Innovation in Europe 2007-2017 - 10th anniversary

- **Clean Energy Ministerial**, a high-level global forum to promote policies and programs that advance clean energy technology, to share lessons learned and best practices, and to encourage the transition to a global clean energy economy
- **Mission Innovation**, a global initiative catalysing a decade of action and investment in research, development and demonstration to make clean energy affordable, attractive and accessible for all. This will accelerate progress towards the Paris Agreement goals and pathways to net zero.
- **International Renewable Energy Agency (IRENA)**, which, with its 168 Members, plays a leading role in the energy transformation as a centre of excellence for knowledge and innovation, a global voice for renewables, a network hub and a source of advice and support for countries.

3.3 Revising the SET Plan to deliver the European Green Deal

The European Green Deal represents a step change in the EU's approach to protecting and restoring the environment and mitigating climate change. Achieving the increased ambition set out in the Green Deal 'Fit for 55 package' - including reducing GHG emissions by at least 55% by 2030 compared with 1990 levels and climate neutrality by 2050 - will require additional effort from Member States, industry and research institutions. It will be important to align these efforts with national contexts, as well as EU strategies on Hydrogen, Offshore Renewable Energy, Energy System Integration, Renovation Wave, and the New Industrial Strategy.

In this context, even though the SET Plan has proved to be a strong tool for creating synergy between R&I national and European programmes and actions in energy, it's revision should be considered in order to ensure it is fit for supporting the Green Deal and the European Research Area ambitions. Indeed, as Green Deal legislation is implemented and more funding becomes available, including the new ERA process and other mechanisms set out in Figure 2, it will be increasingly important to ensure the SET Plan priorities and governance structure facilitate efficient information sharing and collaboration between these structures and entities. This will ensure that national and EU strategies are harmonised and governments, industry and research institutions can maximise funding potential. Bringing new technologies to the market will also require an ambitious push on market diffusion investments to minimise lead in times to mass market take up.

In other words, the possible revision of the SET Plan should aim at better supporting the European Green Deal objectives, making the SET Plan fully compatible with the 'Fit for 55' proposals, the 2050 decarbonisation goal and the REPowerEU initiative, while ensuring continued support to long-term research on new energy sources. It shall also contribute to the European Research Area (ERA) Policy Agenda and reinforce synergies between countries' R&I efforts, while increasing the participating countries' engagement and raising the political visibility of their SET Plan activities.

4. Methodology

This interim evaluation is based on a mixed qualitative approach involving a non-systematic analytical desk research, stakeholders interviews and responses from a questionnaire distributed to the wider SET Plan ecosystem to address the five evaluation criteria outlined below. The use of both qualitative and quantitative methods allows this evaluation to gather relevant data from the existing literature to draw out an initial high-level analysis, and then to unlock knowledge collectively shared by the relevant stakeholders.

4.1 Evaluation Criteria

Following the Better Regulation Guidelines, the study uses an intervention logic and an evaluation matrix to conceptualise the key elements of the policy intervention, design the data collection, help to establish judgements and recommendations in response to the evaluation questions, and finally provide grounds for the conclusions. The scope of this evaluation looks at the following five criteria:

- How **coherent** has the SET Plan been with other EU interventions?
- How **effective** has the SET Plan been in achieving its objectives?
- How **efficient** has the SET Plan been in achieving its objectives?
- What is the **EU added value** of the SET Plan?
- How can objectives and actions implemented under the SET Plan stay as **relevant** as possible in the **foreseeable future**?

The delivery of the evaluation is based on a pre-defined **evaluation matrix** (Appendix 1). The Evaluation Matrix is the logical link between the study objectives and the actual analysis, as it operationalises the research questions to be considered in the assignment by connecting it with judgement criteria and indicators. The Evaluation Matrix furthermore links these, in a systematic and structured way, with the appropriate data sources and hence it drives our data collection process during the whole project – ensuring that all data necessary is collected and allowing us to produce conclusions and recommendations that are evidence-based. The Evaluation Matrix is structured around the five evaluation criteria presented above, further broken down to judgment criteria and evaluation indicators/topics. The coding of individual evaluation indicators/topics finally clearly link these to specific sections in the interview guide and questionnaire.

4.2 Methodological tools

Desk research

In order to prepare the interviews and questionnaire, desk research has been performed as a first step. Desk research is the activity of collecting evidence from existing sources. It is essential in providing general information on the state of play of the area considered, providing an overall overview of all the theoretical and empirical evidence available and deepening the understanding of the specific context of the assignment. The desk research focused on available literature and serve the purpose of identifying relevant legislation, contextual elements, issues, as well as existing studies and reports. The desk research also identified relevant high-level qualitative assessments and/or opinions on the functioning of the SET Plan. The list of documentation consulting as part of the desk research phase of this evaluation is available in Appendix 2. Based on consolidated findings from the desk research, some key insights have been drawn as per evaluation matrix. These key findings

and conclusions have also enabled the fine-tuning of the interview guide and the questionnaire.

Interviews

The primary purpose of conducting **targeted interviews with the key SET Plan stakeholders** is to support, supplement, or reject the preliminary findings from the initial desk research with a richer set of qualitative data to enhance the quality and validity of the research findings, as well as better reflect multiple perspectives. Stakeholder interviews are particularly fit in the context of an evaluation as they can help elicit the tacit knowledge that lies within particular stakeholder groups and generate insights that go beyond what we can learn through desk research or a close-ended questionnaire. In turn, this can help unpack the different policy mechanisms that influence decision making amongst the relevant stakeholders, provide a sound policy evaluation on the issues at hand.

The list of stakeholders to interview has been provided by the European Commission. Overall, a total of 48 interviews have been carried out with the following key stakeholders of the SET Plan community:

- SET Plan Steering Group Bureau and Steering Group members (Member States and Associated country representatives)²⁸;
- Implementation Working Group (IWG) chairs and co-chairs²⁹;
- European Technology and Innovation Platforms (ETIPs) chairs and vice chairs³⁰;
- Coordinators of the Co-funded European Partnerships (formerly ERA-NETs);
- High-level representatives of the European Energy Research Alliance (EERA) and EERA Joint Programmes' chairs active in IWGs;
- High-level representatives of the Coordination & Support Action (CSAs).

To ensure a consistent approach to all interviews, interview guides were prepared and distributed in advance to all interviewees, covering the background and context of the research, the objectives of the interview, and a list of key topics and questions to be explored in the interview. The interviews were **semi-structured** to encourage an open dialogue. While focusing on the initial predefined questions this approach allowed the interviews to be flexible and adaptable to accommodate the expertise and experiences of the stakeholders and the time available for the interviews. This flexible approach allowed by semi-structured interviews combined the exploratory nature of unstructured interviews with the rigorous and practical nature of structured interviews. All of the questions were open-ended and avoided directing the interviewee. No indication of the outcomes generated in other interviews was provided, to avoid bias. Additionally, informal follow-up questions were sometimes used to further explore specific ideas or analyses.

28 There are 30 members in the SET Plan Steering Group: 27 EU Member States, Island, Norway and Turkey. Among them, 5 members are identified to also be chair(s) of IWG(s). This means there remains 25 members to interviews next to the 5 that will be interviewed as part of the IWG representatives' interviews.

29 The SET Plan is made up of 14 Implementation Working Groups (IWGs): Offshore wind; Photovoltaics; Deep geothermal; Ocean energy; Concentrated solar power / Solar thermal electricity; Energy systems; Positive energy districts; Energy Efficiency in buildings; Energy efficiency in industry, Batteries; Renewable fuels and bioenergy; Carbon capture and storage - Carbon capture and utilisation; Nuclear safety; High voltage direct current & direct current technologies.

30 ETIPs are industry-led communities that develop and implement the SET Plan priorities. Each ETIP promotes the market uptake of key low-carbon energy technologies by pooling funding, skills, and research facilities. There are 10 ETIPs: ETIP BatteRIes Europe, ETIP Bioenergy, ETIP Wind, ETIP Deep Geothermal, ETIP Ocean Energy, ETIP Photovoltaic, ETIP Renewable Heating and Cooling, ETIP Smart Networks for Energy Transition, ETIP Sustainable Nuclear Energy, ETIP Zero Emission Fossil Fuel Power (ZEP).

Since the roles of interviewees in the SET Plan are diverse, all interviews have been carried out using a **modular approach**. A specific interview guide based on the evaluation matrix composed of a pre-defined list of questions have been prepared per type of membership of the interviewee: 1) SET Plan Steering Group, 2) IWGs, 3) ETIPs/EERA/ERA-NETs/CSAs. The three interview guides consisted of questions common to all interview guides as well as specific questions tailored to the interviewees' role in the SET Plan. All three interview guides are available in Appendix 3.

All interviews were conducted by at least two of the evaluators on a two-to-one basis with the interviewee and lasted approximately 60 minutes for stakeholders holding one role within the SET Plan community and 90 minutes for stakeholders holding two (or more) roles (e.g., IWG Chair and Steering Group member). For stakeholder interviewees with more than one role within the SET Plan community, personalised interview guides combining questions relevant to both roles were used. All interviews have been conducted in June 2022.

In preparation for the stakeholder interviews, a GDPR-compliant data privacy policy was developed and implemented. Along with providing the corresponding interview guide, a data privacy statement was sent to each stakeholder prior to the interviews, explaining how their personal data was collected, processed, protected and used.

Description of the sample of SET Plan stakeholders interviewed

Summary: A total of 46 stakeholders directly involved in the SET Plan ecosystem as a member of the Steering Group (Bureau), Chair or Co-Chair of the IWG, Chairs and Vice-Chairs of ETIP, ERA-NET Coordinator, CSA or EERA representative were interviewed for this evaluation. In addition, two indirect stakeholders (the CEO of a consultancy company and a former JRC member) were also consulted. The Steering Group (Bureau) members interviewed represent 14 SET Plan Countries and the interviewed IWG, ETIP, ERA-NET and CSA members cover 11 of the 14 SET Plan R&I areas in the field of low-carbon energy technologies (representatives from energy systems, batteries and HVDC were not interviewed).

Description of Figure 3: among the 48 SET Plan stakeholders interviewed, 38 hold one position (i.e., Chair of an IWG or Steering Group member). Most of the stakeholders who hold more than position are chair or co-chair of an IWG in addition to being a member of the Steering Group (Bureau), an ETIP or an ERA-NET.

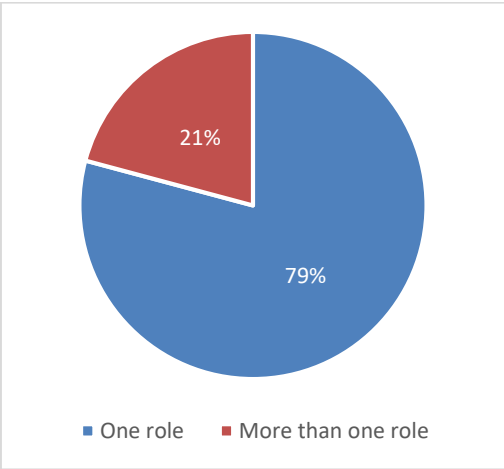


Figure 3. Breakdown of stakeholders interviewed according to the number of positions they hold in the SET Plan ecosystem. (48 interviewees)

Description of Figure 3. Breakdown of stakeholders interviewed according to the number of positions they hold in the SET Plan ecosystem. (48 interviewees) Figure 4: among the 48 SET Plan stakeholders interviewed, half of them (24) hold a position in at least one IWG (either as chair or co-chair) and 17 of them are a member of the Steering Group (Bureau). Members of the ETIPs, CSAs, ERA-NETs and EERA have also been interviewed.

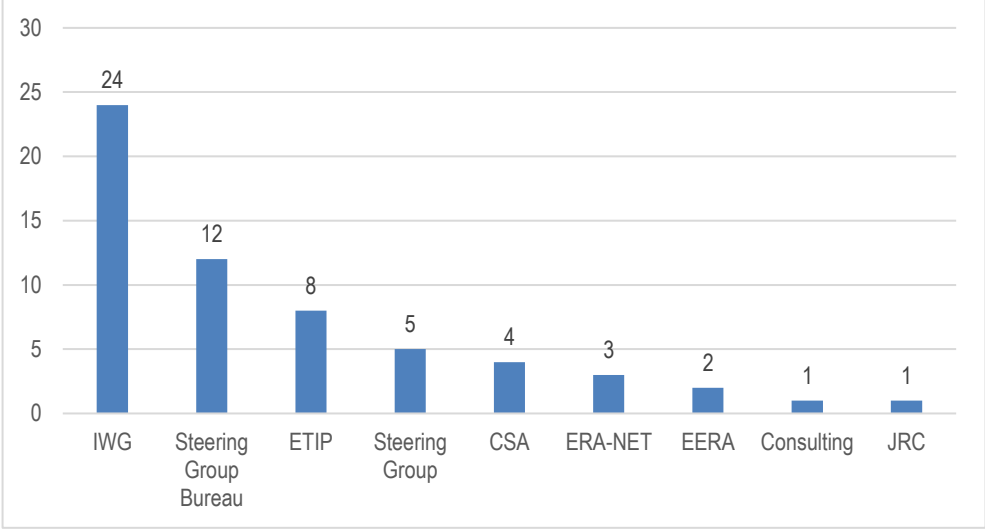


Figure 4. Breakdown of stakeholders interviewed according to the position they hold in the SET Plan ecosystem. (48 interviewees)

Description of Figure 5: among the 31 countries within the scope of the SET Plan (EU27 + Turkey + Iceland + Norway + Switzerland), 17 Steering Group (Bureau) members covering 14 SET Plan Countries have been interviewed.

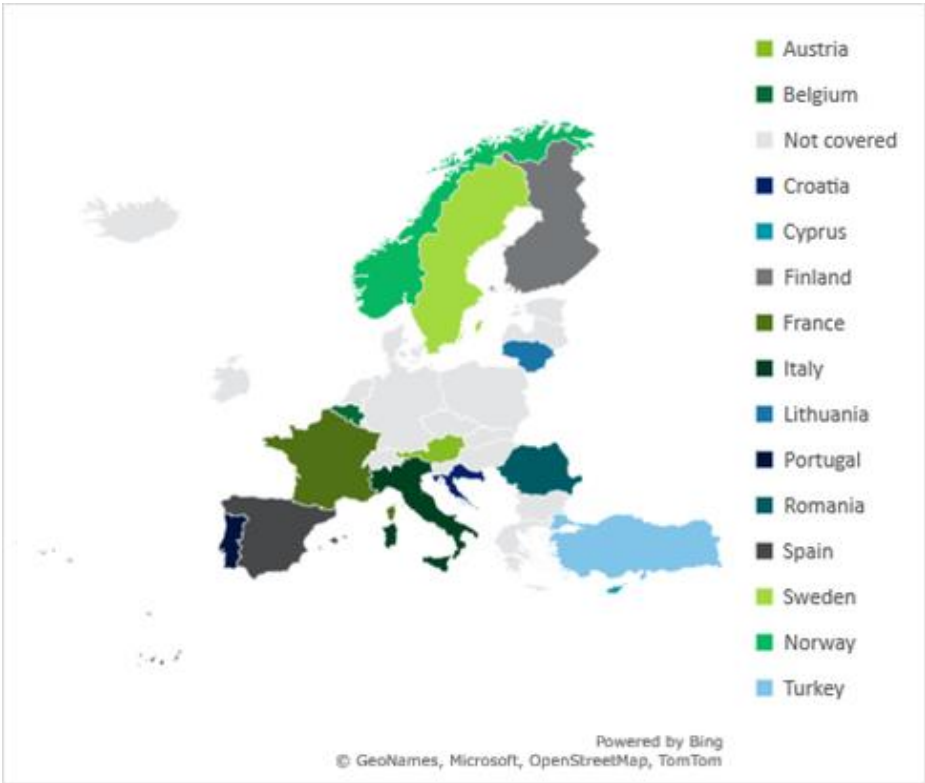


Figure 5. Breakdown of SET Plan Countries covered by the Steering Group members interviewed. (48 interviewees)

Description of Figure 6: the sample of stakeholders interviewed (members of IWGs and ETIPs, ERA-NETs and CSAs) covers 11 of the 14 SET Plan R&I areas in the field of low-carbon energy technologies. Only representatives of the R&I areas Energy Systems, Batteries, HVDC have not been interviewed for this evaluation. Also, a representative of the ETIP "Hydropower Europe" was interviewed.

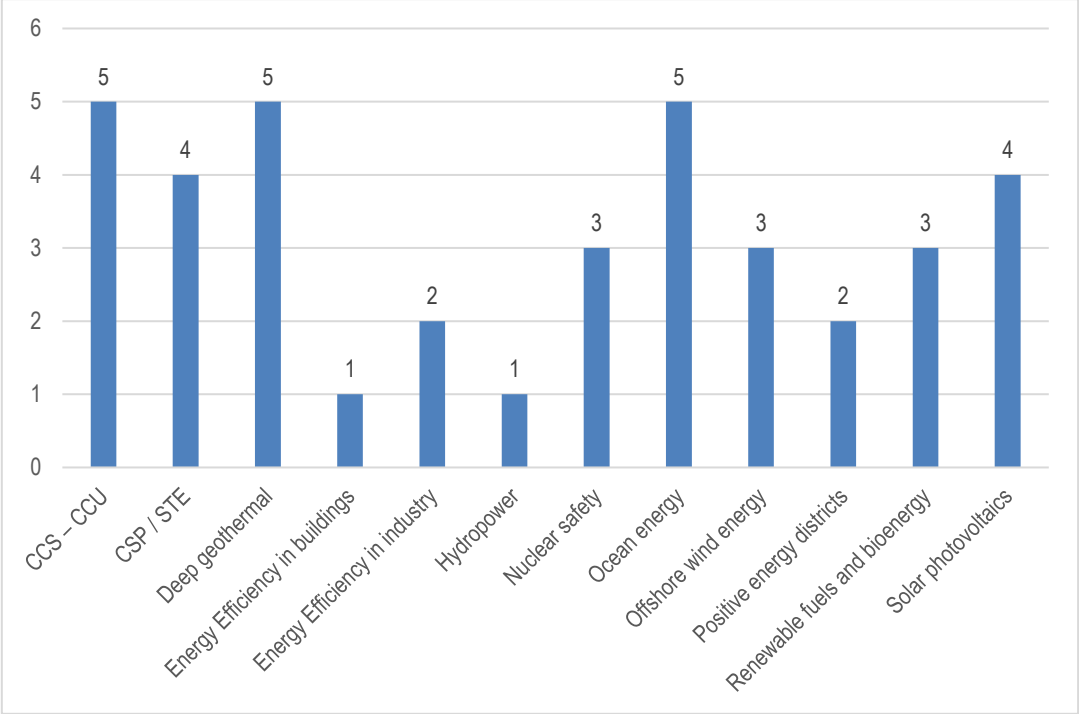


Figure 6. Breakdown of SET Plan R&I areas covered by members of IWGs and ETIPs, ERA-NETs and CSAs interviewed. (48 interviewees)

Recognizing that the data collected through interviews may lack the specifics of a more quantitative nature, which above all enable aggregation and comparison across respondents, this evaluation applied also an in-depth questionnaire for a wider range of stakeholders.

Questionnaire

Online questionnaires are a useful tool for gathering the views and opinions of a larger part of an intervention’s target population. Online questionnaires consist predominantly of close-ended questions (to facilitate comparisons) and to a lesser extent of open questions (to facilitate understanding and interpretation of the responses). They offer a time- and resource-effective way to generate data and are particularly well-suited for research frameworks in which the geographic dimension plays an important role, as they can improve the geographic representativeness of the questionnaire sample. The questionnaire answers both supplemented the data collected during the interviews on specific evaluation indicators from the evaluation matrix and provided input on evaluation indicators not addressed in the interviews. It has been designed with the aim to keep its completion under a duration of 20 minutes in order to maximise the number of respondents. The dissemination of the questionnaire to the wider SET Plan community has been carried by the European Commission through several channels, in order to maximise the outreach and the number of answers. All the stakeholders identified in Figure 2 have been targeted and be given the possibility to respond to the questionnaire. The questionnaire is available in Appendix 4.

Description of the sample of SET Plan stakeholders that responded the questionnaire

Summary: the 68 respondents to the questionnaire are involved in a very wide range of organisations, directly (e.g., ETIPs, the Steering Group, EERA, ERA-NETs and IWGs) or indirectly (i.e., industry associations, universities, national ministries, national organisations, etc.) affiliated to the SET Plan activities. The respondents to the questionnaire are working in organisations based in 21 SET Plan Countries (+ the UK) and covers all of the 14 SET Plan R&I areas in the field of low-carbon energy technologies. Overall, approximately half of the respondents to the questionnaire are working in organisations that have been involved in SET Plan activities for 11 years or more and half of the respondents to the questionnaire have been personally involved in SET Plan activities for a maximum of 5 years. Finally, more than 80% of the respondents to the questionnaire are involved in organisations that are at least “somewhat highly” engaged in the SET Plan activities, with 27% of the respondents who perceive the level of engagement of their organisation in the SET Plan activities as very high.

Description of Figure 7: the respondents to the questionnaire are involved in a very wide range of organisations, directly or indirectly affiliated to the SET Plan activities. Respondents directly connected to the SET Plan are involved in ETIPs, the Steering Group (Bureau), EERA, ERA-NETs and IWGs. Most of the respondents indirectly connected to the SET Plan work for industry associations, universities, national ministries, national organisations, industries and international organisations. Also, a majority of respondents are affiliated to more than one organisation that is directly or indirectly related to the SET Plan.

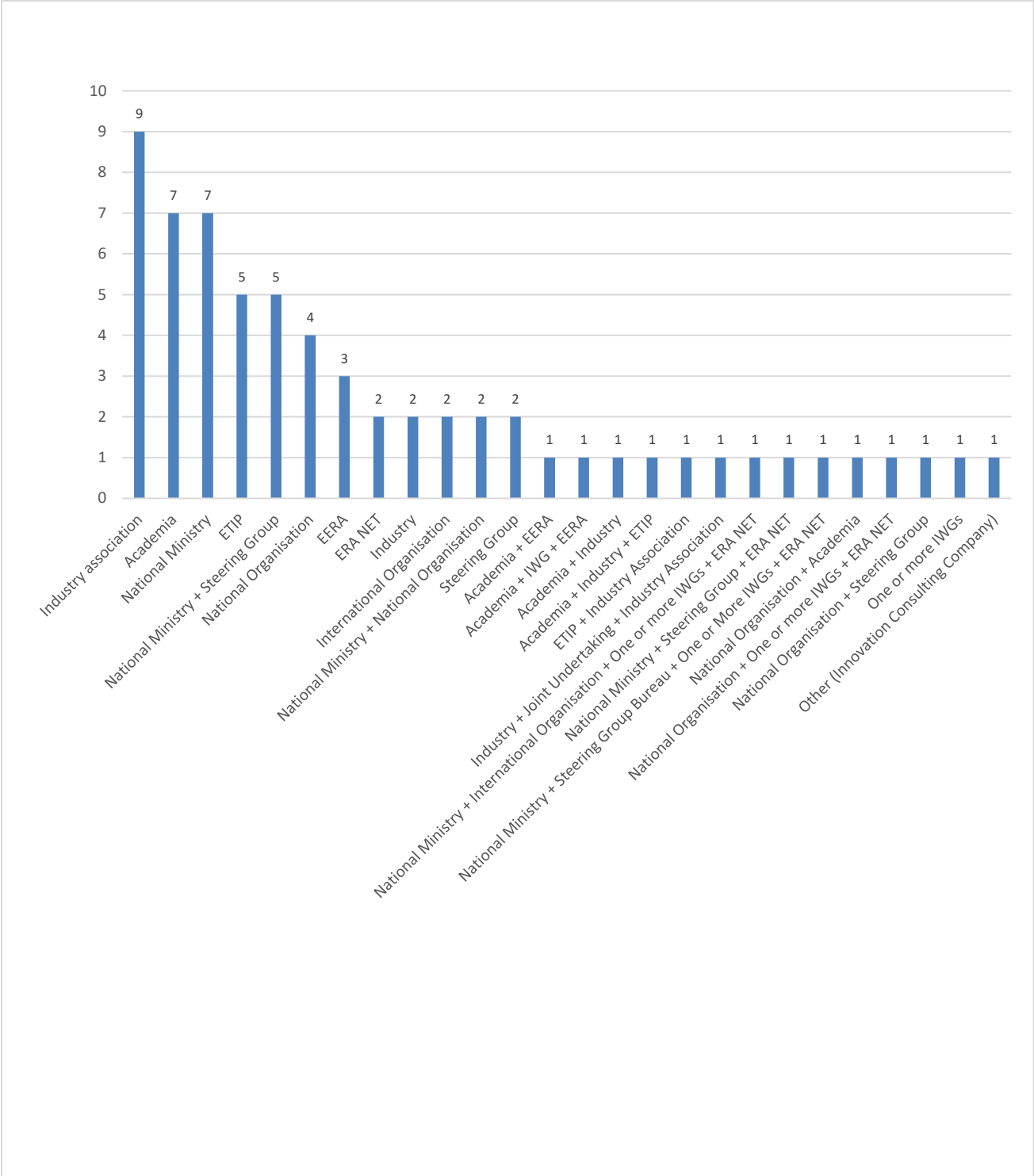


Figure 7. Breakdown of respondents to the questionnaire according to the position they hold in the wider SET Plan ecosystem.

Description of Figure 8: the respondents to the questionnaire work for organisations based in 21 SET Plan Countries (+ the UK). The over-representation of respondents representing organisations based in Belgium can be explained by the fact that many industry organisations as well as SET Plan related groups (EERA, ETIP, ERA-NETs, etc.) are based in Brussels (Belgium).

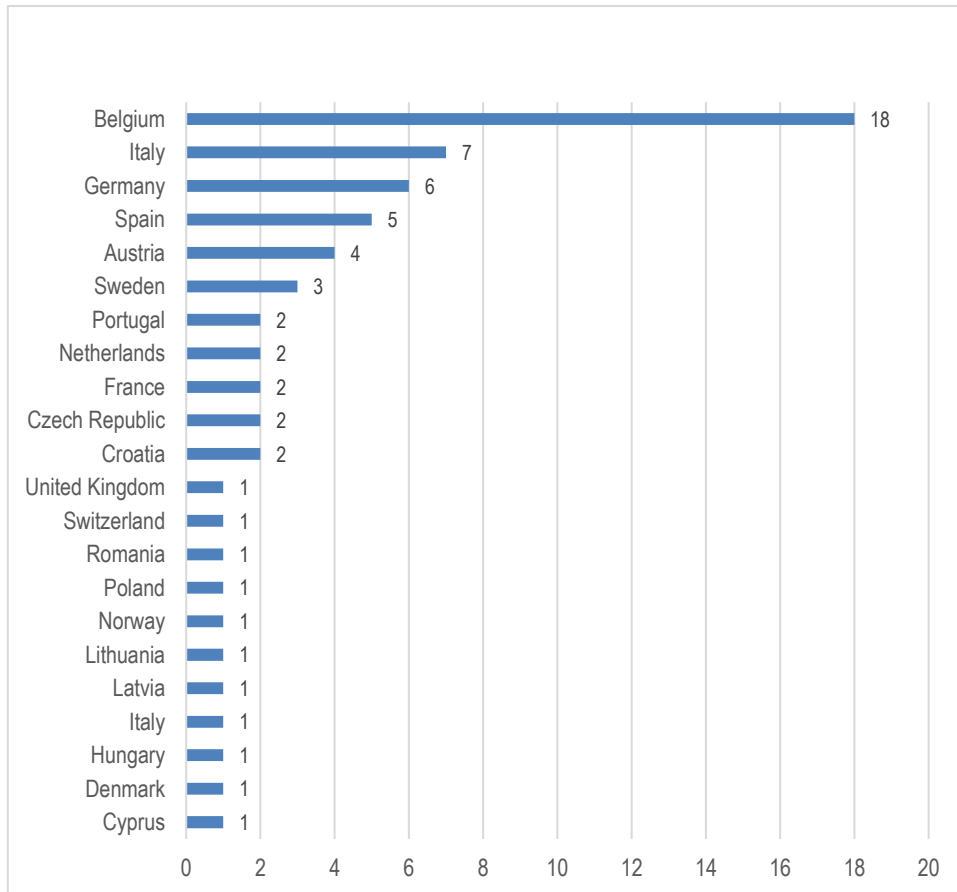


Figure 8. Countries in which the organisations for which the questionnaire respondents work are located.

Note: Among the respondents to the questionnaire, representatives of national ministries or national organisations (including some SET Plan Steering Group and Steering Group Bureau members) of the following countries are represented: Spain, France, Poland, Czech Republic, Croatia, Latvia, Portugal, Netherlands, Sweden, Germany, Lithuania, Italy, Romania, Cyprus, Austria, Hungary and Belgium.

Overview – Geographical coverage of SET Plan country (national representatives) in this evaluation (interview and questionnaire).

Overall, through the interviews conducted with members of the SET Plan Steering Group and Steering Group Bureau (national representatives) as well as the answers to the questionnaire provided by representatives of national ministries and national organisations (including some SET Plan Steering Group and Steering Group Bureau members) this evaluation include insights shared by national representatives originating from 20 SET Plan Countries.

The following SET Plan Countries have not been covered neither through the interviews nor through the questionnaire: Iceland, Switzerland, Bulgaria, Denmark, Estonia, Greece, Ireland, Luxembourg, Malta, Slovakia and Slovenia.

Description of Figure 9: the sample of respondents to the questionnaire covers all of the 14 SET Plan R&I areas in the field of low-carbon energy technologies. A vast majority of respondents are active in more than one energy research and innovation area. It is also worth noting that 13 respondents are active in energy research and innovation area that they consider not being represented by the IWGs. These topics are: Solar Thermal, Thermal

Storage, Hydropower, Digitalisation for Energy, Social Sciences and Humanities, Energy system modelling, Renewable Heating and Cooling, Hydrogen, Heat Pumps, Airborne Wind Energy (AWE).

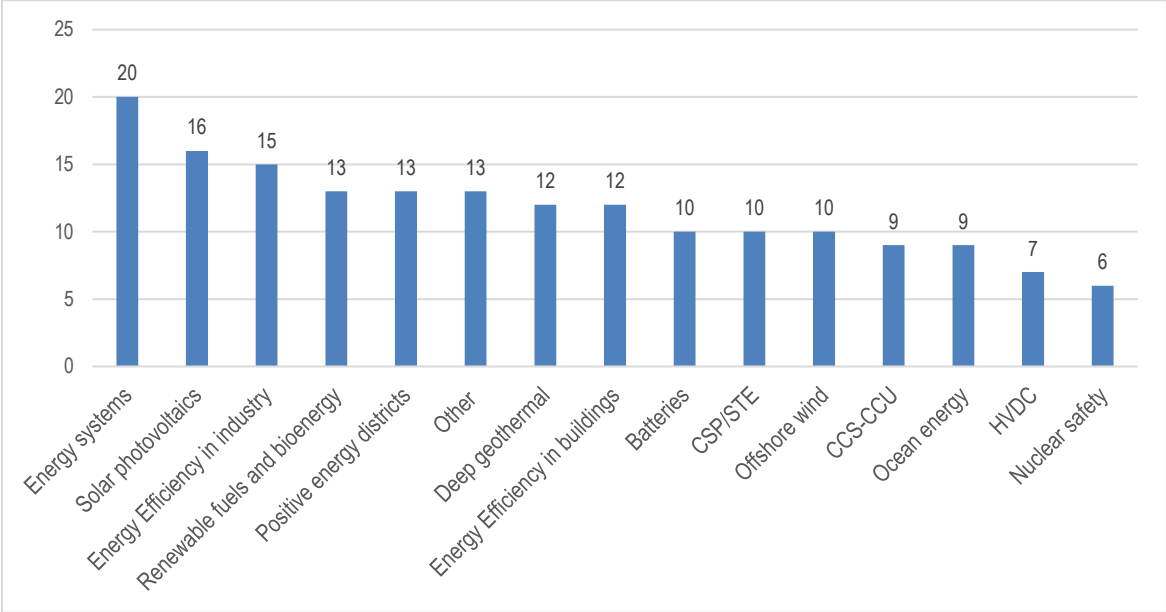


Figure 9. Breakdown of SET Plan R&I areas covered by respondents to the questionnaire.

Description of

Figure 10 Figure 10: overall, approximately half of the respondents to the questionnaire are working in organisations that have been involved in SET Plan activities for 11 years or more. Only 23% of respondents to the questionnaire are working in organisations that have recently (after 2016) join the SET Plan ecosystem.

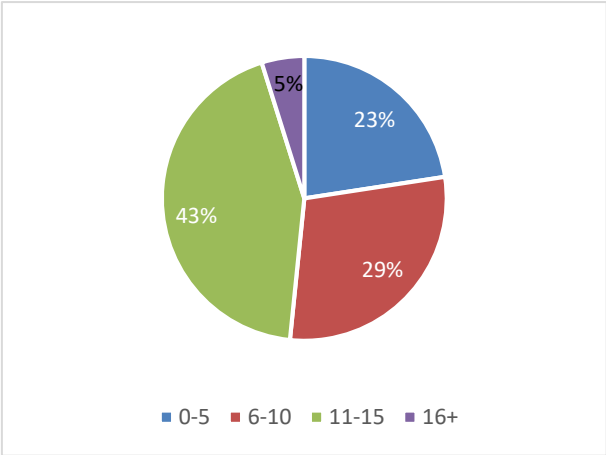


Figure 10. Breakdown of respondents to the questionnaire according to the number of years the organisation they work for has been working with the SET Plan.

Description of Figure 11: overall, approximately half of the respondents to the questionnaire have been personally involved in SET Plan activities for maximum 5 years. Among the respondents to the questionnaire personally involved for more than 5 years, about 40% have more than 10 years of experience with the SET Plan.

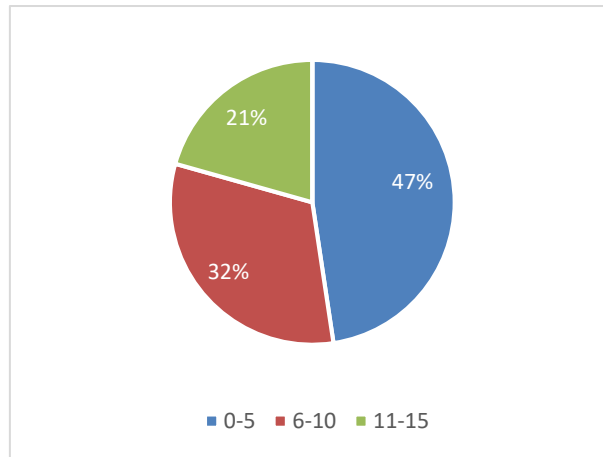


Figure 11. Breakdown of respondents to the questionnaire according to the number of years they have personally been working with the SET Plan.

Description of Figure 12: More than 80% of the questionnaire respondents are involved in organisations that are at least “somewhat highly” engaged in the SET Plan activities, with 27% of the respondents who perceive the level of engagement of their organisation in the SET Plan activities as very high. The remaining 20% do not perceive their organisation as being a significant actor of the SET Plan ecosystem.

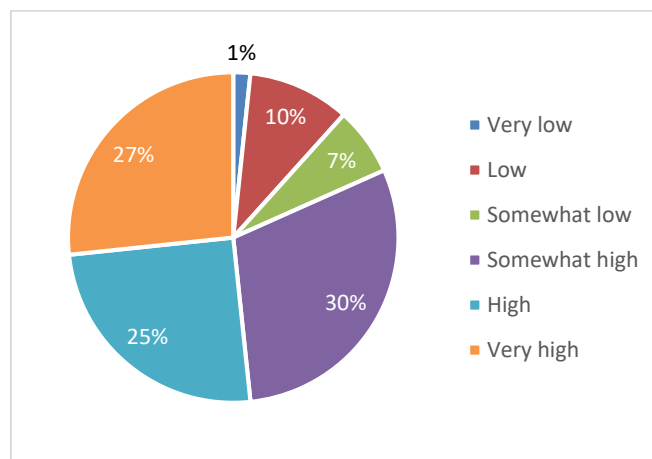


Figure 12. Breakdown of respondents to the questionnaire according to the number of years they have personally been working with the SET Plan.

4.3 Assessment and reporting

To analyse the primary data collected from the interviews, an ‘inductive’ approach was taken, with the purpose to allow findings to emerge from the frequent, dominant, or significant themes inherent in raw data, without the restraints imposed by structured methodologies. Interview transcripts were coded thematically to accurately identify similarities and differences in the data collected while minimising evaluators biases and making explicit the procedures from text to interpretation. The questionnaire responses have also been analysed and summarised, complementing preliminary conclusions drawn from the desk research and the analysis of the interview transcripts. In the data analysis phase, triangulation techniques have been used to make sure that the findings are based on robust data. The process of triangulation included:

- Identifying trends across the data sets and information gathered and consolidating these observations;
- Checking these hypotheses for consistency using different sources of information in order to find contradictions;
- If necessary, approaching the various information sources to obtain additional data to analyse and explain possible contradictions and/or differences in the findings.

Subsequently, the processing of qualitative and quantitative data led to the emergence of conclusions that allow to precisely describe the data and identify patterns. Per evaluation indicator/topic defined in the evaluation matrix, the evaluation team compared the input that has been collected and structure it into:

- Findings (i.e. verifiable conclusions based on facts and figures);
- Conclusions (i.e. judgments in relation to judgment criteria and corresponding indicators, providing the assessment of the SET Plan);
- Recommendations.

Based on inputs of the analysis, a preliminary Assessment Report of the SET Plan was drafted and submitted to the contracting authority for feedback and comments. Subsequently, the final report was refined, submitted for approval and presented to the Contracting Authority at a final meeting.

5. Data analysis

In this chapter, the data collected during the desk research, the interviews and the questionnaire is analysed and triangulated per evaluation criteria and indicator. The solutions proposed by the stakeholders are listed as well. However, our conclusions are to be found in Chapter 6.

5.1 Relevance and coherence of the Set Plan

5.1.1 Alignment between the scope of the SET Plan and the EU energy and climate policy objectives

The objectives of the SET Plan are aligned against the EU energy and climate policy objectives.

At the EU level, there is a strong consensus among stakeholders that the SET Plan objectives and targets are aligned against research and innovation objectives for low-carbon energy technologies. This finding is confirmed by inputs from the questionnaire (see Figure 13).

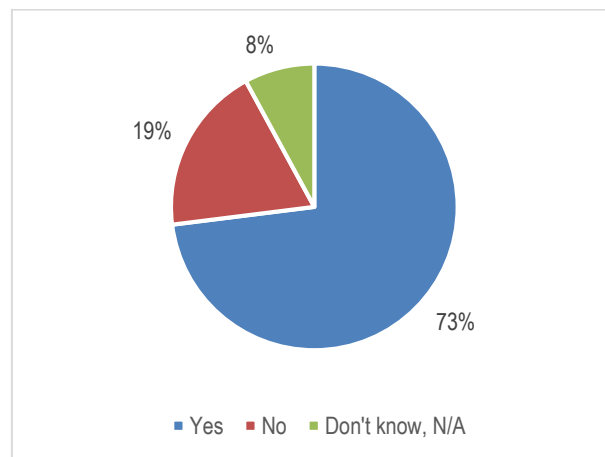


Figure 13. "At the EU level, is the SET Plan scope aligned against research and innovation objectives for low-carbon energy technologies and infrastructure?" (63 respondents)

However, Steering Group members interviewed pointed out the following elements:

- While for some the SET Plan acts as a framework for defining EU-wide low-carbon energy technology deployment goals, the extent to which the SET Plan actually acts as such is uncertain to others.
- Also, while some Steering Group members specifically acknowledged that there is a growing alignment in scope between SET Plan objectives and Horizon Europe Cluster 5 calls for project funding, this link is not yet sufficiently visible. The same is true for the Clean Energy Transition Partnership, where more emphasis needs to be placed on how the co-funded partnership utilises the work of the SET Plan as a starting point for identifying the relevant co-funded R&I projects to develop.
- The SET Plan would also benefit from a clearer link between its scope and that of other EU programs in which energy technologies are addressed (Digital Europe, European Partnerships, etc.).

In general, SET Plan Steering Group members credit the SET Plan with demonstrating over time its ability to adapt to R&I developments and integrate emerging technologies accordingly within its scope (e.g., the new HVDC IWG). The new geopolitical situation resulting from Russia's invasion of Ukraine poses new challenges for the rapid scaling of mature energy technologies (e.g., hydrogen, biomethane, solar PV, offshore wind, heat pumps, etc.), for which the SET Plan can play an instrumental role.

Proposed solutions from interviewed stakeholders to ensure greater and continued alignment between the scope of the SET Plan and the EU energy and climate policy objectives:

- To systematically link Horizon Europe Cluster 5 and Clean Energy Transition Partnership calls for projects to the work of the SET Plan, precisely outlining how the activities of the IWGs provided the foundational framework that substantiates the value of the calls for projects and how these Horizon Europe-funded projects are expected to address one or more of the IWGs' objectives.

5.1.2 Alignment between the objectives of the SET Plan's IWGs and the EU energy and climate policy objectives

The targets of the IWGs are mostly aligned against the EU energy and climate policy objectives.

There is an overall consensus among the majority of the interviewed IWG chairs and co-chairs that, in their respective sector, the individual objectives and targets of the IWGs are aligned against EU-wide research and innovation objectives for low-carbon energy technologies. This finding is confirmed by inputs from the questionnaire (see Figure 14).

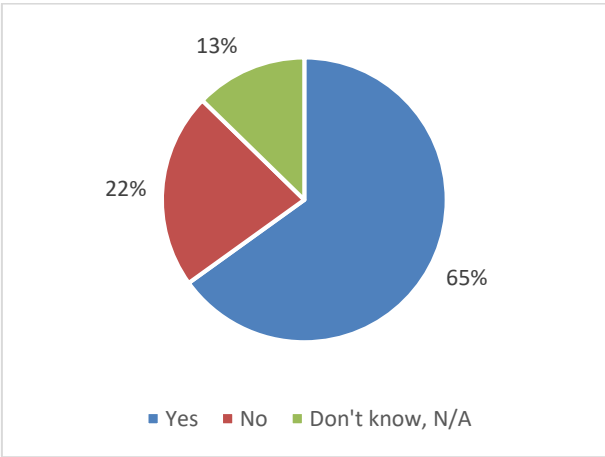


Figure 14. "At the EU level, are the SET Plan IWGs' objectives and targets aligned against research and innovation objectives for low-carbon energy technologies and infrastructure?" (63 respondents)

However, IWG chairs and co-chairs interviewed pointed out the following elements:

- Although the Deep Geothermal, CSP/STE and CCS-CCU IWGs have set specific targets and objectives, it is difficult to assess the extent to which these are aligned with EU R&I objectives in their respective sectors, due to the current absence of political will to articulate and implement EU roadmaps for geothermal energy, CSP/STE and CCS-CCU developments along with specific objectives. As a result, deep geothermal, CSP/STE, and CCS-CCU technologies receive limited attention in

EU policies and communications, leading to heightened difficulties in convincing the EU and Member States of the value of advancing these technologies at the large scale to meet decarbonisation goals.

- In some geothermal projects, carbon capture technologies are needed to prevent the release of CO₂ into the atmosphere (from the fluid that is pumped to the surface). This factor entails the need to enhance the development of carbon capture and storage applications in the geothermal sector, which is not currently reflected in the EU's sectoral R&I objectives. Furthermore, although some interactions have occurred between the Deep Geothermal and the CCS-CCU IWGs, collaboration needs to be formalised and strengthened.
- There is insufficient clarity at the EU (Commission) level on which R&I initiatives are to receive priority in the IWG on Nuclear Safety, resulting in hurdles for the IWG to implement relevant activities and deliver visible results.

Proposed solutions from interviewed stakeholders to ensure greater and continued alignment between the scope of the SET Plan IWGs' objectives and targets and the EU research and innovation objectives for low-carbon energy technologies:

- In order to guarantee a proper alignment between the objectives and targets of the different IWGs and the EU-wide low-carbon energy technology development objectives in their respective sectors, it should always be ensured that the Implementation Plans of the IWGs are defined in a bottom-up approach through collaboration between the IWG members and the industries (through the associated ETIPs), before being eventually conveyed to the EU and the Member States.
- Attention should be paid to ensure that the activities and objectives pursued by the IWGs and the associated CETP are always complementary to and integrated with the activities and objectives pursued by other R&I programs (such as Horizon Europe). Ensuring that the work of the SET Plan community actually influences EU policy-making on low-carbon energy technology development is a prerequisite for enabling it to achieve sectoral R&I targets and objectives.

5.1.3 Alignment between the scope of the SET Plan and the national R&I agenda formulated in the National Energy and Climate Plans

The alignment between the national R&I agenda formulated in their NECP and the scope of the SET Plan could be improved.

Views of interviewees differ regarding the alignment between national R&I priorities formulated in the NECPs and the scope, objectives and targets of the SET Plan.

For some, mainly stakeholders from the Steering Group, both are aligned. This good alignment is primarily attributable to the comprehensive range of technologies covered by the SET Plan, which helps secure that each country's national R&I priorities in low-carbon energy technologies address at least some of the R&I areas addressed in the SET Plan. Additionally, the roll-out of the CETP, which is co-funded by national governments, is expected to ensure very good alignment between national R&I agendas and the SET Plan scope and objectives. The national R&I priorities and targets in low-carbon energy technologies set will be captured in the next update of the NECPs.

However, for others, there is little alignment between NECPs and the SET Plan. This finding was confirmed by inputs from the questionnaire, in which only 40% of the respondents believe that there are enough synergies between the SET Plan and the national R&I actions

formulated in the NECPs (see Figure 15). It should however be noted that only one third of respondents expressed the view that synergies between the SET Plan and the national R&I actions formulated in the NECPs are lacking.

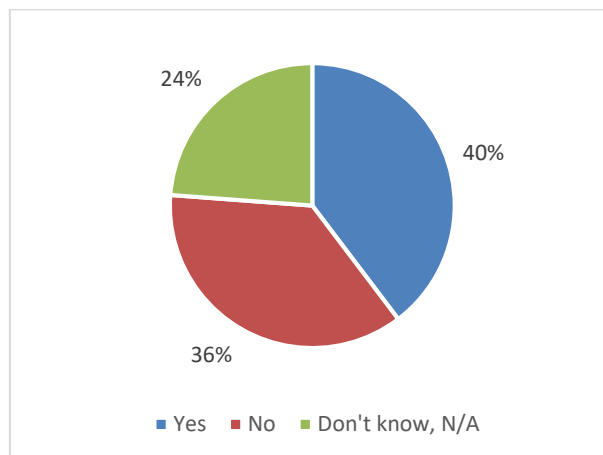


Figure 15. "Are there enough synergies between the SET Plan and the national R&I actions formulated in the National Energy and Climate Plans?" (63 respondents)

Steering Group members interviewed pointed out the following elements of interest:

- Primarily as a function of national geographic and climatic characteristics, as well as domestic policy priorities, the focus of energy R&I strategies is necessarily different across the SET Plan Countries (e.g., Sweden does not particularly prioritise R&I in CSP/STE technologies, but focuses on biomass-based technologies, due in part to its forestry capacity). Thus, while national R&I objectives should be aligned with the main objective of developing technologies that can contribute to the decarbonisation of the European energy system, it is not deemed relevant to attempt to homogenise the scope of the areas covered by the R&I strategies of each SET Plan Countries.
- Overall, the successful alignment between national R&I priorities and the scope, objectives, and targets of the SET Plan is greatly dependent on the extent to which national representatives serving in the SET Plan Steering Group are adequately positioned to effectively inform and influence their national government in defining the key strategic priorities to be addressed in R&I policies and initiatives.
- Many Steering Group members pointed out that the lack of visibility of the SET Plan among national policy makers prevents the SET Plan from directly influencing national R&I priorities and objectives. Instead, the SET Plan contributes to informing EU policies, legislations and objectives, which in turn are factored in by national governments when shaping national R&I priorities and objectives. The link between the scope, objectives and targets of the SET Plan and national R&I priorities and objectives is therefore only indirect. It was noted by some Steering Group members that, in some instances, this limited visibility of the SET Plan makes it difficult to align SET Plan goals and targets with national/regional R&I goals for low-carbon energy technologies. Ultimately, the alignment between national R&I priorities and the scope, objectives, and targets of the SET Plan is in some cases achieved directly by researchers who are well aware of the strategic directions set out in the SET Plan in their field of study and who deliberately steer their work and projects in these directions, without any particular political push by their national governments.
- Some Steering Group members indicated that national governments also have consideration of transnational forums, such as the IEA Technology Collaboration

Programs, in deciding on strategic R&I priorities in the area of low-carbon energy technologies.

- Some Steering Group members pointed out that some countries participating in the SET Plan have not yet defined a specific national R&I agenda on low-carbon energy technologies, making it difficult for now to assess alignment with the scope and goals of the SET Plan.
- In some cases, when energy topics are covered by various ministries, the lack of effective communication and collaboration between them can hinder the successful implementation of national R&I strategies. At the same time, when different portfolios complement each other (i.e., the ministry of R&I and the ministry of energy policy), and effective and efficient cooperation is in place, a stronger alignment between national R&I priorities and the scope, objectives, and targets of the SET Plan can be realised.

Proposed solutions from the interviewed stakeholders to ensure greater and continuous alignment between the scope of the SET Plan and the national R&I agendas formulated in the NECPs were as follows:

- To make sure that national representatives serving in the SET Plan Steering Group are adequately positioned to effectively inform and influence their national government in defining the key strategic priorities to be addressed in R&I policies and initiatives.
- To systematically make clear reference to the SET Plan in the technical specification of national R&I projects, precisely outlining how the activities of the IWGs provided the foundational framework that substantiates the value of these projects and how these projects are expected to address one or more of the IWGs' objectives.
- To systematically make clear reference to the SET Plan targets in the NECPs for each technology and to explain how national R&I targets are aligned with SET Plan targets. In parallel, new areas of interest for R&I in low-carbon technologies (if any) not within the scope of the SET Plan should be highlighted in the NECPs to enable a more efficient identification of new technologies by SET Plan protagonists. Overall, the structure, content and instruments to be implemented (what, how, who, when) formulated in the NECPs should be more prescriptive as they currently vary widely.
- To encourage more top-level involvement of national policy areas relevant to the scope of the SET Plan. A suggestion would be to appoint two representatives from each SET Plan country to the Steering Group, one representing the R&I ministry and the other the (energy) policy ministry. With proper communication and cooperation between the ministries, such a structure can help better align SET Plan Countries' R&I strategies with the SET Plan, from setting strategic priorities to monitoring actual implementation.

5.2 Effectiveness of the SET Plan

In this section, we will analyse whether the SET Plan is achieving or has achieved its objectives. Insights will be provided on whether the SET Plan has attained its planned results, the process by which this was done, the factors that were decisive and if there were any unintended effects.

5.2.1 Results against original objectives of the IWG

According to the publications of the SET Plan, there were important R&I advances over the last decade across the 14 energy sectors the SET Plan covers, showcasing the SET Plan's role in the energy transition³¹. The SET Plan has contributed to the development of promising technologies through the projects deployed in the IWGs. It has helped directly the SET Plan Countries, the industry and the research actors towards the development of key low-carbon energy technologies, and it has also contributed to the reduction of the cost of key low-carbon energy technologies and their large-scale development through structuring national and EU programmes³².

However, the development of key low-carbon energy technologies and the reduction of the cost of key low-carbon energy technologies and their upscaling cannot be only correlated to the SET Plan activities, as they depend on a complex interplay of several socio-economic factors driving the investment of both the public and private sector.

Lastly, many stakeholders pointed out that the objectives of the SET Plan are not clear for a large part of its members, which makes it difficult to measure their achievement and to attribute direct results to the initiative. Moreover, some projects under the SET Plan of course may have contributed to some of the developments, but they are not the only factor. For all these reasons, we are currently not able to measure the actual link of these projects to the work performed under the SET Plan.

5.2.2 Contribution to the SET Plan objectives

The main outcome of the SET Plan is that it positively contributes to the EU's energy and climate targets. Next to that, many respondents also pointed out that the SET Plan contributes to the development of strategic planning, the coordination of targeted actions and the mobilisation of funding. On the other hand, some respondents disagree with the statement that the SET Plan contributes to the development and market take-up of low-carbon energy technologies and the hypothesis that it contributes to driving down the costs of energy technologies.

According to the 2007 Impact Assessment of the SET Plan, the SET Plan supports the EU to meet its climate and energy targets by lowering the cost of clean energy and realising the economic opportunities of the green transition. Its objectives are the following ones:

- Address market barriers and failures to support low-carbon energy innovation, by:
 - Elaborating a strategic planning that directs research and innovation efforts towards key low-carbon energy technologies and infrastructure;
 - Defining a cost-effective and results-oriented allocation for the R&D and increase the means.
- Strengthen the coordination and cooperation between the SET Plan Countries, including on energy R&D programs and policy, through:

31 The SET Plan. At the heart of Energy Research & Innovation in Europe 2007-2017 - 10th anniversary

32 C(2015)6317 - Towards an Integrated Strategic Energy Technology (SET) Plan : Accelerating the European Energy System Transformation 2015

- Transforming the governance of the European energy research and innovation system, including by the implementation of a monitoring system;
- Coordinating targeted actions at national and EU levels.

In the questionnaire, stakeholders were asked to assess the following statements:

- “The SET Plan significantly contributed to the acceleration of the development and market take-up of low-carbon energy technologies (in your domain)”;
- “The SET Plan contributed to the EU's energy and climate targets”;
- “The SET Plan contributed to the development of strategic planning that directs research and innovation efforts towards low-carbon energy technologies and infrastructure outlined in EU energy and climate regulatory frameworks, as well as in key sectoral initiatives and strategies”;
- “The SET Plan contributed to further mobilising cost-effective, complementary and targeted public and private R&I investments in the field of energy technologies and infrastructures”;
- “The SET Plan is contributing to the coordination of targeted actions at national and EU levels”;
- “The SET Plan (significantly) contributed to driving down the costs of existing energy-related technologies”.

Their perception towards these statements can be found below.

5.2.2.1 *Contribution to the development and market take-up of low-carbon energy technologies*

For 52% of the respondents, the SET Plan has significantly contributed to the acceleration of the development and market take-up of low-carbon energy technologies. On the other hand, however, 40% disagree with this statement, of which 13% strongly disagree. This reflects the desire of some IWG representatives to allow funding for higher TRL (7 to 9).

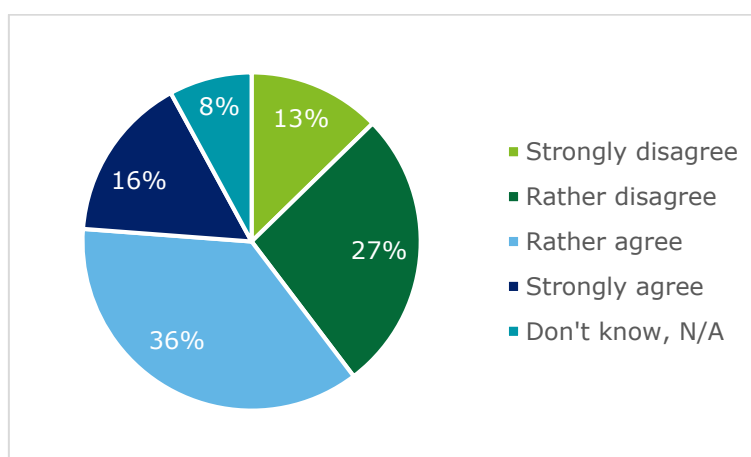


Figure 16. “SET Plan significantly contributed to the acceleration of the development and market take-up of low-carbon energy technologies (in your domain).” (63 respondents)

5.2.2.2 Contribution to the EU's energy and climate targets

90% of questionnaire respondents believe that the SET Plan contributes to the EU's energy and climate targets. This appears to be aligned with the results presented in 5.1 on if the objectives of the SET Plan and the targets of the IWGs are aligned against the EU energy and climate policy objectives and targets.

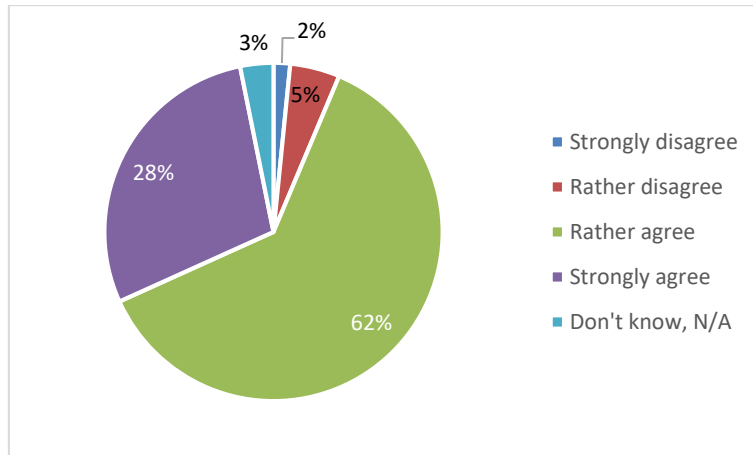


Figure 17. "SET Plan contributed to the EU's energy and climate targets." (63 respondents)

5.2.2.3 Contribution to the development of strategic planning

For 76% of the respondents, the SET Plan contributed to the development of strategic planning that directs research and innovation efforts towards low-carbon energy technologies and infrastructure outlined in EU energy and climate regulatory frameworks, as well as in key sectoral initiatives and strategies. Despite the fact that each country has its own ambition and strategy, the alignment of stakeholders for such a transnational matter as is energy transition is crucial. Most respondents felt that the SET Plan allowed that.

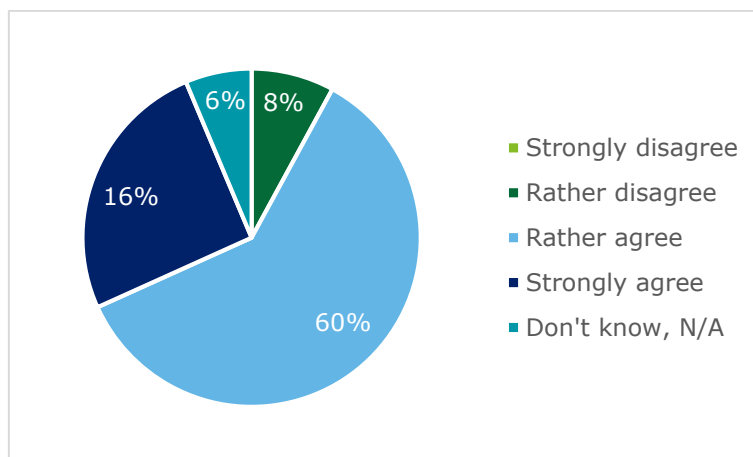


Figure 18. "SET Plan contributed to the development of strategic planning that directs research and innovation efforts towards low-carbon energy technologies and infrastructure outlined in EU energy and climate regulatory frameworks, as well as in key sectoral initiatives and strategies." (63 respondents)

The fact that the SET Plan offers a common vision on the future of the energy sector was mentioned as a key outcome several times in the questionnaire's answers.

5.2.2.4 Contribution to the mobilization of public and private funding

For 57% of the respondents, the SET Plan contributed to further mobilising cost-effective, complementary and targeted public and private R&I investments in the field of energy technologies and infrastructures.

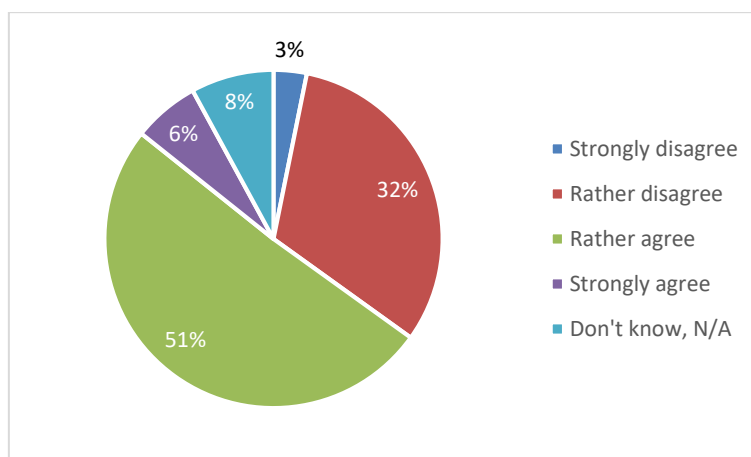


Figure 19. "SET Plan contributed to further mobilising cost-effective, complementary and targeted public and private R&I investments in the field of energy technologies and infrastructures." (63 respondents)

However, there are varying views on this. Firstly, some do not consider the SET Plan as a funding vehicle (but instead as a compass to align national energy research agendas), most interviewees believe that the SET Plan does not sufficiently mobilise European, national, and private funds for R&I investments in low-carbon energy technologies, despite clear targets for the number of cross-border SET Plan-funded projects in the IWGs' Implementation Plans. While most recognize the role of the ERA-NET's programs in directing national funds towards funding cross-border R&I projects, European and national funding schemes, as well as private funding initiatives, are being leveraged without any SET Plan intervention in most of the R&I areas covered by the SET Plan. Now, with the Clean Energy Transition Partnership (CETP) taking over the mandate of the ERA-NETs (SET Plan objectives are the core to define the allocation of CETP fundings), it is widely recognized that the SET Plan has the potential to play a leading role in mobilising funds for the development of co-funded projects. It should be noted, however, that for the representatives of the Ocean Energy, Positive Energy Districts, Energy Efficiency in Buildings, and CCS-CCU IWGs, the SET Plan has adequately leveraged fundings.

In addition, the majority of interviewees believe that the SET Plan does not sufficiently mobilise EU, national and private fundings dedicated to R&I investment. This is confirmed by inputs from the questionnaire (see Figure 20).

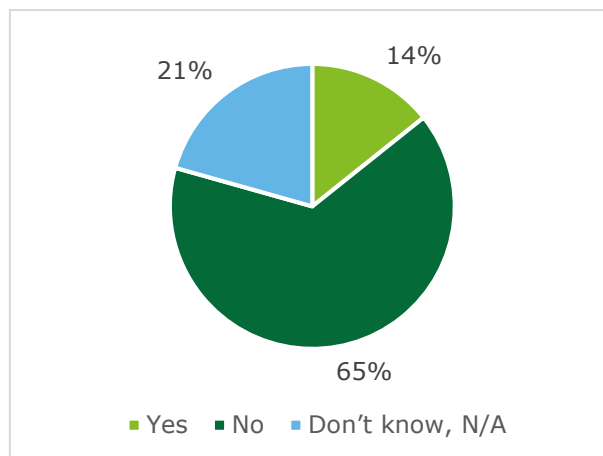


Figure 20. "Does the SET Plan adequately mobilise EU, national and private fundings dedicated to R&I investment (sufficient, targeted and coordinated fundings)?" (63 respondents)

IWG chairs/co-chairs and Steering Group members interviewed pointed out the following barriers for SET Plan to adequately mobilise EU, national and private fundings dedicated to R&I investment:

- There is considerable uncertainty as to whether the SET Plan actually influences national governments' decisions on the provision of public R&I funding. In other words, for some stakeholders, national governments are not influenced by the SET Plan when deciding on their R&I funding schemes. The SET Plan is basically viewed as a platform for the R&I community to align on the same objectives, thereby allowing it to speak with one voice when seeking funding from national governments.
- Insufficient capacity to leverage adequate fundings for some low-carbon energy technologies is due to the fact that some of these technologies do not benefit from an adequate visibility in many national governments, which leads to an underrepresentation of these technologies in the national R&I agendas.
- With the launch of the Horizon Europe Cluster 5 Program and several other EU R&I programs and partnerships covering low-carbon energy technologies, the attention given by national governments and the private sector to the IWGs and the associated ERA-NET co-funding programs has diminished, leading to the SET Plan (through ERA-NET) not being regarded as the appropriate vehicle for national governments to turn to for funding transnational projects.
- The difficulties encountered by the SET Plan in effectively mobilising national funding through the ERA-NETs can be attributed (in part) to insufficient standardisation of the project eligibility and selection processes across the R&I schemes in SET Plan Countries. As each national R&I funding agency has its own rules, this lack of streamlined approaches creates barriers to raising the adequate resources to fund transnational projects. The same is true for EU funding instruments (i.e., ERA-NETs, Horizon Europe, Co-Fund programs, etc.), where the lack of standardised approach to select and provide funding to projects is hampering adequate allocation of funds.
- Large-scale mobilisation of private funding is challenging, as private stakeholders tend to gravitate towards R&I initiatives which can yield short-term results, whereas R&I in the field of low-carbon energy technologies operates in a medium- to long-term time horizon, due to the high capital intensity required to develop R&I initiatives in this field. Consequently, there is a strong mismatch of interests

between the private sector and public institutions (both EU and national), resulting in poor representation of industries in the IWGS.

- Some IWG representatives stressed the necessity for the SET Plan to not only focus on funding R&I projects in the low TRL levels, but also to contribute to the leap from TRL 7 to TRL 9, which is a prerequisite for enabling the mass market developments needed to achieve the EU Green Deal objectives.

Proposed solutions from interviewed stakeholders to ensure greater ability of the SET Plan to mobilise EU, national and private fundings dedicated to R&I investment:

- To increase EU funding in low-carbon energy technologies that do not have sufficient visibility in many countries (e.g., geothermal) can be a way to stimulate interest and eventually boost public (national) and private funding.
- To position the SET Plan as the appropriate vehicle for national governments and the private sector to fund (transnational) projects, the visibility of the SET Plan should be enhanced around a clear narrative that frames the SET Plan as the scheme that links public and private stakeholders in the field of European R&I for low-carbon energy technologies.
- To ensure that government officials involved in the IWGs are actively taking part (i.e., through regular consultations) in the drafting of funding programs both at national and EU level.
- Given that there are no significant differences in the scope of Horizon Europe Cluster 5 and SET Plan, and that each of these initiatives have a complementary role in supporting R&I at the EU and national levels (Horizon Europe is made up of European funds while ERA-NETs consist of national funds), duplication of programs remains positive as it entails more fundings available for developing projects. However, stronger connections between these two programs should be ensured to maximise the impact of the project funded. Establishing a closer link between the Horizon Europe Cluster 5 Committee and the SET Plan Steering Group by appointing the same national representatives to both bodies could help to ensure better alignment and thus mutual benefits in R&I projects funded by either programme. Alternatively, Horizon Europe Cluster 5 Committee could be somehow represented in the SET Plan governance structure. Additionally, it would be beneficial to provide clear communication on how the SET Plan work influenced the content and topics covered in Horizon Europe Cluster 5 projects.
- To use only Horizon Europe Cluster 5 through standard calls for projects, which could help mobilise private funds in a coordinated way, while making the process of submitting projects for funding easier and more efficient for industries.
- To undertake joint work between the Commission and the national R&I funding agencies to standardise the rules of the funding allocation process, in order to overcome the insufficient standardisation of project eligibility and selection processes in the R&I programs of the SET Plan Countries and in the EU funding instruments.
- To position the SET Plan as the appropriate vehicle for national governments to fund (transnational) projects, it would be beneficial to appoint relevant national representatives in the Steering Group who are decision-makers and who have good knowledge of their national R&I strategies.

- To strengthen the weight of the private sector's voice by involving the ETIPs in the SET Plan IWGs during the fund-raising process could be beneficial in convincing national governments and the private sector that the SET Plan is the appropriate vehicle for (transnational) project funding.
- To further advance public-private partnerships in the framework of the SET Plan may offer a way to overcome the reluctance of the private sector in engaging into medium- to long-term R&I initiatives, hereby meeting the expectations of both the private and public sectors and eventually allowing for greater involvement of industry in the financing of R&I in low-carbon energy technologies.
- To better exploit state aid schemes used by national governments, in order to contribute with the SET Plan (and other EU finding mechanisms) and enable the leap between TRL 7 to TRL 9. Greater involvement, coordination and communication between national ministries with complementary areas of competence (i.e., energy, R&I) and R&I funding agencies needs to be ensured to align state aid strategies.
- To ensure continuous monitoring of R&I public investments (at the national and EU levels). The establishment of an open repository database mapping public (and private) funding for low-carbon energy technologies in Europe could help to assess and monitor the extent to which adequate funding is being mobilised in each country and by technology.
- To create rolling funding instruments dedicated to providing funding to specific low-carbon solutions and technologies (i.e., renewable heat supply to industry). The development of this type of targeted funding instruments would help to dilute risks over a larger number of projects while focusing investments on a specific area, therefore facilitating risk assessments and investment strategies. It would also ensure systemic funding aimed at increasing the technologies' TRL readiness and market uptake.

5.2.2.5 Contribution to the coordination and co-funding of targeted actions

For 65% of the respondents, the SET Plan is contributing to the coordination of targeted actions at national and EU levels.

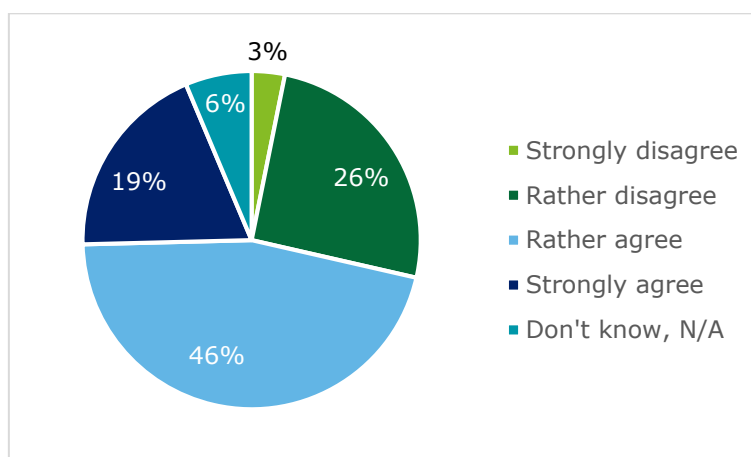


Figure 21. "SET Plan is contributing to the coordination of targeted actions at national and EU levels." (63 respondents)

The fact that the SET Plan is synchronising the efforts of the countries was mentioned as a key outcome by multiple respondents. The SET Plan has a synergy effect through the collaboration it enables between different stakeholders from different SET Plan Countries. This was also stressed in the interviews, during which it was highlighted that the SET Plan

has been very helpful as both the IWG and ERA-NET helped bring together representatives from European Member States. This is particularly important for some sectors because, even though the number of projects is relatively small, the budget needed per project is significant and co-investments as well as national coordination are key to accelerate developments. This coordination comes from the collaboration that started with the creation of the SET Plan.

5.2.2.6 Contribution to driving down the costs of energy technologies

For 46% of the respondents, the SET Plan (significantly) contributed to driving down the costs of existing energy-related technologies. On the other hand 35% disagree with this statement.

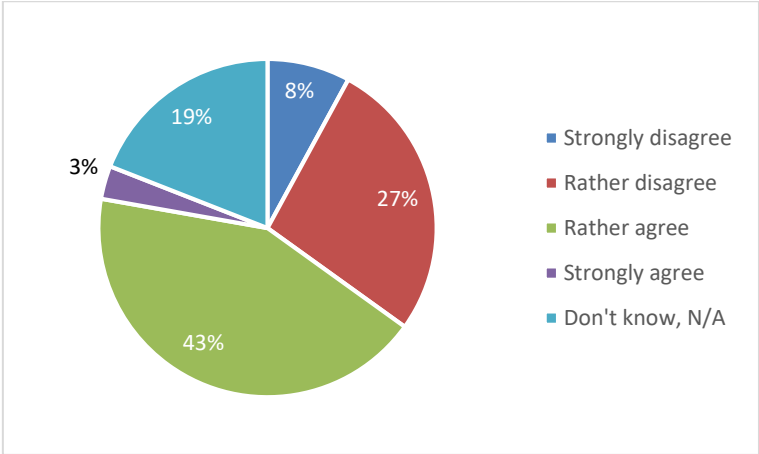


Figure 22. "SET Plan (significantly) contributed to driving down the costs of existing energy-related technologies." (63 respondents)

This dimension of the evaluation was only done through a survey and were not addressed in the interviews. In addition, it would be difficult to link directly the SET Plan contribution to drive the costs of energy technologies down since this depends on a variety of factors, including those not related to SET Plan.

5.2.3 Factors with the biggest positive impact on the achievement of the objectives

The factors influencing positively the achievement of the objectives of the SET Plan that were the most mentioned during the interviews were the composition of the IWGs as well as the collaboration between actors and the synchronisation of the efforts.

5.2.3.1 The governance bodies' composition

As regard to the composition of the IWG, there is unclarity on how high-level representatives are nominated by the countries, and if those have an adequate decision-making power (or access to decision makers). The representatives of the SET Plan Countries do not always hold a key position within their organisation to make impact. The importance of strengthening the contribution and encouragement of 'less active' members to be involved were mentioned several times. Sufficient engagement of the SET Plan Countries is a key factor for the achievement of the SET Plan objectives and targets. Currently, not all the countries are equally represented in the IWGs, and there is a need for strong representation and mobilisation. This requires an interest in and support for the SET Plan at the political level.

The involvement and on-time mobilisation of relevant stakeholders (industry, SET Plan Countries, research institutes), which is perceived to be inadequate, should be boosted. Some interviewees indicated that other stakeholders, such as the industry, should be brought into the IWG.

Proposed solutions by the interviewees to ensure that the SET Plan objectives and IWGs' targets are achieved:

- To simplify the governance structure by potentially decreasing the number of stakeholders groups (IWGs vs ETIPs vs ERAs) as well as the redundancy between groups and discussions on the results of the activities. One option could be to merge the ETIPs with the IWGs.

Proposed solutions from interviewed stakeholders to ensure that ETIPS, EERA and ERA-NETs are collaborating with the IWGs:

- To have more technical (industrial/academic) knowledge as well as people who know how the government processes work and people who have relations for funding in the IWGs.

5.2.3.2 The partnerships and dialogue between stakeholders

The synchronisation of the SET Plan Countries' efforts was mentioned as a key factor contributing to the achievement of the SET Plan objectives and targets. According to the interviewees, the coordination of R&I initiatives between SET Plan Countries fosters connections and dialogue. It is important to ensure that the R&I community understands the activities of ongoing R&I programs. Trans-national co-funded EU partnerships are also a mentioned factor.

In addition, the collaboration and the alignment between actors is a key factor that was mentioned several times. Governments, industry and research institutions should be coordinated, namely by increasing the communication and improving the understanding between each other, as well as ensuring alignment between their initiatives as much as possible. The IWGs should engage with these stakeholders and establish collaboration between them. Some IWGs consider it as necessary to have a forum, as it brings together the stakeholders in the sector and engage them.

Proposed solutions from interviewed stakeholders to ensure the SET Plan objectives and IWGs' targets are achieved:

- To put the focus on dedicated task forces instead of a forum in order to have more focused discussions, as the forum does not always lead to an alignment due to the important number of stakeholders involved.

5.2.3.3 The relationship with the Commission

Being well connected to the Commission is a key factor: it is important that IWGs are proactive in engaging with the Commission to discuss and align with the EU communications and regulatory developments. Moreover, stakeholders mentioned that the Commission should provide support for development at the political level.

5.2.3.4 The resources

The IWGs mentioned that funding, both national, EU (via Horizon) and private, was a key factor contributing to the achievement of the objectives and targets as it is an important tool to support innovation. In addition, the SET Plan is perceived to have an influence on the future funding topics. Some interviewees mentioned that the accessibility to funding

should be increased in order to address emerging R&I collaboration needs. Funding is considered instrumental to push down the costs of the technologies. While the IWGs and the ETIPs used to benefit from two separate grants in Horizon 2020, Horizon Europe now allocates only one grant to both, which can be expected to strengthen cooperation and collaboration.

The support of the structures (both the IWGs and the Bureau) was mentioned to be a key factor as well. The Secretariat can support the work of the IWGs by ensuring a smooth operation of the activities, but also support with the monitoring of progresses against their target, alignments between the stakeholders involved in the IWG, and with the development and operation of cross-border projects. Some ETIPs and IWGs benefit from a support structure that acts as secretariat and delivers industry support through the monitoring of the progress towards the targets and the fostering of cross-border projects and alignment between actors. If it is the same team that coordinates both the ETIP and the IWG, it is considered useful both to ensure effective collaboration and to avoid the duplication of work between entities. The Horizon 2020 Call for the administrative support of the IWG work had a big positive impact, as it gave resources to public funders, but it also motivated them to develop a more strategic thinking and long-term planning in order to achieve a common objective. It is also easier for other structures to cooperate with the IWGs that have a CSA as communication is more efficient.

Proposed solutions from the interviewees to ensure that the SET Plan mobilises the funds effectively:

- To have more grants dedicated to policy- and market-oriented projects, showing the blocking factors or incentivising the deployment of technologies in the SET Plan Countries. Given that the SET Plan does not have direct decision power on the implementation measure choices of the countries, this type of project would indirectly help with the implementation of measures and, therefore, the achievement of targets.
- To provide travel grants for occasional SG and IWG meetings in Brussels. Physical meetings increase the possibility for operational collaboration and the engagement from all countries, however these are costly for national administrations.
- To harmonise the support across IWGs (and ETIPs), as not all IWGs have a secretariat at the moment. A central secretariat, which would make sure that the IWGs are meeting on a regular basis (e.g., twice a year) and that their reporting processes are harmonised, could be set-up.

5.2.3.5 A common vision

Having a common vision for the future of the energy sector and harmonising different actions and national priorities were also mentioned as key factors by the interviewees. They mentioned that the importance of having common planning between the IWGs and the ETIPs to achieve the targets of the SET Plan. According to some interviewees, ETIPs are crucial for the development of the strategic innovation and research agenda, which serves as a basis for the work of IWGs. However, according to others, ETIPs do not always seek collaboration with the IWGs, and vice versa.

5.2.3.6 The communication and visibility

Having a clear communication of the SET Plan objectives and purpose, also to “new joiners”, is an important factor highlighted in the interviews. According to the IWGs, the current and the future focus areas should be better communicated, as well as the achievements of all IWGs. According to them, it is important to disseminate the results of the IWGs to achieve a meaningful impact.

Proposed solutions to ensure more communication and visibility of the SET Plan:

- To increase the visibility of the SET Plan by working on its image and its communication, given that currently the initiative is still not well known within the EU. According to an interviewee, the Steering Group should have closer exchanges, for example during a new dedicated SET Plan event. As the SET Plan Conference objective is to attract investors and talk to policy-makers, a Convention for the Steering Group would be more valuable to discuss reporting and other relevant matters.
- To establish effective communication channels for IWGs towards the Commission and the national authorities on policy priorities.

5.2.4 Existing and future barriers to achieving the objectives

While a few IWGs expect their targets to be mostly achieved, most IWGs face barriers. The main barriers that negatively influence the implementation of the IWG activities and the achievement of their targets are the lack of interest from some SET Plan Countries and their low level of engagement.

5.2.4.1 The low level of engagement from countries

The level of participation by the representatives of many SET Plan Countries in meetings appears to be low; some representatives either do not come to the meetings or even if they are present, they do not actively contribute to the discussions. It appears difficult to get the countries onboard and have them to contribute substantially to the IWGs, according to the interviewees. There is an identified pattern that the “new” SET Plan Countries, such as the newer EU MS, are less active than the “older” participants, such as from Western and Northern European countries. This lack of engagement hampers effective cooperation and the progress towards meeting the common goals.

Stakeholders pointed out several factors as potential reasons for this low level of involvement from SET Plan Countries. These are further developed in 5.3.9 Level of engagement of stakeholders towards the SET Plan.

5.2.4.2 The lack of resources

The achievement of the targets depends on what national government, EU bodies and private companies decide (e.g., on where to invest). According to the people interviewed, there is a lack of adapted and attractive financing. In general, the amount of funding is too little to make a big difference for the running trends. There is no specific funding to achieve those objectives, e.g., for large scale demonstration projects. More funding would give some discipline to the actors, and it would make them think of what they want to achieve in the next years. Also, representatives have no incentives in getting Horizon Europe funding.

5.2.4.3 The lack of cooperation between entities

Interviewees pointed out that the IWGs were sometimes not communicating among them, while more links between their targets and activities could be made. According to some, this could be explained by the fact that there is no shared mission for the SET Plan. In

addition to this, there is little cooperation between the IWGs, as well as a general lack of dialogue and trust between the structures (including between the different IWGs). Also, the ETIPs and the IWGs should cooperate more to ensure that there is an alignment between their activities and no redundancy. Finally, the SET Plan was found to be not using EERA effectively as a working group for directing / pushing the SET Plan forward, even though EERA could be considered a key element to guide the scientific direction of the SET Plan. In summary, the position of EERA within the SET Plan remains unclear.

5.2.4.4 The lack of visibility

Some interviewees feel that the results and the impacts of their activities are not visible enough at the EU level and in the energy field. They also stressed that they would like to have more feedback from the Commission on their work. Moreover, there is a lack of transparency about the SET Plan, its objectives, its activities and its members. It is not easy to access certain information, namely the names, positions and contact details of the representatives and other members (e.g., there is a difficulty to reach members that are not directly working together). The SET Plan could communicate more openly on these aspects. Stakeholders pointed out several elements as potential reasons for this low visibility of the SET Plan and their proposed solutions to these. They are explained in detail in 5.5.6 Increase of the SET Plan visibility.

5.2.5 Activities that contributed the most and least effectively to the achievement of the objectives

According to the different stakeholders groups included in this evaluation, the SET Plan effectively enabled the synchronisation of the efforts of different SET Plan Countries, and also the efforts between the government, the industry and research institutions. This was achieved through developing a common vision and planning, as well as enabling activities such as the Commission support and the CSA.

On the other hand, stakeholders also recognised some activities and behaviours hindering the efficiency of SET Plan implementation. The most frequent comment was on the lack of engagement and commitment by some IWG members, which can mostly be attributed to their non-mandatory role in the SET Plan implementation and/or the related influence of the delegate within their organisation. Under-resourced activities, inadequate visibility activities, as well as lack of collaboration between the ETIPs, the EERA-NETs and the IWGs were mentioned as well.

5.3 Efficiency of the SET Plan

5.3.1 Efficiency of the current SET Plan governance structure

The SET Plan governance structure is generally adequate, but could be more efficient in its operation. A number of factors prevent the SET Plan governance structure from being as efficient as it needs to be able to achieve its intended objectives, namely the lack of clear decision-making authority, the lack of commitment/involvement of some stakeholders and the lack of access to information.

Stakeholders stated that the SET Plan governance structure is generally adequate, but lacks some efficiency in its operation. There is room for improvement when it comes to SET Plan governance, as explained below.

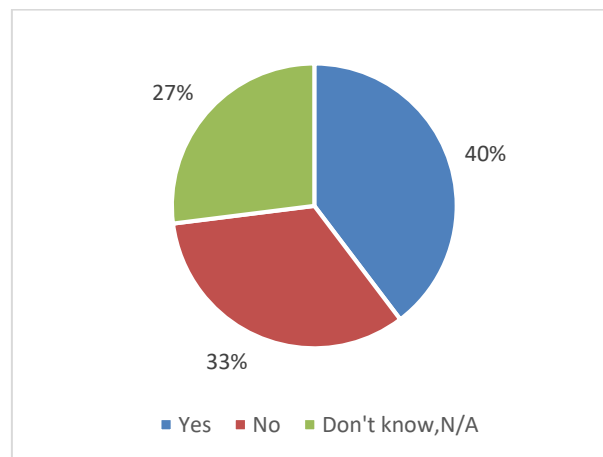


Figure 23. "Do you believe that the current SET Plan governance structure (Steering Group and Bureau) is adequate and efficient?" (63 respondents)

The stakeholders mentioned the following factors to impact the adequacy and the efficiency of the SET Plan governance structure negatively:

- The Steering Group lacks clear decision-making authority which has two main consequences: 1) a handful of SET Plan Countries take on the coordinator role, sometimes pushing their own national interests and R&I agendas; 2) other SET Plan Countries (often Central and Eastern European countries) struggle to see an added value in taking a more active role in the Steering Group, and tend to further decrease their already limited involvement. As a result of this, an unbalanced coordination of R&I efforts between participating countries occurs.
- The level of efficiency of the Steering Group and of the Bureau depends largely on the personal engagement and interest of the SET Plan country representatives. Should an active national representative be replaced by someone less engaged, major slowdowns can occur.
- The composition of the Steering Group (Bureau) is frequently changing and lacks continuity when a new national representative is appointed, which leads to internal operational inefficiencies.
- Given that the members of the Steering Group and of the Bureau have many other positions and responsibilities aside from their role in the SET Plan governance, their involvement in the SET Plan activities is limited by the time they can devote to their Steering Group (Bureau) member role. This situation can lead to operational

inefficiencies as Steering Group (Bureau) members often struggle to be fully committed to the completion of tasks that fall under their alleged responsibilities.

- Often, members of the Steering Group and of the Bureau do not have direct access to national policy decision-makers, therefore limiting the impact of the SET Plan on the policy decisions made in their respective country. This lack of influence results in a lower level of personal commitment among members (due to their perception of having limited impact). Also, because of lack of human resources in national governments, representatives of many SET Plan Countries, particularly the “smaller” countries, are often not specialised in energy technologies or policies.
- Given that there is no overarching mapping that details the composition of each of the entities related to the SET Plan (Steering Group, IWGs, ETIPs, CSA, etc.), it is difficult for all parties to know who to reach out to when necessary.
- At the national level, the level of communication and cooperation between the ministries in charge of research and innovation and the ministry of (energy) policy could be insufficient, leading to lack of political willingness to commit time and resources in advancing the agenda of the SET Plan.
- There is perceived lack of visibility of the industry (ETIPs) and the research community (EERA) in the SET Plan governance. Both seems excluded from the high-level discussions, leading to lack of first-hand input that would make Steering Group decisions more effective. In short, the current structure fails to bridge the gap between energy policy and energy technology policy.
- There is very little interaction between the lines of work of the Steering Group (Bureau) and the IWGs and ETIPs. Most of the members of IWGs and ETIPs are not aware of the work and activities conducted by the Steering Group, and vice versa. There is no real follow-up from members of the Steering Group on the work conducted by the IWGs and ETIPs.
- Steering Group online meetings are not as effective as physical meetings, with most of the members not providing as much inputs as they usually do.
- It seems that the ability of the Members to have a good command of the English language is a factor that influences the level of involvement of members in the Steering Group discussions and activities.

Proposed solutions from interviewed stakeholders to increase the adequacy and efficiency of the current SET Plan governance structure

- The Commission should support the national governments in appointing the representatives in the Steering Group who are sufficiently high-level to directly talk to the national policy decision-makers, therefore enabling them to have an influence on the decisions made in their respective countries. Such a push can be specifically mentioned and formalised in Terms of Reference applicable to all SET Plan Steering Group members.
- The ETIPs need to be much more involved in the overall SET Plan governance. Therefore, it would be appropriate to create a “Scientific Advisory Committee” attached to the Steering Group and composed of representatives of the ETIPs and EERA, and who would act as an advisory body that will bridge the gap between the fields of energy policy and energy technology policy.
- The role of the Bureau in the governance of the SET Plan should be strengthened and formalised in Terms of Reference. In the current setting, the Bureau acts

essentially as the link between the Commission and the Steering Group. In order to increase the perceived influence of the SET Plan on the European R&I strategy in low-carbon energy technologies, it would be appropriate to delegate the reflection work currently done by the Commission to the Bureau. Concretely, the 7-8 main driving countries represented in the Bureau (preferably geographically balanced) could have the mandate to co-define with the Commission the strategic orientations of the SET Plan, and then to effectively communicate the agreed strategy to the Steering Group, IWGs and ETIPs.

- The Steering Group need to put more efforts on following-up after meetings so that all parties understand what has been agreed upon and what are the next steps.
- Regular sessions (every 4 months) could be organised for the chairs and the co-chairs of the IWGs to report to the Steering Group on the progress of the annual measurable objectives against their Implementation Plan. These regular status update would boost the interaction and understanding between the Steering Group (Bureau) and the IWGs.
- The Commission should facilitate the organisation of physical Steering Group meetings every 4 to 6 months.

5.3.2 Efficiency of the current SET Plan IWGs structure

Most of the interviewed IWG chairs and co-chairs and almost half of the respondents to the questionnaire find the SET Plan IWGs structure is adequate and efficient. With a few exceptions, the most relevant topics are covered, and the key technologies are already within the scope of the IWGs. However, it seems that the SET Plan IWGs structure could be improved notably by developing R&I initiatives in crucial topics not enough covered by current activities (e.g., renewable heating and cooling, hydrogen, energy system integration), dismantling the silo approach to development of R&I initiatives and including in its scope research in the field of Social Sciences and Humanities.

Most stakeholders believe the current structures of the IWGs is working well (46%), although nearly a similar share of the respondents (41%) do not agree.

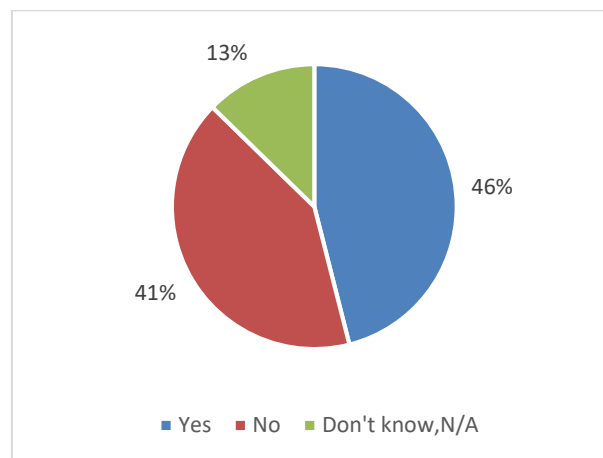


Figure 24. "Do you believe that the current SET Plan IWGs structure is adequate and efficient? (63 respondents)

Stakeholders identified the following factors that make the current SET Plan IWGs structure suboptimal:

- The current structure of the IWGs do not put enough emphasis on developing R&I initiatives in the fields of renewable heating and cooling technologies (e.g., solar thermal), energy system integration and renewable hydrogen.
- Building resilient low-carbon energy systems does imply strong interconnection of multiple technologies. However, the current structure of the IWGs is based on a siloed approach, which does not adequately encourage the development of cross-sectoral R&I initiatives.
- The SET Plan does not encompass within its R&I activity scope topics in the field of Social Sciences and Humanities to better understand the impact of the development of specific low-carbon technologies in the context of the energy transition on households and communities.

Proposed solutions from interviewed stakeholders to increase the adequacy and efficiency of the current SET Plan IWGs structure:

- Emphasis on developing R&I initiatives in renewable heating and cooling technologies (e.g., solar thermal), energy system integration and renewable hydrogen through the creation of dedicated IWGs could be further strengthened.
- The silo approach to development of R&I initiatives could be overcome by:
 - Organising more frequent plenary meetings (i.e., every 4 or 6 months) with the Steering Group, the IWGs, the ETIPs and the EERA during which all entities would be informed about the status of the activities that are being conducted in the framework of the SET Plan, along with the specific associated targets and timeline.
 - Organising recurrent specific forums/workshops with IWGs and ETIPs to exchange and explore the potential cross-sectoral collaborations that could be established between two or more IWGs. Each implementation working group should continuously assess cross-cutting dimensions in order to avoid overlapping activities, develop adequate connections and synergies with other Implementation Plans and reduce overall costs.
 - Formalising in the revised Implementation Plans of the IWGs the ambitions in R&I initiative development that will require the establishment of formal collaboration with other IWG(s).
- To formalise in Terms of Reference specific expectations regarding the role and responsibilities of the IWG stakeholders (chairs, co-chairs, and other country representatives). Specifically, these Terms of Reference should delineate the level of qualification needed, the precise scope of individual and collective responsibilities, and the role of each IWG stakeholder in executing the Implementation Plan.
- The SET Plan should include in its scope a wider portfolio of research, including in the field of social sciences and humanities in order to better understand the impact of the development of specific low-carbon technologies in the context of the energy transition on households and communities.

5.3.3 Efficiency of the current internal IWG structure

The current internal structure of the IWG is adequate and efficient, but factors unrelated to the internal structure of the IWG negatively affect the efficient functioning of the IWGs.

There is a general consensus among IWG chairs and co-chairs that the current internal structure of the IWG is adequate and efficient. However, stakeholders identified some factors that negatively affect the proper functioning of the IWGs. The following inefficiencies were pointed out:

- In the vast majority of the IWGs, most of the SET Plan Countries represented in the IWGs are not actively participating in the work of the IWG, or at least are not contributing to the expected level. The main reason for this lack of commitment on the part of many SET Plan country representatives is the lack of clarity about the added value that participation in IWG activities would bring to their national governments.
- In most of the IWGs, there is little or no direct channels with the high-level national policy-makers that have the power to make decisions on the national orientations of R&I in low-carbon energy technologies and associated fundings. This inability from most of the national representatives involved in the IWGs to effectively influence national policies is a significant barrier to the efficient operation of the IWGs towards achieving stated goals.
- Most of the representatives from IWGs which do not have the support of a CSA stated that the lack of human resources is a factor that contributes to the inadequate operation of the IWGs.
- There is a lack of clear alignment on the scope of the work that is being conducted by the IWGs. While some of the IWGs are focusing their work on the development of transnational R&I initiatives, others are focusing on gathering the most relevant industrial and SET Plan Countries representatives to foster discussion, alignment on priorities and objectives and transfer of knowledge.
- The proper functioning of the IWGs is highly dependent on IWG's chair and co-chair engagement and motivation.

Proposed solutions from interviewed stakeholders to increase the efficiency of the IWGs

- To increase the level of engagement of the national representatives involved in the IWGs by giving more clarity on the added value that participation in IWG activities would bring to national governments.
- To strongly incentivise national governments to appoint national representatives who have decision-making power or, alternatively, who have directed a channel with the high-level national policy-makers that have the power to make decisions on the national orientations of R&I in low-carbon energy technologies and associated fundings.
- Should the number of representatives in IWG increase, it would be key to ensure that this expansion of the team leads to expansion of the links and connections with high-level government officials SET Plan Countries.

- Having the support of a CSA would enable each IWG to collect relevant data and information on the relevance of the R&I agenda on behalf of country representatives, report on activities and progress, and help foster linkages with senior government officials in SET Plan Countries would be very valuable to all IWGs.

5.3.4 Efficiency of synergies/collaborations between the SET Plan governance and protagonists, and the EERA, ETIPs, ERA, CSAs, and ERA-NETs

The full potential of synergies and collaborations between the supporting organisations and the Steering Group and IWGs is currently not attained.

While some representatives of SET Plan supporting organisations acknowledge already efficient cooperation and communication with the SET Plan Steering Group and IWGs, many factors have been identified as limiting the full potential of synergies between these stakeholders. According to representatives of the ETIPs, EERA, ERA, ERA-NETs, CSAs, as well as respondents to the questionnaire, most of these blocking factors could be resolved by better linking the governance mechanisms that are structuring the operation of each of these entities.

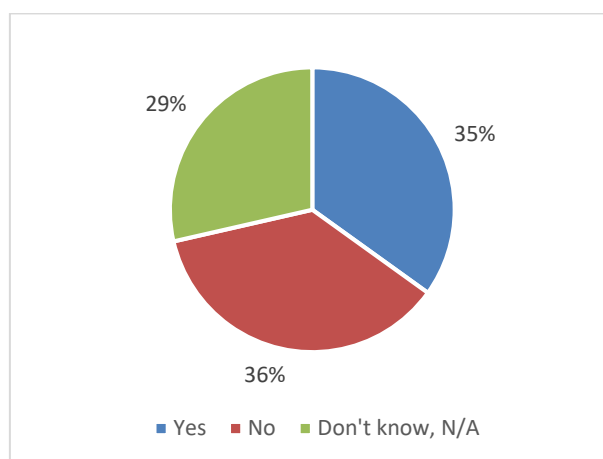


Figure 25. "Do you believe that the synergies between the SET Plan and the supporting R&I organisations (ETIP, EERA, ERA-NETs and Joint Undertaking) are adequate and efficient?" (63 respondents)

Stakeholders identified the following inefficiencies that negatively affect the synergies and collaborations between the SET Plan governance and protagonists, and the supporting R&I organisations:

- Even though there is general acknowledgement that, individually, the supporting organisations (EERA, ETIPs, ERA, ERA-NETs) work quite well (good engagement of the members, clear targets, etc.), there is a common lack of understanding from many stakeholders of how the specific mandate/mission/goal of each of these supporting organisations are complementary. Their specific role in the wider SET Plan ecosystem lacks clarity. Furthermore, in some cases, some stakeholders perceive that the activities and competences of these supporting organisations overlap, and that inadequate cooperation and monitoring mechanisms are in place.

- Overall, there is a lack of perceived involvement of the ETIPs with the SET Plan Steering Group and IWGs. The role of ETIPs in the SET Plan is not adequately highlighted.
- There is a lack of organisational support and commitment from the Commission that would help formalise the key outcomes of the discussions and collaborative progresses made between the IWGs and the Steering Group, and the supporting organisations.
- The current silo-based structure around technological R&I activities is a limit to extensive collaboration between the SET Plan IWGs and supporting R&I organisations in multiple low-carbon energy technologies. This also limits the possibility to address the challenges involving multiple fields.
- There is a lack of coordination and communication between the ETIPs, which makes it difficult for the ETIPs to speak with a single voice to other supporting organisations, the IWGs and the Steering Group.
- Even though positive collaboration between the EERA and the SET Plan framework is ongoing (mainly through EERA's member participation in the IWG), the EERA is currently under-leveraged by the IWGs and the Steering Group.

Proposed solutions from interviewed stakeholders to increase synergies and collaborations between the SET Plan governance and protagonists, the EERA and the ETIPs:

- To have better communication frameworks between IWGs and between ETIPs and IWGs.
- Ensuring greater alignment between the ETIP and the IWG could be achieved by appointing the same team as coordinators of the ETIP, the IWG, the ERA-NET and the EERA for each relevant technology. However, implementing this structural approach to all SET Plan technological area would be difficult and time-consuming, questioning the feasibility of such a proposition.
- To involve ETIPs and EERA in the overall SET Plan governance (Steering Group) as a formal scientific advisory board advising on the high-level agenda of the SET Plan. EERA/ETIPs can also be formally commissioned to influence SET Plan Countries toward stricter alignment of national R&I strategies with the SET Plan.
- The governance structure between the SET Plan Steering Group, the IWGs, and the supporting R&I organisations could be more clearly defined.

Proposed solutions from interviewed stakeholders to increase synergies between the SET Plan governance and protagonists, the Clean Energy Transition Partnership (CETP) and the Driving Urban Transitions (DUT) programmes under Horizon Europe:

The CETP and DUT are good examples showing how the activities of the SET Plan have the potential to be used as the strategic instrument for R&I investment policy-making. The CETP and DUT shows good potential for setting topical priorities along with increased cooperation between SET Plan Countries and sectors. IWGs are well represented in the governance of the CETP.

However, the following concerns have been expressed by the respondents to the questionnaire:

- With regards to the CETP, attention must be paid to the fact that the yearly budget for financing investments in projects is at least the same amount as all the ERA-NETs budget combined.
- Strong attention must be paid at ensuring that the CETP does not transform into a funding vehicle for R&I in renewable-based electricity production and use. The broader set of technologies required for the energy transition, including renewable and low-carbon gases and fuels, as well as renewable heating and cooling technologies must be seen as top priority when deciding on the funding allocation.
- It would be relevant to raise more awareness on the links between the CETP/DUT and the work of the SET Plan, and how the funding calls of these two partnerships take into account the outputs of the IWGs. Clear communication should be made on how the funding calls of CETP and DUT contribute to the achievement of the SET Plan and IWG targets in detail.
- Given the positioning of EERA in the CETP, ETIPs and IWGs structure, additional synergies could be developed by mandating EERA to guarantee consistent strategic coherence between the work of the IWGs and the ETIPs, and funding calls of the CETP.
- The coordination between the CETP and DUT with ETIPs can be further developed and clarified.

Proposed solutions from interviewed stakeholders to increase synergies between the SET Plan governance and protagonists and ERA:

- Links between the ERA and the SET Plan need to be strengthened at the governance level. The representatives of the ERA and of the SET Plan Steering Group at the national level should be in close contact.
- Links between the ERA and the SET Plan need to be strengthened at the operational level. This could be supported by a joint programming framework with communication channels to align on priorities and targets. Also, research activities, such as the Green Hydrogen ERA pilot initiative, should have clear dedicated follow-up actions and applications through the SET Plan.
- The positioning of the SET Plan should be clearly differentiated from the positioning of ERA. While the SET Plan aims at defining R&I orientations in the field of low-carbon energy technologies, the role of ERA is to mobilise the relevant financial and non-financial instruments to support the development of transnational projects aligned with the SET Plan orientations.
- The SET Plan and ERA could cooperate on improving the involvement of SET Plan Countries and Associated Countries (SET Plan Countries) representatives in the framework of their participation in IWGs by undertaking two actions:
 - Lifting existing barriers that have been blocking change of mindsets and new project developments to scale-up at the national level;
 - Redirecting part of public funding to industrial projects in order to advance innovation and competitiveness of low-carbon energy technologies at the European level.
- ERA can be leveraged to facilitate expert involvement in IWGs (which is currently lacking).

- SET Plan activities and accomplishments could be shared with ERA for communication purposes, which would help increase the visibility of the SET Plan.

5.3.5 Adequacy of current national government representation on the IWGs

The IWG membership should be extended to additional national government representatives.

At the moment, on average, around 10 to 15 countries are represented in most of the IWGs. Stakeholders believe that the IWGs should be extended in order to include more representatives. However, this depends on the IWG and the political choices of each country: in some IWGs, enough countries are joining on their own initiative and most key countries working on the technology are already part of the related IWG.

The IWGs members pointed out the following advantages to have more countries represented in the IWGs:

- Overcoming of the current lack of resources needed in order to achieve the SET Plan priorities;
- Access to more discussions on a broader set of topics and with a broader range of stakeholders.

According to some, it would also be beneficial to have all the EU countries involved in the IWGs. However, some countries have very little activities in some technologies, which may explain their non participation to some IWGs. This is due to several reasons, including the potential of the energy resource in a given country. Most interviewees agree on the fact that at least all the EU countries active in a technology should be represented in the linked IWG. When including additional countries to an entity, it is important to ensure that the additional representatives are actively contributing and participating to the IWG.

Overall, there is a need to increase the representation of Eastern European countries in the IWGs; even if the landscape of industries is scattered, they still have great potential, and their industries need support.

Proposed solutions from interviewed stakeholders to have a broader and more targeted participation of SET Plan Countries in the IWGs:

- A “heat map of projects” would be beneficial, visually describing the geographical development of R&I projects per technologies, which could be compared to have a clearer view on the regional developments per technologies.
- Partnership groups should be more involved in the work of IWGs (e.g., Clean Hydrogen Partnership, Built4People, ...).
- A clear value proposition for EU countries could be identified, thus incentivising the dialogue between the right persons in each government.

5.3.6 Efficiency of the reporting methodology developed by SETIS

Some stakeholders think the reporting should focus on showcasing successful stories and on the narrative, others believe it should be focusing on technical KPIs.

The SET Plan Information System (SETIS) monitors the implementation of the Integrated Roadmap and the Action Plan through a reporting system. SETIS helps the implementation of the SET Plan by providing a technology-neutral planning tool, which reflects the current state of the art of the individual technologies and their anticipated technological development and market potential. SETIS also accounts for its progress and achievements through the annual monitoring progress reports. Since 2019, SET Plan Progress Monitoring reports are published annually. The reports namely report on the progress of the IWGs by providing an overview of their individual achievements. The annual SET Plan conferences have been organised since 2008 and offers a chance for decision-makers, stakeholders and researchers to assess the SET Plan's progress. The annual progress reports are released yearly during the SET Plan Conference. The SET Plan is the most appropriate tool to collect, monitor and report on R&D results and to formulate clear conclusions. The NECPs provide an excellent opportunity to make this process systematic and relate it to SET Plan progress (having in mind that reporting requirements for the 5th dimension of the Energy Union in the NECPs are linked with SET Plan and Energy Union overall objectives)³³.

Although many results are widely accessible, not all the results are made available. The SET Plan is supposed to enable the creation of an open innovation ecosystem which capitalises on the results of research and contribution to open science by making many results accessible to all³⁴. Nevertheless, the share of openness varies across IWGs. Most IWGs have identified projects that are either fully or partially open to the SET Plan community. Of 1203 projects identified by the IWGs in 2020, 39 % have results that are partially open to the SET Plan: some deliverables and a final project report are available to the SET Plan community. 26 % of the projects are open: access to scientific information and deliverables is granted to any user. For 31% of the projects no information is provided³⁵.

The process until 2021 was perceived as not effective and time-consuming by IWGs due to the difficulty to get the requested information. There was a significant difficulty in collecting and compiling the relevant indicators all over Europe. Moreover, the topics covered by each IWG are too different to be compared with the same set of indicators. According to some interviewees, a common set of indicators cannot be relevant to measure the progresses of the IWGs, as different IWGs have their own specialities.

Since 2022, the reporting focuses on highlighting successful stories to make it is less technical and more accessible to outsiders so that the work of IWGs can be seen, shared and understood by a wider audience Besides, each IWG has its own assessment criteria and they report on different KPIs, projects and timelines. All the results are gathered in an unique annual report. Reporting on project financing and specifics was not carried out in 2021 and 2022 as it was time consuming and hard to complete by the IWGs.

Stakeholders interviewed have different views on the effectiveness of the current SETIS reporting process in tracking the progress of the IWG Implementation Plans.

On the one side, a good share of stakeholders believe the current reporting process reflects well the activities of the IWGs, gives a good overview of development and progress of the IWGs, and works well as a tool to provide information to the Commission. The fact that it is narrative driven, showcasing some stories about ongoing and successful projects and showing stronger coordination efforts between the relevant entities makes it relevant and fit fur purpose. Moreover, the format is perceived as accessible, not too technical and accessible also to a larger community beyond SET Plan immediate stakeholders (e.g. politicians and decision makers). Also, the current process is perceived as adequate as it

33 SET Plan Agenda 2018-2023

34 C(2015)6317 - Towards an Integrated Strategic Energy Technology (SET) Plan : Accelerating the European Energy System Transformation 2015

35 "Implementing the SET Plan – 2020" progress report

does not require too many resources to be performed. According to this view shared by some stakeholders, “the reporting development is positive and the direction taken should be maintained”.

On the other hand, some interviewees are not in favour of the current format. Due to the fact that the indicators used by the reporting system are very broad, some say it is not possible to draw relevant conclusions that bring insightful information. According to them, the report shouldn't be focusing on the achievements of the IWGs, as it is difficult to provide this information in a concise manner with a clear cause and effect link. Moreover, some stakeholders mentioned that the KPIs are not adequately communicated to the IWGs and that some IWG focus on projects for which the outputs are not visible.

Proposed solutions from interviewed stakeholders to improve the reporting:

- To ensure EU (grant) funding to hire someone whose task would be to collect all the relevant data as currently people involved in the IWG are lacking time to complete this work. One option would be to include the tracking of the progresses within the mandates of a horizontal CSA (as it is already the case in some IWGs thanks to their individual CSAs).
- To focus more on highlighting the success stories of each IWGs in the report, to better reflect their achievements and progresses. It is important to highlight individual successful projects per IWGs rather than reporting on a common set of indicators. Looking at the achievements of the IWGs and telling success stories would be more valuable for the development of the IWGs activities.
- To better monitor progresses individually achieved by each of the entities (IWGs, ERA-NETs, ETIPs).
- To foster greater cooperation with the other relevant DGs (i.e., CLIMA, GROW), so that the reporting would be better integrated within a broader Commission update on the progresses made in the EU Green Deal framework. According to interviewees, such a decision would make the narrative stronger.
- To use a simple and unified set of indicators across countries and stakeholders, so that the indicators can be easily assessed and compared between SET Plan Countries and/or technologies. The goal is to provide more granular information (than that available in national statistics) to track progress across technologies from the Commission side (to increase response rate and involvement of Central Eastern European countries). This entails also more national-level data collection.
- To communicate with higher political level (visibility outside community is currently not certain).
- To clarify the objectives of the SET Plan (defining the year's programme, with milestones and deliverables, and monitoring progress). It is necessary to clarify the objectives to be achieved in order to be able to determine the extent to which the objectives are achieved.
- To highlight in the report if a SET Plan is active and following a strategic approach which is valid for Europe.

5.3.7 Factors with the biggest impact on the efficiency of the operations of the SET Plan

The factors with the biggest impact on the efficiency of the SET Plan are the support team such as a CSA, the financial support, the communication between stakeholders and the size and stability of the entities.

According to the IWGs members, the factors with the biggest impact on the efficiency of the operations in their IWG are :

- **Support:** the biggest impact is made through adequate support team. Having a CSA has a real impact on the running of activities of the IWGs. As many IWGs have not dedicated funding in the form of a CSA for all secretariat-type of work, IWGs members have no choice but to do it themselves, which in turn entails less time to make progress on the core of their IWG-related work.
- **Funding:** financial support for the running of the implementation group, e.g., for the travels, the monitoring, etc. is another key factor. There needs to be some support in the industry and the government., as there have the necessary funding. Currently, the lack of funding is often an issue.
- **Communication:** for some IWGs, the level of communication with the Commission is perceived as inadequate and too limited. Also, there is the perception by some IWGs that there is a lack of guidance from the Commission and not enough partnerships are being developed.
- **Size:** if a IWG is too large, not everybody is involved at the same level. In some case, it might be useful to have a core group with the ones that are the most interested and active.

According to the Steering Group members, the factors with the biggest impact on the efficiency of the operations of the SET Plan are :

- **Stability:** the EC officials assigned to the SET Plan are changing quite frequently, which results in the loss of organisational knowledge and hinders continuity of efforts.
- **Clarity:** during the past meetings, the activities and direction of the Steering Group was unclear to some members.

Proposed solutions from interviewed stakeholders to increase the efficiency of operations are addressed under other evaluation topics.

5.3.8 Activities that are the most and least cost-efficient

According to respondents to the questionnaire, the activities delivering most results with optimal resources are :

- **Transnational R&I programming and funding,** as it has resulted in significant alignment in the national R&I funding schemes of the participating countries and strengthen research and innovation across Europe.
- **IWG workshops and strategic round tables** to align industry, research and SET Plan Countries.

- Alignment within R&I community, including discussions between the Commission, European Research Institutions and Industry to identify and align on priorities.
- Support provided through the CSA.

According to respondents to the questionnaire, the activities that are taking most of the resources and time are:

- The development of the Implementation Plans: as the purpose and goal were not clear, it took a lot of efforts to perform this exercise. Moreover, some respondents question the usefulness of the documents. Moreover, the updating of the Implementation Plan implied large efforts for many participants.
- Annual SET Plan Conferences: it has been difficult to involve and engage with the SET Plan Countries. Also, the conference focuses on a relatively narrow range of topics and include a lot of discussions, but not enough actions.
- The progress tracking of the Implementation Plan targets.
- Steering Group meeting: sometimes information provided at Steering Group meetings is repetitive to the delegates who participate in other related EU energy research and innovation initiative.

Proposed solutions from interviewed stakeholders to enhance the cost-efficiency of the activities are addressed under other evaluation topics.

5.3.9 Level of engagement of stakeholders towards the SET Plan

The level of engagement demonstrated by the different SET Plan Countries highly varies from one country to another. While some representatives are well involved and actively engaging in the activities, others don't actively participate during - or even attend - meetings.

There is an overall consensus among the SET Plan members on the fact that there is a disparity in the level of engagement demonstrated by the different participating countries. Our interviews suggest that some participants are more involved and actively engaged in the SET Plan activities than others. A low level of engagement is described as a lack of presence in meetings or/and a lack of participation during these meetings. It appears that, while countries involved in the Bureau generally showcase higher levels of commitment, Eastern European countries usually showcase lower levels of engagement.

This is confirmed by the answers to the questionnaire, which highlight that only half of the interviewees (52%) assess their level of engagement as high or very high.

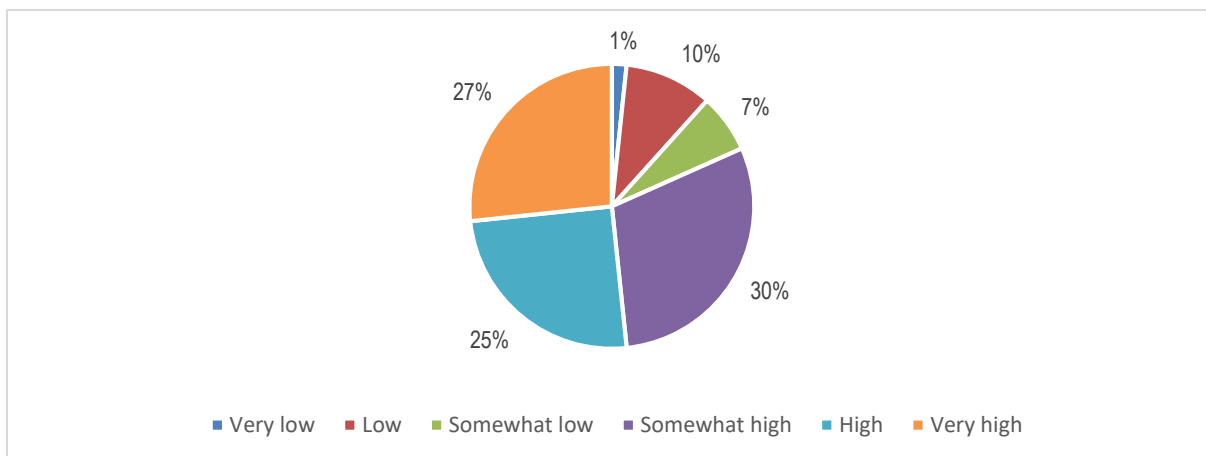


Figure 26. "How would you assess the level of engagement of your organisation in the implementation of the SET Plan?" (63 respondents)

Reasons for the lack of engagement are various and intertwined. Stakeholders pointed out the following elements as potential reasons:

- **Non-adequate profile of countries representatives.**
 - Countries representatives are not allowed to make commitments on behalf of their countries. The representatives involved in the IWG do not always have a mandate to take decisions.
 - Many officials representing their country in the SET Plan IWGs do not always have a solid technical background, and therefore do not see the urgency of convincing their national ministries to push for more R&I fundings. Secondly, the people sent to represent their country sometimes do not have an adequate level of expertise and cannot equally discuss technologies with their peers from other countries.
 - People sometimes lack the capacity to lead the work and to participate at the expected level. Respondents to the interviews and survey point out that this does not set a suitable working environment for effective cooperation and progress toward achieving common goals.
 - Lack of continuity/changes in national policies. Once the official leaves a position, succession is often not ensured.
- **Countries focus their work on their own interest.** SET Plan Countries that provide most of the funding have strong interests and incentives to focus their R&I-related work on their own interests, and to not fully invest in trans-national cooperation in the framework of the SET Pan. This is reinforced by the fact that countries priorities are not always aligned and that there is inconsistency between national energy policies. Each country invests in technology that matches primarily their national priorities and interests. Consequently, the projects that come from these investments have also primarily national interest. Every country set their own priorities considering budget and capacity constraints and some technologies are not the priority for all the countries.
- **The misalignment between the positions taken by some countries during meetings,** and their practical actions at the national level, which could be explained by the fact that these countries see their EU counterparts as potential competitors and they intend to keep a competitive advantage. Outcomes of the decisions taken

by the SET Plan do not necessarily translate to national objectives, meaning that the decisions of the SET Plan may not influence many national governments.

- **Lack of dedicated resources.** Some countries have adopted a follower approach and justify a low level of engagement with the lack of human resources and time. Oftentimes, the SET Plan Countries do not have enough human resources to dedicate to the SET Plan and people appointed do not have time and cannot fully engage in it as much as they would like to. It needs to be noted that the lack of resources is an issue pointed by countries with higher level of engagement as well. Generally, the people appointed have many other roles and functions aside from their involvement in the SET Plan, which means that in the end they only have very little time to dedicate to the SET Plan and to concretely follow-up on actions after agreements have been reached. This general finding is that higher levels of engagement would be desired for all the SET Plan participants.
- **Lack of interest.** The lack of interest from the participants and their local governments was identified as another reason for the low level of engagement in the SET Plan. Countries with lower level of engagement often mention the fact that they do not see the added value of the SET Plan and therefore deprioritise their involvement. Three root causes for this issue were mentioned during the interviews:
 - Lack of perceived added value of the SET Plan. Due to the perceived unclarity of the objectives, some countries do not understand the benefits of being involved in the SET Plan. The fact that engaging with the IWGs or with the SET Plan more generally brings an added value to their own country is not clear. Producing publications or being invited to conferences are not considered enough of an incentive. It would be good to give a more influential role to the SET Plan, for example by making it participate in the shaping of political discussions on R&I energy topics at national and EU level. Moreover, most of the Central and Eastern EU countries are not concretely involved in the SET Plan. The reason for this lack of involvement is also due to the fact that some countries don't know what the benefits for them are to be involved in the SET Plan. For some, the Implementation Plans are not perceived as a decisive and powerful tool by some of the national authorities. It is therefore necessary to enhance the communication of the SET Plan to improve its image and added-value in the eyes of all stakeholders.
 - The lack of communication around the outcomes and results of the IWGs' work makes them less visible, which discourages them and hampers the engagement.
 - The lack of visibility towards government and national authorities can prevent some governments to prioritise proper involvement in the SET Plan. In addition, the SET Plan not being cited enough as an influential tool or as a reference has an impact on the engagement of some representatives.
- **Non recognition of some R&I areas.** Some IGWs experience a lower level of engagement from the participating countries because there is general sentiment that their technology is not recognised adequately by the SET Plan (and other European policy instruments). This is the case, for example, for Social Sciences and Humanities, thermal and airborne wind energy.

As mentioned before, there is disparity in the levels of engagement showcased by the participating countries of the SET Plan. Some countries demonstrate higher levels of engagement, below are the main reasons for this:

- We noted that ETIPs are usually more engaged. It was suggested that this is probably due to the fact that their work is more valued by the participants. ETIP members have a greater feeling of effectively shaping the EU debates in their respective field.
- The SET Plan is perceived to have high importance for the identification of national priorities in the energy transition.
- Another aspect that was mentioned is the fact that the participation and leadership in the SET Plan actions lead to a boost in the country's energy R&I.
- The SET Plan is aligned with their national strategy and supported by their government.
- They understand the SET Plan as a tool to pave the way for the development, implementation and deployment of the technologies.

It could be said that the main reason why some countries are more active in the SET Plan is because they see the added value of it and understand that time and resources must be dedicated to it.

Although some respondents emphasised that the participation to the SET Plan is on voluntary basis and the countries that do not actively participate should step out of it, there is a general consensus on the desire to increase engagement from participating countries. A higher engagement was seen as a way to achieve targets and lead to better results. The SET Plan being an international initiative, the low level of engagement by some participating countries makes it less effective to tackle the challenges of the energy transition.

Proposed solutions by the interviewees to increase the level of engagement by the SET Plan Countries:

- To dedicate proper human resources and time by each country to contribute to the SET Plan. For this, the SET Plan must be visible and understood enough for governments to prioritise it and dedicate enough resources for it.
- To engage people with adequate level of decision-making power (or access to it). For this, the Steering Group should reach out the governments to appoint a representative with a political reach.
- To have more focused IWGs in order to produce more concrete results. This would also be beneficial to convince stakeholders of its added-value, even if they have limited interest in the first place.
- To encourage country representatives to be actively engaged and being accountable (by (or 'to') the Commission). Currently, there are no formal follow-up from the Commission on who is responsible for what in the SET Plan Countries. A solution would be to initiate yearly individual appointment with every SET Plan country during which the Commission and the national contact points would present the key messages to national governments.
- To ensure the involvement of the SET Plan Countries at a higher national policy/political level. There should be a higher-level message from country representatives to their national R&I funding agencies to determine what is most needed in terms of R&I at the national level and to bring it forward within the SET Plan framework.

5.3.10 Delineation in scope and actions between the ETIPs and the IWGs

There is some overlapping in scope, actions and composition of ETIPs and IWGs across sectors.

While the delineation of scope, actions and composition between the ETIPs and the IWGs is clear and appropriate according to some of the IWG/ETIP representatives, it is quite unclear to many others, highlighting the lack of consistency in scope, actions and composition of ETIPs and IWGs across sectors. There is a strong need to formalise this delineation, as well as to harmonise the defined delineation among all IWGs and ETIPs.

Compositions, scope of work and actions of the IWGs and the ETIPs per IWGs according to the stakeholders interviewed:

- Deep geothermal. The IWG is composed of representatives from the SET Plan Countries (policy officials). Its primary objective is to define a common vision, as well as R&I targets for the development of geothermal technologies, and eventually to influence the EU and the national governments on the relevance of investing in R&I programs that will contribute to reach the stated vision and technological R&I targets. If a political level of government is well informed and engaged, this can provide funding to the ERA-NET Programs (now replaced by the CETP), which then use the funding to develop relevant R&I projects. In this context, the IWGs use the Implementation Plans (R&I agenda) of the associated ETIP as a basis to draft its own Implementation Plan. The ETIP is composed of representatives from industries. Its main objective is to identify which R&I activities in Deep Geothermal should be prioritised by industries.
- CCS – CCU. In the IWG, both national governments and industry representatives are represented. Same as the ETIPs, the IWG has the objective to promote R&I for technological development in CCU-CCS. In addition, the ETIP has the objective to provide clear recommendations to the Commission on the regulations, policies and fundings required to reach the targets set by the IWG. In the ETIPs mostly industries are represented.
- Batteries. The objectives and activities that were originally under the purview of the IWG are now being pursued by the ETIP, calling into question the relevance of the IWG's existence.
- Positive energy districts. Given that they key stakeholder of interest for R&I initiatives focusing on urban energy transition are the city authorities and developers, having an industry driven approach focusing on technology development is not useful for the IWG. Collaboration with the ETIP is therefore not as relevant.
- Ocean energy. The IWG has the role to raise awareness among policy-makers regarding the relevance to invest in R&I activities. The ETIP has the role to convince industries in the relevance to invest in R&I activities.
- Nuclear safety. There is no clear separation of activities between the IWG and the ETIP. Members of the IWG are often the same as the members of the ETIP.

- Solar PV. The ETIP develops the Joint Strategic Research Agenda on which the Implementation Plan of the IWG is based. ETIPs are composed of public and private sector stakeholders.
- Energy efficiency in industry. ETIPs and IWGs fulfil the same goals. For the IWG on Energy efficiency in industry, creating an ETIP does not make sense as it would be redundant given the work of the IWG.
- Energy efficiency in buildings. Given the operation of the European Construction Technology Platform and the Renewable Heating and Cooling ETIP, the role of the IWG is not entirely clear.
- Offshore wind energy. There is no delineation between the work of the ETIP and the work of the IWG. Both in terms of the topics and the members involved.
- Renewable fuels and bioenergy. The views differ on this topic. For some, the ETIPs and the IWGs have similarities in terms of activities and composition, with both composed of representatives from industry, research, as well as national governments. For others, the ETIPs are composed of industry representatives while the IWGs are composed of policy representatives from the SET Plan Countries.

Some stakeholders also gave their general point of view. For some, the works of the IWGs and the ETIPs are complementary. The ETIPs are both industry and policy focused with the goal to help the deployment of technology, while the IWGs are focusing on defining shared interests and targets among SET Plan Countries from a policy perspective. However, although the entities have different focus on paper, for most, the delineation in scope, activities and responsibilities of the IWGs and ETIPs is unclear. In the comprehension of interviewees, the IWGs are driven by SET Plan Countries representatives and focus on innovation needs. On the other hand, the ETIPs are driven by the industry, research and government representatives, deal with the uptake of the R&I initiative (from the innovation to deployment), and are in charge of producing the Implementation Plans of the IWGs.

5.4 Added value of the SET Plan at the National and EU level

5.4.1 Added-value of the SET Plan as an EU policy instrument

The SET Plan is a valuable policy instrument for driving the R&I agenda for clean energy technologies across the EU. However, its objectives need to be streamlined and more communicated on.

Most respondents (57%) stated that similar results would not have been achieved without the SET Plan.

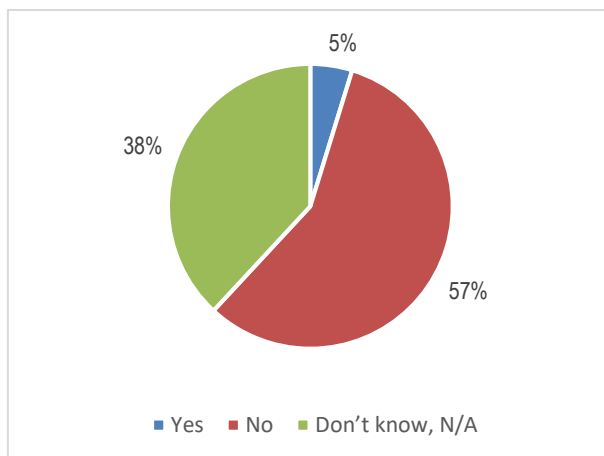


Figure 27. "Would similar results have been achieved without the EU intervention via SET Plan?" (63 respondents)

In addition, many respondents believe that their country in fact did benefit specifically from their involvement in the SET Plan activities.

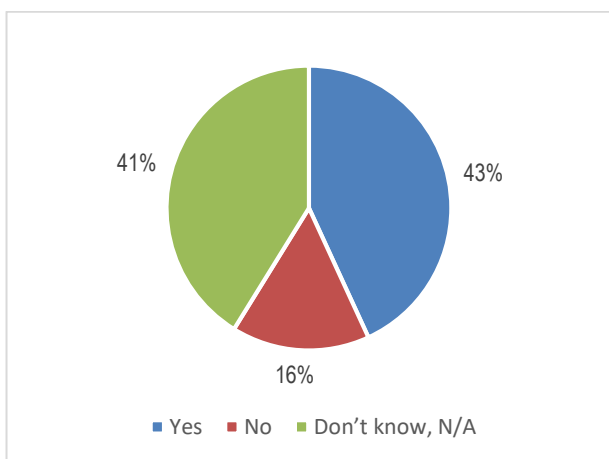


Figure 28. "Did the country you represent benefit specifically due to its involvement in the SET Plan activities?" (51 respondents)

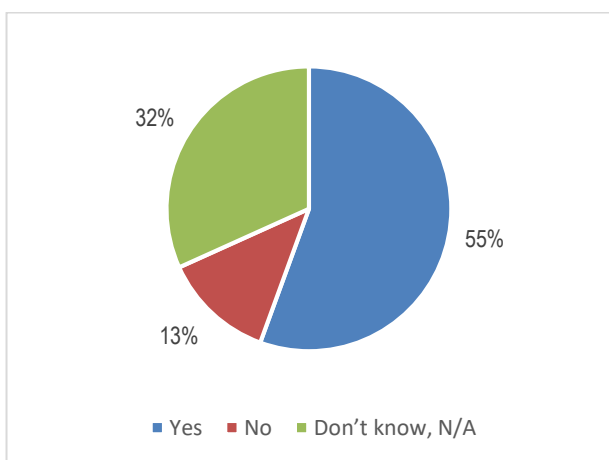


Figure 29. "Did the SET Plan Countries (EU MS and associated countries) benefit specifically due to their involvement in the SET Plan activities?" (63 respondents)

5.4.2 Influence of the SET Plan on R&I orientations for the energy transition

The opinions on the influence of the SET Plan in supporting and guiding the R&I orientations for the energy transition at the national and European level in the short, medium and long term are divided. However, although some stakeholders doubt its actual influence, for the majority of them, it does positively influence the R&I orientations for the energy transition.

5.4.2.1 For most of the stakeholders, SET Plan enables an alignment of the priorities...

According to most stakeholders, the SET Plan does play a role in supporting, and, to some extent, guiding the R&I orientations for the energy transition at national and European level in the medium and long term. The priorities defined by the SET Plan help the stakeholders (EU, MS and industries) to look in the same direction, which is crucial. The SET Plan sets a high-level political signal and that its key added value. Also, the SET Plan does play a role in guiding the orientations for R&I funding. According to some, the SET Plan has a “structuring effect on what to pursue and what to cater for by own funds in a coordinated manner” and it offers a common agenda on priority topics and targets.

This tendency is confirmed by the results of the survey. Indeed, we can see that a majority of the respondents to the questionnaire believe that the SET Plan significantly contributed to influence R&I orientations for the energy transition at national and European level.

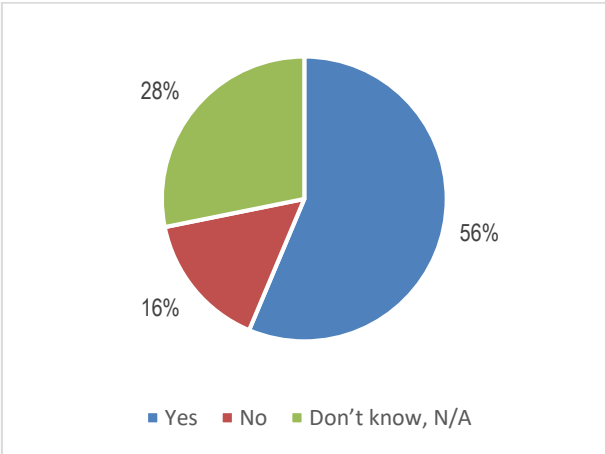


Figure 30. “SET Plan significantly contributed to influence R&I orientations for the energy transition at national and European level in the short, medium and long term.” (63 respondents)

At the national level, as the SET Plan produced sectorial Implementation Plans, which are important as instruments to public policies, it is perceived to have an effect on the participating countries. However, these should be updated more often, as well as finetuned for each participating country as a funding provider. In some cases, the SET Plan has aligned align the priorities among countries. A strong connection between the national and the EU funded projects could be observed as well. Without the SET Plan, there would not be the alignment of the SET Plan Countries’ agendas with the EC high-level climate targets. In some countries, the content of the national R&I programs have been progressively aligned over the years with those of the SET Plan.

At EU level, there appears to be very strong alignment at the European level on the short, medium, and long term. If you look at the European level the IWG is part of shaping the agenda.

Finally, by setting a dialogue with the industry the SET Plan guides the R&I policies and creates a mutual interest.

5.4.2.2 ...although the level of direct contribution remains unclear

Many respondents have specified that the level of contribution of the SET Plan is not so clear, and doubt that it contributed “significantly” to influence the R&I orientations, as these are very much influenced by the EU and the national level policies and legislation, as well as the availability of funding. The SET Plan supports R&I orientations, and to some extent guide it, but a lot depends on the participating countries. In addition, it is difficult to say if the SET Plan significantly contributes to improved dialogue between academics, industries and the EU governments, as other vehicles might be more responsible for these successes.

One respondent also mentioned that: “the SET Plan gave some guidance on priorities, but its work did not start from scratch, it built on existing priorities at the Commission level and SET Plan Countries level.” Some respondents do not see any clear link or proof of such influence as not a lot of stakeholders take into account the R&I orientations defined in the corresponding Implementation Plan. Lastly, the influence of SET Plan is not visible when looking at the latest Horizon Europe Work Programme.

Stakeholders pointed out the following elements:

- The European strategy on R&I is influenced by the SET Plan and the SET Plan Countries are influenced by the European strategy. Even if there is not a direct influence, the SET Plan and ETIPs are in the end the most influential initiatives in the energy R&I field in the EU for Member States.
- There is stronger influence at the operational level (than the strategic level).

5.4.2.3 For some, the SET Plan has little influence on R&I orientations

On the contrary, according to some stakeholders, although some countries have been influential and consider the SET Plan to be an important initiative, this it is not necessarily the case in other countries. The SET Plan is not perceived to be very influential in some countries. At national level, according to some, there is no visible benefit to date exclusively due to the SET Plan. Stakeholders pointed out the following elements behind this:

- There is already good alignment between the national and the EU R&I priorities without the SET Plan.
- Although some activities can have some impacts at the national level, most of the interesting conversation on promoting low-carbon EU technologies do not mention the SET Plan.
- The extent to which a country invest in R&I largely depends on the national political decisions, and not on SET Plan.
- Little reference is made to the SET Plan in the NECPs, and overall there is hardly influence at the national level. Furthermore, the investment for emerging technologies is minimal because most of the funding goes to the established technologies. Some countries are building their R&I strategy without taking the SET Plan into account.

According to a few, the SET Plan has little influence in supporting and guiding R&I orientations for the energy transition at the European level as well.

- If some IWGs disappear, it will not have a significant impact on EU energy research and innovation policy.
- The EC produces an annual competitiveness report (DG ENER), which already informs on how a particular technology is doing.
- SET Plan in general may have been redundant with other programs or even projects activity.
- The SET Plan influence mainly the ETIPs and ERA joint programs. There is not much additional value for the IWG, therefore the entities need to be better defined.
- For some, although the SET Plan is guiding well R&I within the technology domain, it does not provide adequate guidance for the non-technological topics.

Proposed solutions by the interviewees to ensure that the SET Plan supports and guides the R&I orientations for the energy transition at the national and the European level, and reinforces its influence:

Alignment with national priorities

- To improve the relation between the SET Plan Countries and the Commission through the "mandatory" translation of strategies/policies/IPs into national agendas.
- To guide countries in the formulating plans for the transition, such as the NECPs. This could be done through SETIS.
- To make it part of the NECPs, in order to increase its visibility and level of influence at the MS level. The SET is not adequately integrated into the NECPs, which could be seen as an option to make it more influential. It is important to align European energy plans into the SET Plan.

Resources

- To have a central secretariat to ensure that the IWGs meet twice or three times a year and that they would be aligned on reporting. This could work if the central secretariat has very precise mandates and targets.
- Allocated EU resources to organise yearly events in each individual SET Plan country, during which the Commission and the SET Plan country representative(s) directly communicates the relevant messages to the national government. "This would have a much greater impact on influencing national R&I orientations for the energy transition at national than the current yearly conference organised and to which many countries do not send representatives."
- To have more transparency in funding (amount, beneficiary, projects) and have a reviewing analysis (quantitative or qualitative) of funding.

Monitoring

- To implement a monitoring system to follow-up with each IWG on the correct implementation of the items agreed on during the meetings.

Communication and visibility

- To increase communication between SET Plan Countries and representatives and on what the SET Plan achieves. For the moment, the plan is hardly known outside of the stakeholder's community. If it is better communicated, the SET Plan Countries will be more aware of its potential and understand better how they can use it more directly as a tool. It is important to highlight the success stories to incentive stakeholders.
- To ensure that the SET Plan representatives effectively communicate to national officials the key directions for each low-carbon energy technology. The extent to which the SET Plan is influencing R&I orientations at the national level largely depends on the extent to which the country representatives are efficient in communicating the SET Plan outputs to their national governments.

Structure and focus

- To restructure the SET Plan around transition channels/pathways instead of technologies. It is important to take into consideration the system / societal aspect of the transition.
- To have a common vision and to clarify and structure the expectations (include timelines).
- To more actively push the technologies that are not as fast-growing, due to a lack of traction from the market or political interest.

5.5 Future-proofing of the SET Plan

5.5.1 New energy and climate related technology and infrastructure research areas

Some of the low-carbon energy technologies identified in the EU energy policy, NECPS or IEA's low carbon technology value chains are either covered in the SET Plan current scope, but at a relative low level of importance, or not covered by it. This is the case, among others, for floating Solar PV, onshore wind power, batteries for planes, blue hydrogen, as well as substitution, reuse and recycling of critical raw materials.

Overall, the IWG chairs, co-chairs, and Steering Group members concur that the IWG Implementation Plans are providing a robust picture of the range of low-carbon energy technologies to focus on in current and future R&I activities. This overall well-rounded focus is due to the current approach to defining Implementation Plans, which establishes the scope of technologies covered and associated targets through a bottom-up approach with industry experts, thereby ensuring proper technology coverage. However, whereas through interviews or the questionnaire (see Figure 31), a majority of stakeholders agree that there are energy technology and infrastructure areas, which are crucial for the energy transition and that are not included in the SET Plan scope and covered by the IWGs.

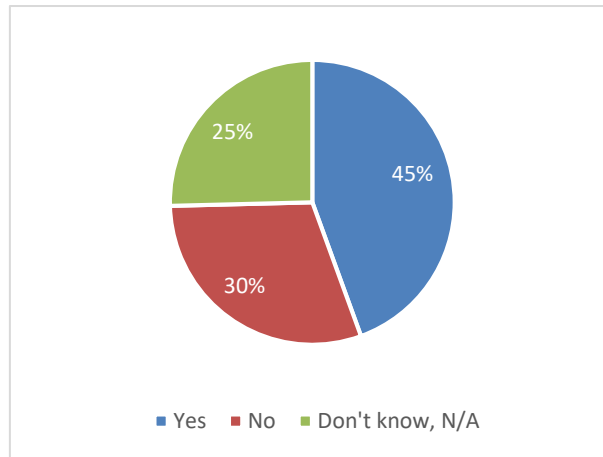


Figure 31. "Do you think that there are energy technology and infrastructure areas, which are crucial for the energy transition, that are not included in the SET Plan scope and covered by the IWGs?" (63 respondents)

The interviews with the IWGs' chairs, co-chairs, and Steering Group members, combined with the input from the questionnaire allowed the identification of the following low-carbon energy technologies as missing or not sufficiently addressed within the scope of existing IWGs:

- Sub-surface (seasonal) thermal storage in the Deep Geothermal IWG³⁶;
- Joint-production of geothermal heat/power and minerals extraction in the Deep Geothermal IWG³⁷;
- Greater consideration of various depths for geothermal energy production in the Deep Geothermal IWG³⁸;
- Floating solar PV both for applications on lakes/reservoirs and offshore in the Solar PV IWG;
- Onshore wind energy in the (Offshore) Wind Energy IWG (there is a significant number of technologies used in the offshore wind energy sector that have first been developed for applications in existing onshore wind energy systems);
- Direct Air Capture technologies (removal of CO₂ from air) in the CCS-CCU IWG;
- CO₂ removal from nature-based solutions in the CCS-CCU IWG;
- Solar Thermal Energy for heating and cooling applications (low temperature) in the Energy Efficiency in Buildings IWG;
- Nuclear technology for high temperature industrial heat (high temperature heat generators) in the Nuclear Safety IWG;
- PV for agricultural applications in the Solar PV IWG;

³⁶ The Deep Geothermal IWG is currently in the process of revising its Implementation Plan and this currently missing technology will be included in the updated version, along with specific targets.

³⁷ Ibid

³⁸ Ibid

- Small modular reactors, nuclear cogeneration and micro-reactors in the Nuclear Safety IWG;
- Airborne wind energy in the Offshore Wind Energy IWG.

The interviews with the IWGs' chairs, co-chairs, and Steering Group members combined with the inputs from the questionnaire allowed the identification of the following low-carbon energy technologies as missing or not sufficiently represented in the overall work of the SET Plan:

- Energy storage (not only for flexibility purposes);
- Renewable (green) hydrogen & Low-carbon (blue) hydrogen (including hydrogen storage);
- Heat pumps;
- Hydropower;
- Nuclear energy;
- Critical raw material extraction, refining and recycling technologies;
- New energy vectors such as ammonia (NH₃), and green methane (CH₄);
- Heating and cooling in buildings and industries.

To better inform the analysis on the identification the low-carbon energy technologies as missing or not sufficiently represented in the overall work of the SET Plan, the analysis of the stakeholder views as well as responses inputs the questionnaire has been complemented by a desk-research-based analysis. The details of the methodology applied to conduct the assessment is described in Appendix 5, 6 and 7.

Here under, the list of low-carbon energy technologies for which there is only a **partial alignment** (the low-carbon energy technology or infrastructure is clearly formulated in EU energy and climate policy/regulatory frameworks and/or EU Member States' NECPs and/or IEA's low-carbon technology value chains **and** is covered by the current scope of the SET Plan but at a relative lower level of importance) between the current scope of the SET Plan and the EU energy and climate policy objectives:

- Heating and cooling + thermal energy storage technologies (incl. Heat pumps) for buildings
- Renewable hydrogen (water electrolysis technologies)
- Biogas from non-recyclable human and agricultural waste
- Biomethane from non-recyclable human and agricultural waste
- Hydrogen use in fuel transformation (oil refining, synthetic methane, synthetic liquid hydrocarbons)
- Hydrogen use in industry (ammonia, methanol, iron and steel)
- Renewable ammonia and methanol as a fuel
- Synthetic methane

- Fuels from non-biological origin (e-fuels/synthetic fuels)
- Small nuclear modular reactors (SMR)
- Energy (electricity and/or heat) storage and integration of storage systems (incl. Power-to-gas and gas-to-power) storage systems

Below is the list of low-carbon energy technologies for which there is no alignment (the low-carbon energy technology or infrastructure is clearly formulated in EU energy and climate policy/regulatory frameworks and/or EU Member States' NECPs and/or IEA's low carbon technology value chains AND is not covered by the current scope of the SET Plan) between the current scope of the SET Plan and the EU energy and climate policy objectives:

- Floating Solar PV
- Onshore wind power
- Batteries for other transport applications (ships, planes, heavy duty road vehicles)
- Use of solar energy in transport
- Biogas-/bioliquid-fired internal combustion engine
- Nuclear-based H2
- Large scale end-use applications of H2 in transports (fuel cell and H2-fuelled heavy-duty transport, ships, trains)
- Low-carbon hydrogen (blue H2)
- Direct Air Capture with Carbon Storage (DACCS)
- Retrofitting of existing gas infrastructures (for H2 and biomethane)
- Critical raw materials substitution, reuse and recycling
- Critical raw materials extraction from domestic deposits
- Detection of methane leaks
- Infrastructures for high-power electric recharging for local public transport (including charging solutions incorporated along the route)

5.5.2 *Creation of additional Implementation Working Group(s)*

The creation of additional IWGs on (1) hydrogen, (2) heating and cooling (with focus on thermal energy systems, including solar thermal) and (3) energy storage has been strongly advocated.

Overall, the creation of at least one additional implementation Working Group is favoured by the majority of IWG chairs, co-chairs, and Steering Group members of stakeholders interviewed, as well as by a large share of the respondents to the questionnaire (see Figure 32). In particular, the creation of dedicated IWGs on hydrogen, heating and cooling (with

focus on thermal energy systems, including solar thermal) and energy storage was strongly advocated.

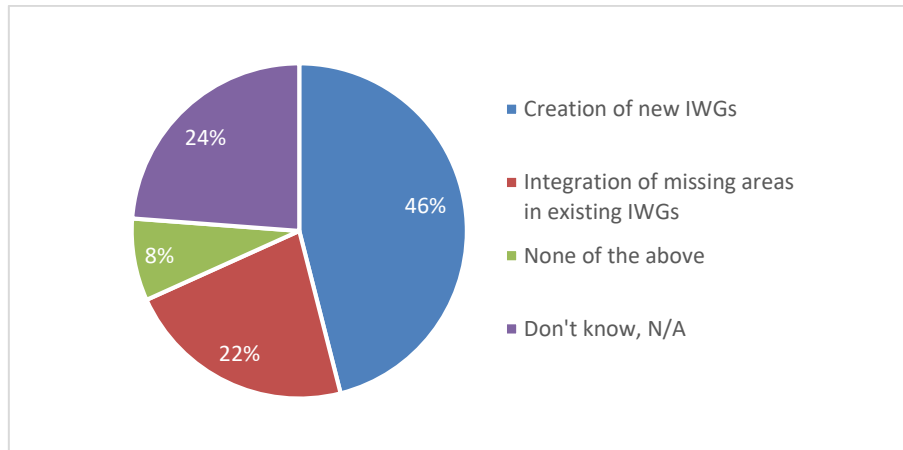


Figure 32. "Should new IWGs be created or should the missing areas be integrated in the existing ones?" (63 respondents)

The interviews with the IWGs' chairs, co-chairs, and Steering Group members combined with the inputs from the questionnaire allowed the identification of the following potential technological-related topics which could benefit from the creation of their own IWG:

- Hydrogen (strong push)
- Heating and cooling in buildings and industries - with focus on thermal energy systems, including solar thermal (strong push)
- Energy storage (moderate push)
- Heat pumps (low push)
- Hydropower (low push)

Focus on hydrogen – description of the range of stakeholders' views on how to consider hydrogen-related technologies in the SET Plan

View 1 (strongly supported): Even though hydrogen is being covered by the IWG on Energy Efficiency in Industry (relevant it should be maintained) and the IWG on Bioenergy and Renewable Fuels, the current approach around hydrogen is lacking a focused approach on the whole hydrogen value chain. Therefore, a separate IWG on hydrogen would help to focus more on the development of technologies that will spur the whole hydrogen ecosystem. However, should a new dedicated IWG on hydrogen be created, attention should be paid to focus on R&I activities that complement the ones already carried out in the Clean Hydrogen Partnership and in the Green Hydrogen ERA pilot initiative. Such complementary areas of focus could be the following:

1. While the Clean Hydrogen Partnership is focusing its work on supporting R&I initiatives in countries that already have a strong foothold in hydrogen technologies (e.g., Germany, France), a new IWG on hydrogen focus its activities on supporting R&I in other countries.

2. The Clean Hydrogen Partnership and the Green Hydrogen ERA pilot initiative do not currently focus on the coordination of approaches and mobilisation of fundings across EU Member States. In the Clean Hydrogen Partnership, the Advisory Group composed of national representatives of EU countries act primarily as a sounding board without actively pursuing alignment and cooperation between R&I national funding programs in hydrogen. A new IWG on hydrogen could fill-in this gap and focus on the development of cooperation/coordination frameworks between EU Member States.
3. While Clean Hydrogen Partnership focuses mainly on demonstration activities (high TRL level research), a new IWG on hydrogen could focus its scope on lower TRL level research technologies.

View 2 (moderately supported): Even though hydrogen is missing in the current scope of the SET Plan, there are many R&I initiatives, covering all the stages of technology development needed for hydrogen deployment in Europe (from low TRL to high TRL), that already exist in the EU ecosystem (the Clean Hydrogen Partnership, Green Hydrogen ERA pilot initiative, etc.). Additionally, the role of governments is quite limited in the field of renewable hydrogen R&I, with industries being the main drivers in technology development projects. Instead of creating a dedicated IWG on hydrogen, it would be preferential to focus on the use existing initiatives and to create links and synergies between their work and to the work of IWGs that are relevant to the hydrogen ecosystem (i.e., Energy Efficiency in Industry). The creation of an IWG on hydrogen is not necessary and would not add value to the existing European R&I initiatives.

View 3 (moderately supported): Renewable and low-carbon hydrogen is missing in the current scope of the SET Plan and there is the need to clarify which already existing IWG(s) is/are best suited to include hydrogen-related technologies to their scope. Adopting a trans-IWG integration of hydrogen-related technologies would imply clear clarifications on the governance structure and process.

View 4 (poorly supported): Hydrogen is already covered in the current scope of the SET Plan through the IWG on Bioenergy and Renewable Fuels and the IWG on Energy Efficiency in Industry. There is no need for a change.

5.5.3 *Strengthening the links between the SET Plan's and the NECPs*

The links between the SET Plan and the NECPs should be strengthened. This could happen by making the NECP a tool to report on the nature and status quo of existing national R&I programs and initiatives, and making extensive reference to the SET Plan in the NECPs.

Whilst the Steering Group members broadly recognised the lack of a common policy approach between the objectives and targets of the SET Plan and the Member States' NECPs to date, there is a strong consensus that better linking the SET Plan to the NECPs is desirable, and that many possibilities exist for achieving this. In particular, strengthening the links between SET Plan objectives and targets could be achieved by making the NECP a tool to report on the nature and status quo of existing national R&I programmes and initiatives, with associated investment allocations and time horizon, and explaining the link (if any) to the SET Plan. In addition, making extensive references to the SET Plan in the NECPs may increase SET Plan visibility to policy makers, leading to greater political awareness, alignment and R&I funding. Strengthening the links between the objectives and targets of the SET Plan and the future revision of the Member States' NECPs is

therefore widely welcomed by the Steering Group members. The overarching finding that links between the SET Plan's objectives and targets and the Member States' NECPs should be strengthened is confirmed by inputs from the questionnaire (see Figure 33).

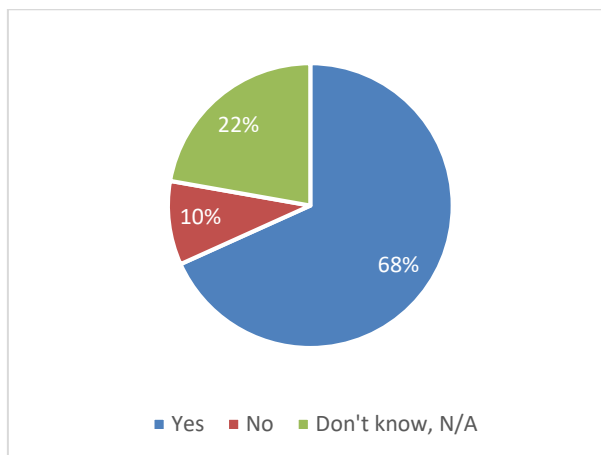


Figure 33. "Do you think the links between the SET Plan's objectives and targets and the Member States' NECPs should be strengthened (i.e., reporting of national R&I initiatives and progresses, allocation of national R&I investments)?" (63 respondents)

According to some of the Steering Group members, the link between the SET Plan and the NECPs is quite weak mainly as a result of the following considerations:

- Since the SET Plan is not a legislative obligation (but a voluntary initiative), there is currently no obligation on the part of Member States to take the SET Plan into account in NECPs
- Within many national governments, R&I is not the primary focus of the energy ministry and energy is not the priority of the research ministry. This lack of proper leadership ultimately translates into the national government's inability to adequately report on R&I progress in low-carbon energy technologies.
- Primarily as a result of the lack of connection between the SET Plan national representatives and the policymakers (because the SET Plan representatives are generally not sufficiently high ranking), the SET Plan clearly lacks visibility at the high political level, which contributes to its lack of consideration in the preparation of the NECPs.

For future revisions of the NECPs, the following proposals were made by the SET Plan Steering Group members as well as respondents to the questionnaire to better link the NECPs and the SET Plan:

- To request SET Plan Countries (Member States and Associated Countries) to report on the comprehensive set of national R&I programmes and initiatives in place, with their associated investment allocations and time horizon, their stage of progress, and with an explanation on the link (if any) to the SET Plan objectives and targets. Practically, this could be achieved by directly connecting the IWGs with the ministries and persons responsible for drafting the NECPs in order to report on a yearly basis on the achieved national against the targets of the different IWGs. The establishment of a pre-defined prescriptive NECP structure (not only by chapters as it is today, but more in detail about what exactly will be implemented and by which means) would be required to report on the level of alignment of national R&I strategies and target with those the SET Plan targets.

- To monitor national R&I initiatives and associated R&I investments (and thus indirectly, the progress of SET Plan activities), the Commission should use the existing IEA reporting methodology used for its annual report on energy technology R&I expenditure. In addition to already providing a proven reporting framework and key performance indicators applicable to each EU country, the use of the IEA reporting methodology would also allow for a comparison of progress between the EU Member States and third countries.
- In response to the fact that the reference to the SET Plan in the NECPs has no legislative basis, some stakeholders suggested that links between SET Plan and the NECPs should be made mandatory. Strengthening the legal basis of the SET Plan and its link with the NECP would therefore be beneficial.
- Reporting on national R&I initiatives and progress, as well as on investment allocation, could be improved and simplified by working in an integrated way on all stages of technology development and deployment (one working group in charge of all stages of development, from research to industrial scale deployment). These initiatives, developed in France, are effective and are co-supervised by a representative of the Ministry of Research and a representative in charge of energy transition topics within the Ministry of Ecological Transition.

However, without the implementation of a regulatory mandate to comprehensively report on national R&I programs and initiatives, and associated investment allocations and targets, the extent to which this approach will be followed by SET Plan Countries and associated countries will depend solely on the willingness of each country. The Commission will therefore need to find a way to make such an approach attractive to national governments. In addition, it was noted that reporting on national R&I initiatives is a very difficult exercise, which the Commission has tried to do in the past, but without success.

5.5.4 Future implications of the rollout of the REPowerEU plan

Both the analysis of the REPowerEU Plan against the scope and objectives of the SET Plan and the views of the majority of respondents to the questionnaire (see Figure 34) point to a common understanding that the deployment of the REPowerEU plan will have significant implications for the revamp of the SET Plan. Indeed, firstly, the rollout of the REPowerEU plan will require many IWGs to frontload existing R&I targets and define new targets for 2030. In addition, consideration should be given to increasing the urgency of investment in R&I, both in low-carbon energy technologies covered and not (largely) covered by the scope of the SET Plan, in order to align with the deployment of the REPowerEU Plan. Secondly, the rollout of the REPowerEU plan explicitly calls for development of R&I activities in non-technological and horizontal areas.

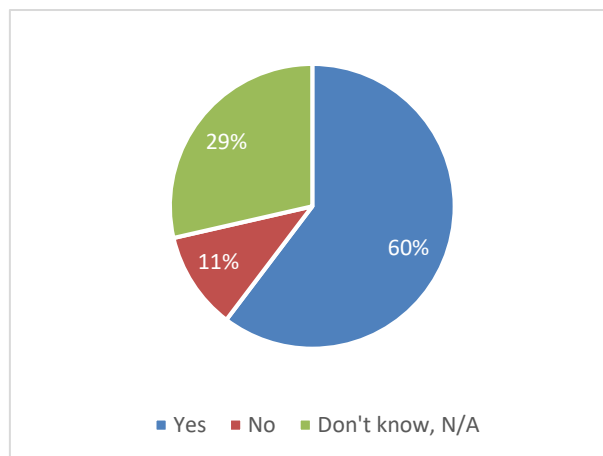


Figure 34. "Do you think that the rollout of the REPowerEU plan will have significant implications for the upgrading of the SET Plan - e.g., on the following IWGs: Renewable fuels and bioenergy (biomethane, hydrogen); Energy Efficiency in Buildings (heat pumps), Solar PV, Offshore wind?" (63 respondents)

Identification and assessment of the potential future implications of the rollout of the REPowerEU plan for the current SET Plan's objectives and targets

Analysis of the REPowerEU Communication³⁹, its Annexes⁴⁰ and the Staff Working Document⁴¹ against the scope and targets of the SET Plan IWGs (see Appendix 8) leads to the conclusion that frontloading targets of some of the existing R&I activities and definition of new targets for 2030 for the following IWGs will be required to align with the rollout of the REPowerEU plan:

- Renewable fuels and bioenergy (R&I Activities #1-3; #7 and #11-13)
- Energy Efficiency in buildings (R&I Activities #5.1; #5.2)
- Energy Efficiency in Industry (R&I Activities #1.1-1.4; #2.1-2.4; #3.1; #3.2; #4.1; #4.2; #4.6, #5.1; #5.2; #5.3, #6.3 and #6.5)
- Solar PV (all R&I Activities)
- CSP/STE (all R&I Activities)
- Wind offshore (all R&I Activities)
- Energy systems (all R&I Activities)
- CCUS/CCU (Target #8)
- Batteries (all R&I Activities)

In parallel, consideration should be given to increase the urgency of investment in R&I, both in low-carbon energy technologies already covered and not (largely) covered yet by the scope of the SET Plan, in order to align with the deployment of the REPowerEU Plan. The following R&I topics have been assessed as needing to be highly prioritised:

39 REPowerEU Communication: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2022%3A230%3AFIN&qid=1653033742483>

40 Annexes to REPowerEU Communication: https://eur-lex.europa.eu/resource.html?uri=cellar:fc930f14-d7ae-11ec-a95f-01aa75ed71a1.0001.02/DOC_2&format=PDF

41 Staff Working Document: Investment needs, hydrogen accelerator and bio-methane plan: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=SWD%3A2022%3A230%3AFIN&qid=1653033922121>

- **Biogas/biomethane value chain.** It may be relevant to create a dedicated R&I Activity within the Renewable Fuels and Bioenergy IWG that will aim at fostering:
 - the development of innovative technologies for the production of sustainable biogas and biomethane based on gasification of biogenic residues and wastes from all sectors and industries, biogenic CO₂ effluents and waste, organic part of industrial waste waters and municipal sludge, as well as feedstock from marginal and contaminated lands through phytoremediation;
 - the development of innovative technologies for the upgrade of sustainable biogas to biomethane (i.e., biological or catalytic conversion of the biogenic CO₂ in the biogas to biomethane). Special focus could be given to increasing cost effectiveness and efficiency of small-scale upgrading technology;
 - the development of innovative solutions and research on barriers and integration of sustainable biomethane to the gas grid;
 - the support for the expansion of the sustainable biomass potential to ensure availability of resources for reaching the biomethane production target.
- **Biomethane use in the building sector.** It may be relevant to create a dedicated R&I Activity within the Energy Efficiency in buildings IWG that will aim at fostering the use of (biogas and/or) biomethane for district heating.
- **Renewable hydrogen value chain.** Given the importance of the large-scale expansion of a renewable hydrogen economy, the creation of a new and dedicated IWG covering the whole renewable hydrogen value chain seems to be appropriate. This hydrogen IWG will aim at fostering:
 - the production of renewable hydrogen through water electrolysis technologies
 - the production of hydrogen through water electrolysis from nuclear-based electricity;
 - the development of technologies required for construction of hydrogen infrastructures (water-based transport, retrofit of existing natural gas pipelines, construction of new dedicated hydrogen and hydrogen carriers pipelines, storage, terminal imports, ports etc.)
- **Hydrogen use in industries.** It may be relevant to create a dedicated R&I Activity within the Energy Efficiency in Industry IWG that will aim at fostering the use of hydrogen in refineries (hydrogenation of mineral oil), ammonia production plants as well as for high-temperature industrial heat in all energy-intensive industries.

Also, the rollout of the REPowerEU plan (the REPowerEU Communication, its Annexes and the Staff Working Document) explicitly calls for development of R&I activities in the following non-technological and horizontal areas:

- Acceleration of investments in reskilling and upskilling of the workforce (i.e., through support in large-scale skills partnerships in different industrial ecosystems such as Energy Intensive Industries, Construction and Renewable Energy);
- Ensuring a just, fair and socially acceptable transition for all (minimise price volatility, protect households at risk of energy poverty, etc.);

- Ensuring a sustainable supply of critical raw materials and renewable energy equipment (i.e., substitute critical raw materials monitoring supply, diversifying supply, development of strategic partnerships, strategic stockpiling);
- Enhance recyclability of renewable energy and other low-carbon technologies and infrastructures equipment, and
- Reduce material consumption in production processes (material efficiency).

Lastly, analysis of the insights shared by the respondents to the questionnaire on the implications of the rollout of the REPowerEU plan for the SET Plan also suggest to consider the following elements:

- The significant investment needed for the deployment of renewable energy solutions needs enhanced R&I activities in renewable heating and cooling solutions (e.g., heat pumps, solar thermal, bioenergy).
- Need of more R&I activities to better (1) understand strategic energy planning requirements (top-down and mission-driven rather than bottom-up), (2) analyse risks and (3) assess dependencies, therefore allowing better consideration of overarching implications (including vulnerabilities) implied by the roll-out of REPowerEU. It has been suggested to create special multi-disciplinary centres of excellence that would address the critical transition challenges/ technologies composed of IWG and ETIP members to "steer the emergency plan".
- Need to enhance the international dimension of the SET Plan by establishing new R&I alliances and partnerships in low-carbon energy technologies.
- The roll-out of the REPowerEU plan increases market perspectives for European low-carbon energy technologies, therefore fostering opportunities for R&I public-private collaborations in benefit of the SET Plan work.

5.5.5 Non-technological and horizontal/cross-cutting areas

As some non-technological and horizontal research areas are of primary importance to the work of the SET Plan, new IWGs with a focus cross-sectoral challenges should be created.

According to some of the stakeholders interviewed, non-technological and horizontal areas have not yet been highly visible in SET Plan activities, primarily due to three factors. First, these research areas were not deemed to be the most critical topics in the context of the SET Plan and, given that the work of the IWGs already has little visibility to decision makers, the IWGs choose to direct their efforts to the most critical areas that are peculiar to their work and that need to have minimal visibility to be considered a priority. Second, the SET Plan community is "engineering heavy" and has not pushed to date to bring non-technology areas of R&I into the scope of the SET Plan. Third, national R&I funding programs in some countries (e.g., Germany) do not require technology research projects to cover non-technology and horizontal areas (these are addressed in separate research projects funded by other programs), which does not encourage IWGs to devote time and resources to these research areas.

However, there is a wide consensus among chairs and co-chairs of IWGs that some non-technological and horizontal research areas are of primary importance to the work of the

SET Plan. This view is supported by 45% of respondents to the questionnaire and rejected by about one-third of them (see Figure 35).

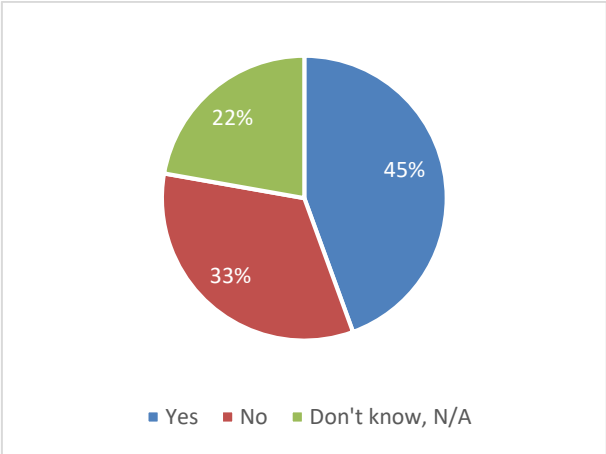


Figure 35. "Do you think new Implementation Working Groups should be created to work on targets for cross-sectoral challenges?" (63 respondents)

The following topics were repeatedly mentioned during the interviews and in the respondents' contributions to the questionnaire as areas of significant relevance to the achievement of the IWG's objectives and targets:

- Enabling societal and social acceptance as a means of facilitating the development and implementation of low-carbon energy technologies and infrastructures (public awareness, better understanding of citizens' concerns, impact on the landscape, etc.)
 - Topic explicitly mentioned in interviews with representatives of the Deep Geothermal; CSP / STE; CCUS/CCS; Renewable Fuels and Bioenergy; Nuclear safety; Ocean Energy; Energy Efficiency in Buildings; Offshore Wind Energy and Solar PV IWGs.
- Fostering the use and recycling of sustainable materials through a life cycle approach to technology and infrastructure
 - Topic explicitly mentioned in interviews with representatives of the Ocean energy; Energy Efficiency in Buildings; Positive Energy Districts; Solar PV and CCS-CCU IWGs.
- Greater integration of digitalisation solutions in low-carbon energy technologies and systems
 - Topic explicitly mentioned in interviews with representatives of the CSP / STE, Energy Efficiency in Buildings; Solar PV and CCS-CCU IWGs.
- Addressing shortage of skills and education
 - Topic explicitly mentioned in interviews with representatives of the CSP / STE; Energy Efficiency in Buildings; Nuclear safety
- Overcoming regulatory barriers (i.e., permitting procedures) to the development and deployment of low-carbon energy technologies
 - Topic explicitly mentioned in interviews with representatives of the Deep Geothermal and CSP / STE IWGs.

- Assessing and minimising the implications low-carbon energy technologies and infrastructures roll-out on biodiversity and ecosystems.
 - Topic explicitly mentioned in interviews with representatives of the Offshore wind energy and Solar PV IWGs
- Addressing shortage of (critical) raw material supply
 - Topic explicitly mentioned in interviews with representatives of the Offshore wind energy and Energy Efficiency in Buildings IWGs.
- Enabling greater and more efficient energy system integration (encompassing topics of research on energy and electricity markets design)
 - Topic explicitly mentioned in interviews with representatives of the Solar PV, CSP / STE IWGs and Offshore wind energy
- Energy Transition Modelling

Additionally, the following non-technological and horizontal areas have been mentioned as relevant during the interviews: managing the environmental impacts of the (micro)seismic consequences resulting from the deep geothermal activities (Deep Geothermal IWG), geopolitics of energy (Offshore Wind Energy).

Although IWG representatives emphasised the importance of including these non-technological and horizontal research areas more broadly in their research agendas, some IWGs appear to be doing so already. Indeed, whether in the current of upcoming revised Implementation Plans, representatives of the following IWGs stated that some non-technological and horizontal research activities are or will be in the conducted:

- CCUS/CCS: awareness;
- Energy Systems: digitalisation, energy system integration;
- Offshore Wind Energy: energy system integration; biodiversity and ecosystems; awareness, shortage of skills and education;
- HVDC: awareness, shortage of skills and education;
- Energy Efficiency in Industry: digitalisation; recycling of sustainable materials, shortage of skills and education;
- Batteries: recycling of sustainable materials, energy system integration;
- CSP / STE: digitalisation;
- Solar PV: recycling of sustainable materials, awareness.

However, some of the interviewed stakeholders emphasised that when considering whether or how to include these non-technological and horizontal research areas in the scope of the IWGs, particular attention should be paid to the following:

- Although these topics are cross-cutting by design, addressing such overarching issues in a common approach across all IWGs will not be appropriate. Indeed, as a matter of fact, each of these cross-cutting research areas is very technology-specific and the junction between two technologies occurs most of the time only at the conceptual level. Therefore, if these topics were to be addressed in SET Plan

activities in the future, it would be necessary to find ways to adapt to the needs of each technology area so that the work matches the practical aspects encountered by each sector.

- Cross-cutting research areas need to be fostered in order to ensure greater integration of digitalisation solutions into low-carbon energy technologies and systems and to address the skills and education gap in the energy sector are already covered by programs and initiatives outside of the SET Plan.

Combining insights from the interviews, responses to the questionnaire, the REPowerEU Plan, DG RTD/DG ENER internal documents and the literature, the following non-technological and horizontal/cross-cutting areas can be considered of significant relevance to the achievement of the IWG's objectives and targets and would benefit from further development of R&I activities, both at EU and regional/country level:

- Create awareness by ensuring just, fair and socially acceptable transition for all as a means of facilitating the development and implementation of low-carbon energy technologies and infrastructures (better understanding of citizens' concerns, increased citizen engagement and participation, making impact on the landscape acceptable, etc.).
- Improving the circularity (recyclability and reusability) and the efficiency of renewable energy materials and other low-carbon technologies and infrastructures through a life cycle approach to technology and infrastructure (e.g., development of advanced sustainable materials and material consumption reduction in production processes).
- Cost reduction, market integration and user empowerment in the energy transition through digital transformation and the development of digital solutions in the energy sector.
- Addressing shortage of skills and education to further encourage investments in reskilling and upskilling of the workforce in the key industrial ecosystems for the low-carbon energy transition (i.e., Energy Intensive Industries, Construction and Renewable Energy);
- Overcoming regulatory barriers (i.e., permitting procedures) to the development and deployment of low-carbon energy technologies
- Assessing and minimising the implications low-carbon energy technologies and infrastructures roll-out on biodiversity, ecosystems and human health.
- Enabling greater and more efficient energy system integration, encompassing topics on energy and electricity markets design, tariffs and regulation.
- R&I in Social Sciences & Humanities areas to identify and develop robust energy transition pathways as alternative strategies to dominant assumptions and policy directions towards a net zero integrated European energy system.

5.5.6 Increase of the SET Plan visibility

The SET Plan is not visible enough at the European, national and private sector levels.

All stakeholders interviewed agree on the (very) low visibility of the SET Plan at the European, the national and the private sector levels across (almost) all technology areas. It is widely acknowledged that currently only a very limited number of people are aware of the SET Plan and its activities (e.g., according to one stakeholder, in the ETIPs, only half of the people involved are aware of the existence of the SET Plan and almost no one can describe in detail what the SET Plan does). However, many solutions have been put forward to increase the visibility of the SET Plan at the EU, national and private sector levels.

The reasons for the (very) low visibility of the SET Plan are multifaceted and are listed below. There are divided in Eu level and national level.

At the EU level:

- With the launch of new EU programmes and strategic funding vehicles (i.e. Horizon Europe, Partnerships, etc.), the SET Plan is perceived as playing a decreasing role in defining low-carbon energy technology development strategies. This perception is directly reflected at national and industrial levels, where the focus is on the Horizon Europe programme because of its funding opportunities.
- There is a perception that discussions in the development of new legislation, regulations and policies (i.e. Fit for 55 package, sector strategies, REPowerEU Communication) do not take into account the SET Plan. Over the last two years, the opportunity has been missed to highlight the role of the SET Plan as a key framework for R&I in energy-related technologies.
- The existing webpages for each IWG are considered to not be efficient/useful to communicate effectively on the activities pursued by the IWGs. For people outside the SET Plan community, it is difficult to identify SET Plan lighthouse realisations or any other type of information.
- The SET Plan is currently (largely) absent from the discussion in the Energy and Competitiveness Councils, where national energy and R&I ministers are represented.
- Current efforts to make the SET Plan visible (organisation of an annual conference and publication of an annual report) are considered not being enough.
- The SET Plan is sometimes overlooked by its stakeholders and the wider policy-making community, as it has never been elevated to the appropriate comitology status for it to become a recognised entity at legislative level.

At the national level, the visibility of the SET Plan's work within Ministries and Agencies depends largely on the level of commitment and personal relationships of the national representatives in the SET Plan (in the Steering Group and IWGs). This institutional approach, which focuses on individuals rather than a collective, is not considered to be effective in ensuring the long-term, consistent and effective visibility of the SET Plan activities to national decision makers. As a result, the SET Plan is not considered a priority by national governments when setting the energy technology R&I agenda, and national ministries rarely consciously integrate SET Plan outputs into national climate and energy plans.

In this context, although some stakeholders interviewed argued that it would not necessarily be useful to make the SET Plan visible to the general public, there was unanimous agreement that its visibility should be made broader and wider, particularly within governments and national agencies, as well as in the private sector. Indeed, according to stakeholders, visibility of the SET Plan should be increased primarily within

national ministries and R&I agencies since these entities are responsible for R&I funding allocations in their respective SET Plan Countries, and because the SET Plan is designed to be main R&I pillar for both energy and industrial policies in the EU, implying strong connections with national ministries and industries. As stated by a stakeholder during an interview: "only 500 people in Europe need to know about the existence of the SET Plan and what it does in details vs. only 100 people today".

On the other hand, according to one Steering Group member, there is no need to increase the visibility of the SET Plan under the current circumstances, as there is no single voice (shared vision/goal) in the SET Plan. This stakeholder therefore argued that before seeking to increase the visibility of the SET Plan, it is necessary to jointly define the message that the European Commission wants the SET Plan to be associated with. However, this stakeholder recognises that it is relevant to increase visibility at the level of the IWGs, as there is often a common objective within the IWGs.

In addition, it is also interesting to note that:

- Within the EU R&I community in the field of CCS-CCU, the visibility of the SET Plan is already very good. Most of the companies in the EU involved in CC(U)S activities know about the work of the CCUS ETIP and most of them are taking an active part in it (as an ETIP member or not). Therefore, the visibility of the SET Plan in the CC(U)S area is very good, both in the area of academic research and in the industries.
- One member of the Steering Group drew attention to the fact that the creation of the CETP is a factor that could reduce the visibility of the SET Plan. Indeed, with 12 ERA-NETs in charge of funding R&I programmes in Europe, each specialised in a specific technological field and directly linked to the SET Plan, very specific links could be established between the funded project and the SET Plan. However, with the establishment of the CETP, a mechanism fixed in a single text and for a period of 7 years (which implies that it is difficult for the IWGs to really influence the orientations taken by the CETP in terms of funding), it is necessary to ensure that strong links are developed between the CETP and the SET Plan. Furthermore, this newly created partnership has been mainly co-constructed by the national research agencies and only to a lesser extent by the national representatives of the SET Plan, which further increases the risk of diluting the visibility of the SET Plan.

Proposed solutions to increase the visibility of the SET Plan at the EU, national and private sector levels from interviewed SET Plan stakeholders as well as respondents to the questionnaire:

- A systematic reference to the SET Plan could be made in all energy-related EU publications (position papers, communications, directives, regulations, etc.) that have an R&I component (both for official communications and synthetic brochures).
- A systematic reference to the SET Plan could be made in all European and national R&I calls for funding in the field of low-carbon energy technologies.
- The exchange of information between the European Commission and the high-level representatives of SET Plan Countries could be enhanced. Such exchange of information could be achieved through the organisation of annual meetings/workshops with high-level representatives of the governments of each SET Plan country, at which the Commission and the national Steering Group member would deliver the key messages tailored to the specific situation in each country.

- Newcomers to the SET Plan (within the Steering Group and IWGs) could be better equipped via adequate training on arrival so that they can then communicate effectively to their respective governments on SET Plan priorities, hereby influencing them on the R&I investment directions in low-carbon energy technologies to prioritise.
- SET Plan should be better anchored within several ministries within SET Plan Countries such as for instance ministries related to research, environment, climate, energy, economy and industry so that there will be more willingness to explicitly incorporate SET Plan targets national in policies and R&I programmes.
- To create an interactive platform for the R&I community (and potentially all citizens) to connect and discuss R&I shortcomings, ongoing initiatives and progress of the SET Plan and IWG toward objectives. Such a platform would foster active participation of the R&I community, potentially leading to public and private stakeholders sharing best practices and successful use cases. The platform could also serve as a repository for key reports and documents from the different work streams of the SET Plan.
- In each IWG, stronger links should be forged with the relevant ETIPs in order to encourage discussions between SET Plan country and industry representatives, thereby increasing the visibility of SET Plan activities within the private sector and facilitating the establishment of potential future public-private partnerships.
- Tools or actions could be imagined, allowing the SET Plan to be highlighted through Horizon Europe Cluster 5, hereby increasing the visibility of the SET Plan.
- EU industrial associations (lobbies) could be better linked to the IWGs and ETIPs in view of aligning on a common message to convey and combining effort in raising visibility on SET Plan work for each technology at the national policy-makers.
- Within the NECPs, Member States could be requested to report on the comprehensive set of national R&I programmes and initiatives in place, with their associated investment allocations and time horizon, their stage of progress, and with an explanation on the link (if any) to the SET Plan. IWGs national representatives could support their respective Member States in national R&I funding planning and NECP drafting processes, giving them with a more specific and visible role in the supervision of their NECPs.
- A targeted social media campaign could promote a wider dissemination of the SET Plan objectives, activities and results to selected interest groups.
- SET Plan should systematically be included in the agenda of the Energy and Competitiveness Councils.
- SET Plan should be given more political visibility at the EU level (e.g. at the level of Commissioners and/or the energy ministerial).
- Working sessions, exchange platforms and stands, and brochures dedicated to the SET Plan during the EU day could be envisaged.
- SET Plan could be rebranded into "Strategic Energy Transition Plan" to give it a truly societal perspective and ambition.
- To have better communication frameworks within the EC and between the EC and the IWG, in order for the SET Plan activities to come closer to DGs (DG RTD, DG ENER, DG CLIMA and DG GROW). Currently, IWGs work with different DGs within

the Commission. It would be more effective to have a harmonised process and communication with the Commission.

Overall, many stakeholders agree that finding and implementing solutions to increase the visibility of the SET Plan is the first and foremost the responsibility of the European Commission.

Therefore, inputs from the Commission were also gathered on why and how to increase the visibility of the SET Plan at the EU, national and private sector levels:

- Being part of ERA action 11 on “green energy transformation”, the SET Plan, until now working more on a technical implementation level, will gain impetus and political visibility to strengthen common goals. The revision of the SET Plan should increase visibility of its objectives and achievements through regular monitoring at high political level (Council, European Parliament, within Member States), supported by structured progress monitoring at operational level, and facilitated by a strengthened SET Plan Information System⁴².
- It would be desirable to get more political support for the SET Plan in the Competitiveness Council and the Energy Council in order to gain a higher level of commitment, ensure consistency between various national actions, and mobilise and levy funding from public and private sectors⁴³.
- It is also important to raise the profile of the annual SET Plan conference, increasing participation and making it the annual rendez-vous of the energy R&I community⁴⁴.
- Throughout 2022, the Commission will also be looking for other communication opportunities to prepare the SET Plan revision, e.g. at the R&I Days and EUSEW⁴⁵.

5.5.7 Geographical coverage of the SET Plan

For the time being, the geographical coverage of the SET Plan should not be extended to other countries. However, stakeholders in favor of extending the geographical coverage of the SET Plan in the future think it would be particularly relevant to integrate the Western Balkans, (North-)Africa, and Non-EU Eastern Europe.

View 1 (Dominant view shared by most of the interviewed SET Plan stakeholders): Although the idea of extending the geographical coverage of the SET Plan is not seen as unreasonable in principle, most of the interviewed SET Plan stakeholders agree that priority should be given to ensuring proper functioning and coordination of the current arrangement, notably by encouraging greater participation of the current SET Plan Countries in the SET Plan initiatives (i.e. the Eastern EU countries). Additionally, concerns were also expressed that extending the geographical coverage of the SET Plan to other countries will contribute to sharing the EU's competitive advantages with other countries, which could in turn reduce competitiveness and strategic independence. In this perspective, it might be more relevant to better position the SET Plan as a vehicle to promote European competitiveness and leadership in the fields of low-carbon innovation

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to other regions of the world. Stakeholders also emphasised that the program 'Mission Innovation', in which the European Commission and some Member States (Austria, Denmark, France, Germany, Italy, Netherlands, Sweden, Finland) are largely involved, is already aiming at accelerating global public and private research, development and demonstration initiatives in low-carbon energy technologies and infrastructures.

However, although the idea of extending the geographical coverage of the SET Plan is not supported by the majority of stakeholders interviewed, many stressed that the participation of additional countries in SET Plan activities could be addressed on a case-by-case basis by establishing collaborations and partnerships rather than formal memberships. In some R&I areas, such as geothermal (Eastern Europe, Latin America, North America), CSP/STE (Middle East, North Africa), ocean energy (Australia, Canada, UK), hydropower (Western Balkans), the establishment of strong links with other countries could help the development of specific technologies. However, it was emphasised that such collaboration or partnerships should not be seen as an objective as such, and that efforts should be aimed at making the current SET Plan arrangement work effectively. Furthermore, external countries wishing to participate in SET Plan activities could be associated with the SET Plan structure as "observers" to ensure better alignment of R&I programmes worldwide for each technology.

View 2 (Alternative view shared by minor share of the interviewed SET Plan stakeholders): It is worth noting that a minor proportion of the stakeholders interviewed support the idea of extending the geographical coverage of the SET Plan to other countries. Such an extension should be gradual and based on a voluntary basis, focusing on European countries in the short term and then on the Balkans and Eastern Europe. One way of determining which specific countries should be prioritised for inclusion would be to examine the level of participation and integration of candidate countries in Horizon Europe Cluster 5 and to assess whether there would be added value in including these countries in the scope of the SET Plan. Any additional countries falling within the scope of the SET Plan must show a strong interest and willingness to participate actively.

Contrasting with the dominant view of the interviewed SET Plan stakeholders, approximately half of the respondents to the questionnaire are favourable to expanding the geographical coverage of the SET Plan to other countries (see Figure 36). However, analysis of the inputs from the questionnaire do not allow to understand whether expanding the geographical coverage of the SET Plan should be done through collaborations and partnerships or formal membership.

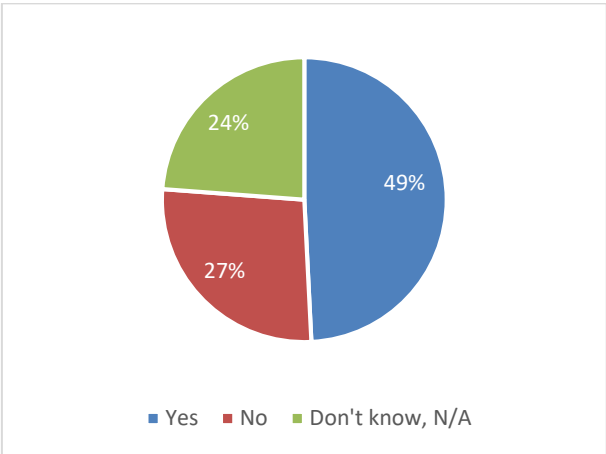


Figure 36. "Should the geographical coverage of the SET Plan be extended to other countries? (e.g. Western Balkans, Eastern Partnership, North Africa, North America?)" (63 respondents)

The following countries/regions were repeatedly mentioned by questionnaire respondents who are in favour of extending the geographical coverage of the SET Plan as being particularly relevant for integration:

- Western Balkans (mentioned 8x) for collaboration across the value chain (including at the operational level).
- (North) Africa (mentioned 8x) due to their increasing (low-carbon) energy demand and their place as natural partner of the EU in the sector or renewable energies (e.g., CSP/STE, Solar PV).
- Non-EU Eastern Europe (mentioned 6x) due to the interlinked with these regions in the energy future.
- Ukraine (mentioned 2x) in relation to ensuring energy security
- North America (mentioned 2x)
- The EU candidate countries (mentioned 1x)
- Countries / Regions listed in the EU External Engagement Strategy (mentioned 1x)
- Mission Innovation countries (mentioned 1x) as they share an ambition to push for climate neutrality and net zero emissions.

5.5.8 Reforming the SET Plan

As shown in Figure 37 and Figure 38 **Error! Reference source not found.** below, survey respondents agree that the SET Plan should be maintained in place, although reform is needed.

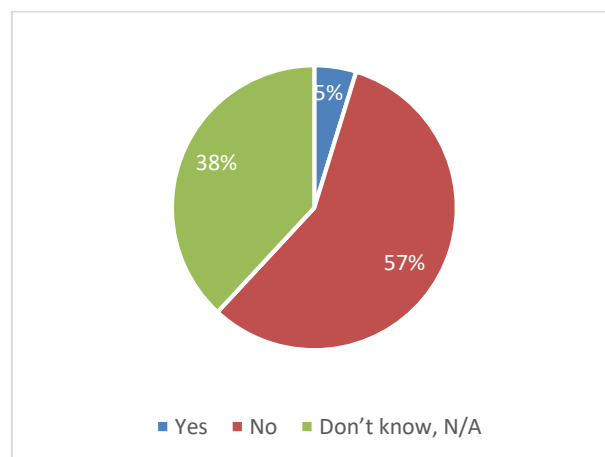


Figure 37. "Do you think the SET Plan or parts of it should be discontinued?" (63 respondents)

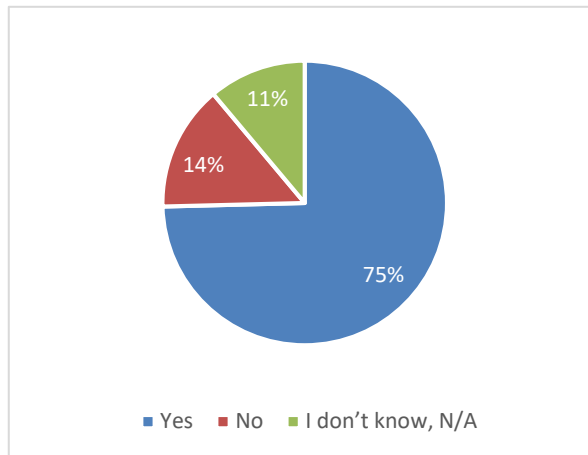


Figure 38. "Do you think the SET Plan needs a reform?" (63 respondents)

In view of recent developments in EU climate policies (e.g., the "Fit for 55" package) and in the energy sector (geopolitical changes, rising energy prices), respondents to the questionnaire agree that there is a need to reform the SET Plan with a view to enable it to play a key role in the energy transition for the next decade. In the context of a reform of the SET Plan, the following key elements were mentioned as priorities to be considered by the European Commission:

- While SET Plan should firmly remain in place as the vehicle driving European ambitions in the area of clean energy technologies, its reform should primarily aim at giving it an institutional (legally binding) role in the framework of the EU energy transition strategy and climate policy targets (Fit for 55 package and REPowerEU Plan) by positioning it as a guiding instrument for R&I policy and funding. A revised positioning of the SET Plan should be integrated into the broader objective of clarifying the articulation and convergence of the SET Plan with all other EU climate/energy initiatives, instruments and policies.
- A revamped SET Plan should position itself as a de-siloed, holistic, mission-driven, systemic, technology-oriented and interdisciplinary instrument that enables R&I in support of the low-carbon energy transition. From a "technology " to a "transition" approach, the SET Plan should be "mission-oriented" and cross-cut "transition challenges", not only focusing on individual technologies. The feasibility of the low-carbon transition from a non-technological perspective should be embedded within the SET Plan framework.
- Bridging both energy policy and R&I/technology-oriented SET Plan stakeholders along shared ambitions and joint actions is a requirement to move forward efficiently and quickly. Therefore, the governance of the SET Plan should be more agile and consist of a governmental group (Steering Group) and a Scientific Advisory Board (expert group composed of members of the ETIPs and EERA – providing a way to ensure appropriate representation of the industries in the SET Plan governance) providing strategic guidance to the Steering Group.
- The governance of the SET Plan should also be further supported by the European Commission in fostering the political visibility of the SET Plan to the national governments of the SET Plan Countries in the perspective to have greater influence and abilities to leverage funds.
- The reform of the SET Plan should accommodate the new energy political landscape in Europe, therefore implying greater considerations for energy storage,

renewable heating and cooling and hydrogen technologies in the scope of SET Plan activities.

6. Conclusions

Figure 39 below maps all listed conclusions by rating them in terms of their ease of implementation and importance /urgency.

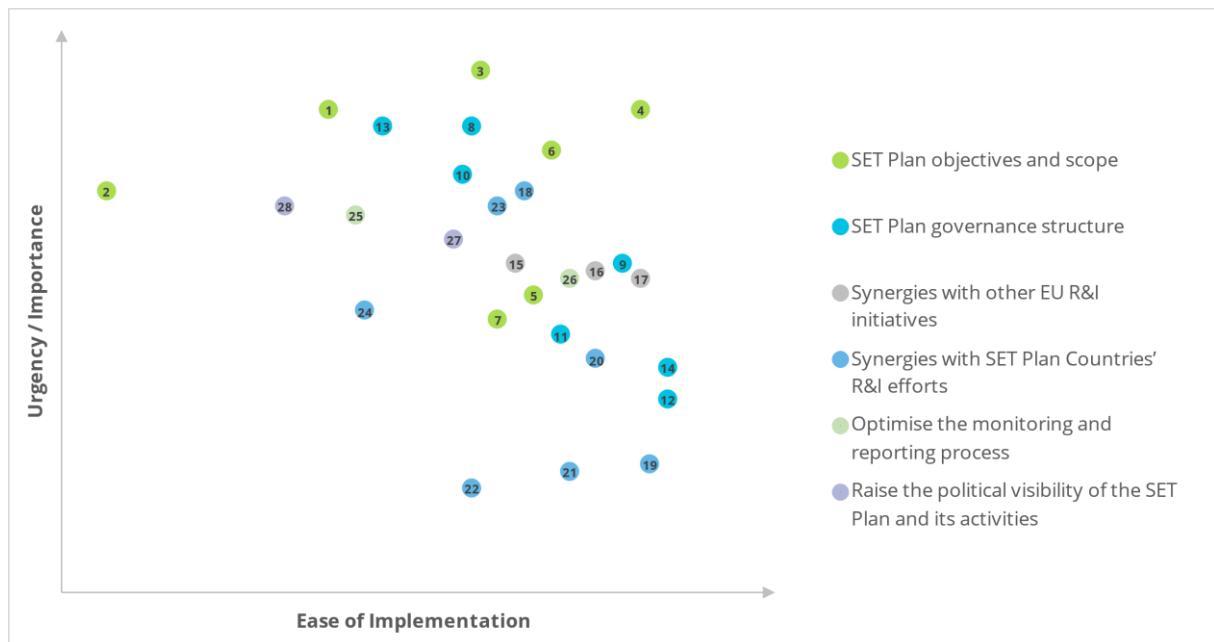


Figure 39. Mapping of conclusions in terms of their ease of implementation and importance/urgency

6.1. Revise the SET Plan objectives and scope

Conclusion 1: Position the SET Plan institutionally as the guiding instrument for EU R&I policy and funding for low-carbon energy technologies, and articulate the specific added value of the SET Plan for national governments and R&I funding agencies of the participating countries, as well as the private sector.

Proposed narrative for the SET Plan

In view of recent developments in EU energy and climate policies (European Green Deal objectives, 'fit for 55' proposals, the 2050 decarbonisation goal and the REPowerEU initiative) and the energy sector (geopolitical shifts, rising energy prices), the SET Plan should be positioned within the wider EU R&I landscape so that it plays a key role in **fostering the energy transition** and **strengthening the EU's strategic energy value chains** (increase its technology independence, global competitiveness, and security of energy supply) **for the next decade**.

To drive European ambitions in the area of clean energy technology developments and **bridge both energy policy and R&I/technology-objectives** along shared ambitions and joint actions, the SET Plan should be framed as the **main vehicle for national governments and the private sector to fund transnational projects in the field of European R&I for low-carbon energy technologies**. Its reform should primarily aim at giving it an **institutional and legally binding role** (e.g., positioning the Steering Group as a formal "high level expert group to the Commission") in the framework of the EU energy transition strategy and climate policy targets (Fit for 55 package and REPowerEU Plan) and positioning it as the guiding instrument for low-carbon energy technology R&I

policy and funding. The revamped SET Plan framework should be positioned as a **mission-driven (top down approach), de-siloed, holistic, technology-oriented** (but not exclusive) instrument that enables R&I in **cross-cutting energy transition challenges**, in support of the low-carbon energy transition.

Conclusion 2: Include within the scope of existing IWGs additional emerging low-carbon energy technologies that are currently not addressed.

The following low-carbon energy technologies are currently outside the scope of existing IWGs and should be addressed in upcoming revised IWG Implementation Plans:

- **Deep Geothermal:** Sub-surface (seasonal) thermal storage; Joint-production of geothermal heat/power and minerals extraction; Greater consideration of various depths for geothermal energy production.
- **Solar PV:** Floating solar PV both for applications on lakes/reservoirs and offshore; Agro solar PV; Solar PV applications on vehicles.
- **Offshore Wind Energy:** Onshore wind energy; Airborne wind energy.
- **CCS-CCU:** Direct Air Capture with Carbon Storage; CO₂ removal from nature-based solutions.
- **Energy Efficiency in Buildings:** Solar Thermal Energy for heating and cooling applications (low temperature).
- **Nuclear Safety:** Nuclear technology for high temperature industrial heat (high temperature heat generators)
- **Batteries:** Batteries for other transport applications (ships, planes, heavy duty road vehicles); Infrastructures for high-power electric recharging for local public transport (including charging solutions incorporated along the route).
- **Renewable fuels and bioenergy:** Detection of methane leaks in the biogas/biomethane value chain.

Conclusion 3: Strongly accelerate R&I activities in specific already-in-scope low-carbon energy technologies for which the current level of emphasis is not sufficient.

Although already within the current scope of the IWGs, the level of importance given to the low-carbon energy technologies below is currently not sufficient. Within the existing IWGs, enhanced emphasis should be placed in upcoming revised IWG Implementation Plans on accelerating R&I activities in the following low-carbon energy technologies:

- **Energy Efficiency in Buildings:** Heat pumps; Heating and cooling systems; Thermal energy storage technologies (including solar thermal).
- **Energy Efficiency in Industry:** Heating and cooling systems; Thermal energy storage technologies (including solar thermal); New hydrogen use in industries.
- **Renewable fuels and bioenergy:** Biogas/biomethane from non-recyclable human and agricultural waste; Renewable ammonia, green e-methanol and green methane as a fuel.
- **CCS-CCU:** Synthetic methane; Fuels from non-biological origin (e-fuels/synthetic fuels).
- **Nuclear Safety:** Small nuclear modular reactors, Nuclear cogeneration and micro-reactors.

Conclusion 4: Create a separate IWG on hydrogen focusing on the development of technologies that will spur the whole hydrogen value chain.

In addition to more largely develop R&I initiatives on new hydrogen use in industries (i.e., iron and steel), **a separate IWG on hydrogen exclusively focusing on the development of technologies that will spur the whole hydrogen value chain should be created**. In particular, the following key R&I activities should be pursued as in priority:

- Production of renewable (green) hydrogen through water electrolysis.
- Production of low-carbon (blue) hydrogen with auto-thermal reforming and CO₂ capture (in cooperation with the CCS-CCU IWG).
- Production of low-carbon hydrogen from nuclear-based electricity.
- Production of renewable ammonia and green e-methanol as a fuel (in cooperation with the Renewable fuels and bioenergy IWG).
- Production of e-fuels/synthetic fuels (in cooperation with the CCS-CCU IWG).
- Hydrogen use in industries for new applications (in cooperation with the Energy Efficiency in Industry IWG).
- Hydrogen use in transport applications (fuel cell and hydrogen-fuelled heavy-duty transport, ships, trains, etc.).
- Hydrogen transport and distribution via pipelines (both new and retrofitted pipelines).
- Hydrogen storage in salt caverns and depleted natural gas fields.

To ensure no duplication in R&I activities pursued by the Clean Hydrogen Partnership and by the Green Hydrogen ERA pilot initiative, this additional IWG on hydrogen should pursue the following priorities:

1. To focus on the **alignment** and **coordination** of **national hydrogen R&I strategies** and the mobilisation of **national R&I funding programs** in the SET Plan Countries (with a focus on bringing the right group of Member States and industry together to help promote and implement the SRIA).
2. To focus on development of hydrogen R&I initiatives for **low TRL level research** technologies.
3. To focus on the development of hydrogen R&I initiatives in **countries that do not currently have a strong foothold in hydrogen technologies** (e.g., Central and Eastern Europe).

Conclusion 5: Create a new IWG focusing on critical raw materials and minerals that are essential components of low-carbon energy technologies.

Create a new horizontal IWG focusing on the **development of technologies enabling the substitution, extraction** (mining from domestic deposits), **refining, reuse and recycling of critical raw materials and minerals** (i.e., copper, lithium, nickel, cobalt, graphite, chromium, rare earths, silicon, etc.) that are essential components of low-carbon energy technologies (wind turbines, electricity networks, batteries for electric vehicles, solar PV, electrolysers, etc.). **Decreasing EU dependency on foreign nations** for the extraction, processing, shipment and recycling of these strategic materials and minerals is seen as **one of the key priorities of the European Union and a prerequisite for a successful energy transition**⁴⁶. Close links should be established with other IWGs to address the specific challenges faced by each sector, especially in R&I activities on substitution of critical raw materials in manufacturing processes and recycling. To ensure

⁴⁶ Communication - Critical raw materials resilience: Charting a path towards greater sustainability and security (COM(2020) 474 final)

that the spectrum of critical raw materials covered reflects the latest developments in commodities markets at any given time, the scope of the newly created IWG on Critical Raw Materials should be aligned with the EU list of critical raw materials (updated every three years).

Conclusion 6: Integrate a dedicated workstream R&I activity on non-technological and cross-cutting areas in each IWG.

Key non-technological and cross-cutting research areas are of primary importance to the work of the SET Plan and should be more widely considered in the upcoming revised IWGs Implementation Plans. Due to the fact that cross-cutting research areas is very technology-specific and the junction between two technologies occurs most of the time only at the thematic level, it is recommended to **directly integrate a dedicated workstream R&I activity on “non-technological and cross-cutting areas” in each IWG**, so that the work conducted matches the practical aspects encountered by each sector. Inspiration can be drawn from the approach taken by the Offshore Wind Energy IWG to list “Ecosystem, Social Impact & Human Capital Agenda” as one of the 6 key activities of the IWG. While the specific non-technology and cross-cutting areas to be addressed in each IWG are to be decided jointly by the IWG chairs and co-chairs in collaboration with the Steering Group, the following topics should receive special attention in the screening process:

- **Creating societal awareness** by ensuring a just, fair and socially acceptable transition for all as a means of facilitating the development and implementation of low-carbon energy technologies and infrastructures (better understanding of citizens' concerns, increased citizen engagement and participation, making impact on the landscape acceptable, etc.).
- **Improving circularity** (recyclability and reusability) **and efficiency** of renewable energy materials and other low-carbon technologies and infrastructures through a life cycle approach to technology and infrastructure (e.g., development of advanced sustainable materials and material consumption reduction in production processes).
- **Cost reduction, market integration and user empowerment** in the energy transition through digital transformation and the development of digital solutions in the energy sector.
- **Addressing the shortage of skills and education** to further encourage investments in reskilling and upskilling of the workforce in the key industrial ecosystems for the low-carbon energy transition (i.e., Energy Intensive Industries, Construction and Renewable Energy).
- **Assessing and minimising the implications low-carbon energy technologies and infrastructures roll-out on biodiversity, ecosystems and human health.**
- **Enabling greater and more efficient energy system integration**, encompassing topics on energy and electricity markets design, tariffs and regulation.
- **Include a wider portfolio of research, including in the field of social sciences** and in order to better understand the impact of the development of specific low-carbon technologies in the context of the energy transition on households and communities.

Furthermore, in addition to integrating a dedicated workstream R&I activity on non-technological and cross-cutting areas in each IWG, the SET Plan framework could **establish an overarching multi-disciplinary Centre of Excellence on Energy Transition Pathways**. As a separate workstream independent to specific IWGs, this Centre of Excellence would focus its work on the key challenges of the energy transition and should be **composed of members of the IWGs and ETIPs**, as well as **new**

members with expertise in the energy transition field from a social science and humanities perspective. This Centre of Excellence on Energy Transition Pathways would prioritise the following R&I activities:

- **Identify and develop robust energy transition pathways as alternative strategies to dominant assumptions and policy directions** towards a net zero integrated European energy system (e.g., energy sufficiency, managing the transition in a world constrained by energy supply shortage).
- **Understand strategic R&I energy planning requirements** (top-down and mission-driven rather than bottom-up) for the effective implementation of the Fit for 55 package and the REPowerEU Plan.
- **Assess socio-economic risks and vulnerabilities** implied by the energy transition and energy-related materials dependencies.

Conclusion 7: At the moment, the SET Plan geographical coverage should not be extended.

Priority should be given to ensuring proper functioning and coordination of the current arrangement (through encouraging greater participation of the current SET Plan Countries in the SET Plan initiatives) **rather than extending the geographical coverage of the SET Plan.** Furthermore, since SET Plan should be positioned as a vehicle that promotes European competitiveness, leadership and strategic independence in the field of low-carbon innovation, **the focus should be put on further developing and maintaining technological advantage in key low-carbon energy technologies at the EU level,** implying to carefully consider which information should or not be shared with non-SET Plan participating countries.

However, allowing greater participation of outside countries in SET Plan activities could have a positive impact if undertaken in the following ways:

- Participation of additional countries in SET Plan activities could be approached on a case-by-case basis by establishing **collaborations and partnerships rather than formal memberships** where developing strong links with other countries could help with the development of specific technologies (e.g., geothermal, CSP/STE, ocean energy).
- **Collaboration could be pursued between the SET Plan and the Mission Innovation program** around relevant research, development and demonstration initiatives in low-carbon energy technologies and infrastructure. This collaboration could be achieved by including a representative of the Mission Innovation program in the governance of the relevant IWGs.
- **External countries** (with a particular focus on the Western Balkans, North Africa, and non-EU Eastern European countries) **wishing to participate in SET Plan activities could be associated with the SET Plan structure as 'observers'** to ensure better alignment of R&I programs in Europe's neighbouring regions for relevant low-carbon energy technology.

6.2. Revise and strengthen the SET Plan governance structure

Conclusion 8: Strengthen the role and responsibilities of the Bureau and the Steering Group

Strengthen and formalise the role of the Bureau in new Terms of Reference. Along with the European Commission, the Bureau should be **formally positioned as a co-decision body in the governance of the SET Plan**. Also, in order to increase the perceived influence of the SET Plan on the European R&I strategy in low-carbon energy technologies, it would be appropriate to delegate the reflection work currently done by the Commission to the Bureau. Concretely, the 7-8 main driving countries represented in the Bureau (preferably geographically balanced) could have the mandate to **co-define with the Commission the strategic orientations of the SET Plan**, and then to effectively **communicate the agreed strategy** to the Steering Group and the IWGs (and their merged ETIPs).

As for the **Steering Group, its weight in the framework of the SET Plan should be strengthened**. For instance, to raise its political importance at the Commission, the current SET Plan Steering Group should be transformed into a formal Member States-driven expert committee. Additionally, **the role and responsibilities of the Steering Group should be clarified in new Terms of Reference**. On the top of the responsibilities and activities that Steering Group Members are undertaking under the current framework, the Steering Group could also be responsible for ensuring proper follow-up after meetings with other SET Plan stakeholders so that all parties understand what has been agreed upon and what are the next steps.

At last, the **Commission should facilitate the organisation of (mainly) physical plenary Steering Group and Steering Group Bureau meetings very 4 to 6 months**.

Conclusion 9: Clarify the role of the IWGs

Composed of both **national representatives from the SET Plan Countries** as well as **representatives from industry and academia** (former ETIP members - see Conclusion 10), the IWG's main role should remain the **definition a common vision for the development of R&I activities for each low-carbon energy technology** relevant to the energy transition in Europe and to **facilitate the development of R&I initiatives that contribute to achieving the techno-economic goals defined in the Implementation Plan**. To achieve these two objectives, **IWGs should implement actions to influence national governments on the value of providing funding to the CETP and investing in national R&I programs** that will contribute to achieving the R&I vision and technology goals. Also, all IWG should **formalise in their revised Implementation Plans which ambitions in R&I initiative development will require the establishment of formal collaboration with other IWG(s)**.

All the specific expectations regarding the role and responsibilities of the IWG stakeholders (chairs, co-chairs, and other country representatives) should be formalised in **new Terms of Reference**.

Conclusion 10: Merge ETIP with their respective IWGs

Significant improvements in SET Plan operation efficiency could be achieved by **operating mergers between each ETIPs and their associated IWGs**. Indeed, bridging both energy policy and R&I/technology-oriented SET Plan stakeholders along shared ambitions and joint actions could be a significant factor to move forward efficiently and quickly. Therefore, ensuring appropriate representation of the industries in the IWG governance and operation would enable the more efficient transfer of scientific knowledge from the strategic research and innovation area to the national and EU energy policy agenda. As it is already the case in some IWGs, each IWGs would be chaired by one or more SET Plan Countries and co-chaired by an industry representative (i.e., former coordinator of the ETIP).

Merging the ETIPs with the IWGs would bring the following benefits:

- **Greater buy-in and engagement from the industries** to the implementation of IWG's Implementation Plans.
- Need to **submit only one common grant application to Horizon Europe program**, therefore ensuring alignment between the interests of national governments and industries as well as greater efficiency and complementarity in the use of the Horizon Europe funding.
- Possibility to **use CSAs to support both IWGs and ETIPs work**, therefore increasing economies of scale through greater efficiency and reduced costs.
- To **combine the respective financial resources** of the IWGs and of the ETIPs under a shared goal and joint actions.
- To give the opportunity to the various ETIPs **to exchange information on best practices and initiatives** at SET Plan meetings in which the IWGs are represented.

Practically, within the IWGs, the former members of the ETIPs (representatives from industry and academia) would **act as the scientific advisor body to the IWG** by identifying the R&I activities for which the public and private sectors should prioritise investments. Based on the list of relevant R&I activities identified and taking into account the vision defined by the IWG, the former ETIP members would then co-conceive the Implementation Plans. Within this framework, former ETIP members would have the **dual responsibility of ensuring that industries are prepared to invest in the agreed-upon R&I activities and providing very clear recommendations to the Commission on the regulations, policies, and funding needed to achieve the goals of the Implementation Plan.**

The list of ETIPs to merge with their respective IWGs is the following.

IWGs	ETIPs
Solar PV	ETIP PV
Offshore wind	ETIP Wind
Deep Geothermal	ETIP-DG
Ocean Energy	ETIP Ocean
Positive Energy District	ECTP
Energy Systems	ETIP SNET
Energy Efficiency in Buildings	Renewable Heating and Cooling
Batteries	ETIP batteries
Renewable fuels & bioenergy	ETIP Bioenergy
CCS-CCU	Zero emissions platform
Nuclear Safety	SNEPT

Note: the IWGs on CSP-STE, Energy Efficiency in Industry and HVDC are not currently supported by any ETIP.

Conclusion 11: Increase the weight of the (former) ETIPs and EERA in the SET Plan governance

To create a “Scientific Advisory Committee” attached to the Steering Group and composed of (former) representatives of the ETIPs and EERA, and who would act as an advisory body that will bridge the gap between the fields of energy policy and energy technology policy.

In addition, while pursuing its activity of aligning the activities of individual research organisations with the needs of the SET Plan priorities, and to establish a joint programming framework at the EU level, EERA should also have a supportive role in influencing SET Plan Countries toward stricter alignment of national R&I strategies with the SET Plan.

Conclusion 12: Provide relevant and harmonised secretariat support to the SET Plan

The Commission should **establish a central CSA**, with very precise mandates, that would **horizontally support all IWGs** (and their merged ETIPs). On the one hand, this horizontal CSA would be responsible for all secretariat-type of work related to the overall work of the SET Plan, such as event organisation, various administrative tasks (i.e., helpdesk) as well as reporting on activities conducted and progresses achieved. On the other hand, this CSA would help foster and maintain linkages with the relevant senior government officials in SET Plan Countries.

In addition to a central CSA, the Commission should also **provide funding for a limited number of CSAs that would support the work of specific IWGs**. The allocation of these CSAs to individual IWGs would be based on an internal competition system (i.e., each IWG wishing to benefit from the support of a CSA would submit grant applications, with a limited number of applications being approved). These CSAs would support IWGs by performing market studies, help with the redaction of papers, among other tasks.

Conclusion 13: Counterbalance the silo approach to development of R&I initiatives by fostering more cooperation between SET Plan stakeholders.

To de-silo the approach to development of R&I initiatives and align on common objectives and orientations, the following actions are suggested to be implemented:

- **Increase systematic exchange of information between the SET Plan governance and high-level representatives of SET Plan Countries.** Such exchange of information could be achieved through the organisation of annual meetings/workshops with high-level representatives of the governments of each SET Plan country, at which the Commission and the national Steering Group member would deliver the key messages tailored to the specific situation in each country.
- **Organise bi-annual plenary sessions during which the chairs and co-chairs of each IWGs would report to the Steering Group on the progress of the annual measurable objectives against the Implementation Plan.** These regular status update would provide the opportunity to foster interaction and understanding between the lines of work of the Steering Group (Bureau) and the IWGs.
- **Organising more frequent plenary meetings** (i.e., every 4 or 6 months) with the Steering Group, the IWGs, the ETIPs and the EERA during which all entities would be informed about the status of the activities that are being conducted in the framework of the SET Plan, along with the specific associated targets and timeline.
- **Organising annual specific forums/workshops between the IWGs** (and their merged ETIPs) to exchange and explore the potential cross-sectoral collaborations that could be established between two or more IWGs. Indicative examples of cross-sectoral collaborations between two of more IWGs could be the following:
 - The Deep Geothermal and the CCS-CCU IWGs on carbon capture technologies needed to prevent the release of CO₂ from the geothermal fluid that is pumped to the surface into the atmosphere.

- The Bioenergy and Renewable Fuels and the CCS-CCU IWGs on the production of e-fuels/synthetic fuels.
- Energy Efficiency in Buildings and Energy Efficiency in Industry on solar Thermal Energy for heating and cooling applications.

Conclusion 14: Establish a compendium

The Commission should take steps to **establish a compendium describing the name, title, contact information, and key responsibilities of all individuals who are composing the SET Plan-related entities** (Steering Group, IWGs, former ETIPs, CSAs, CETP, DUT, etc.). This compendium shall be updated on a monthly basis and be freely available to all members of SET Plan-related entities.

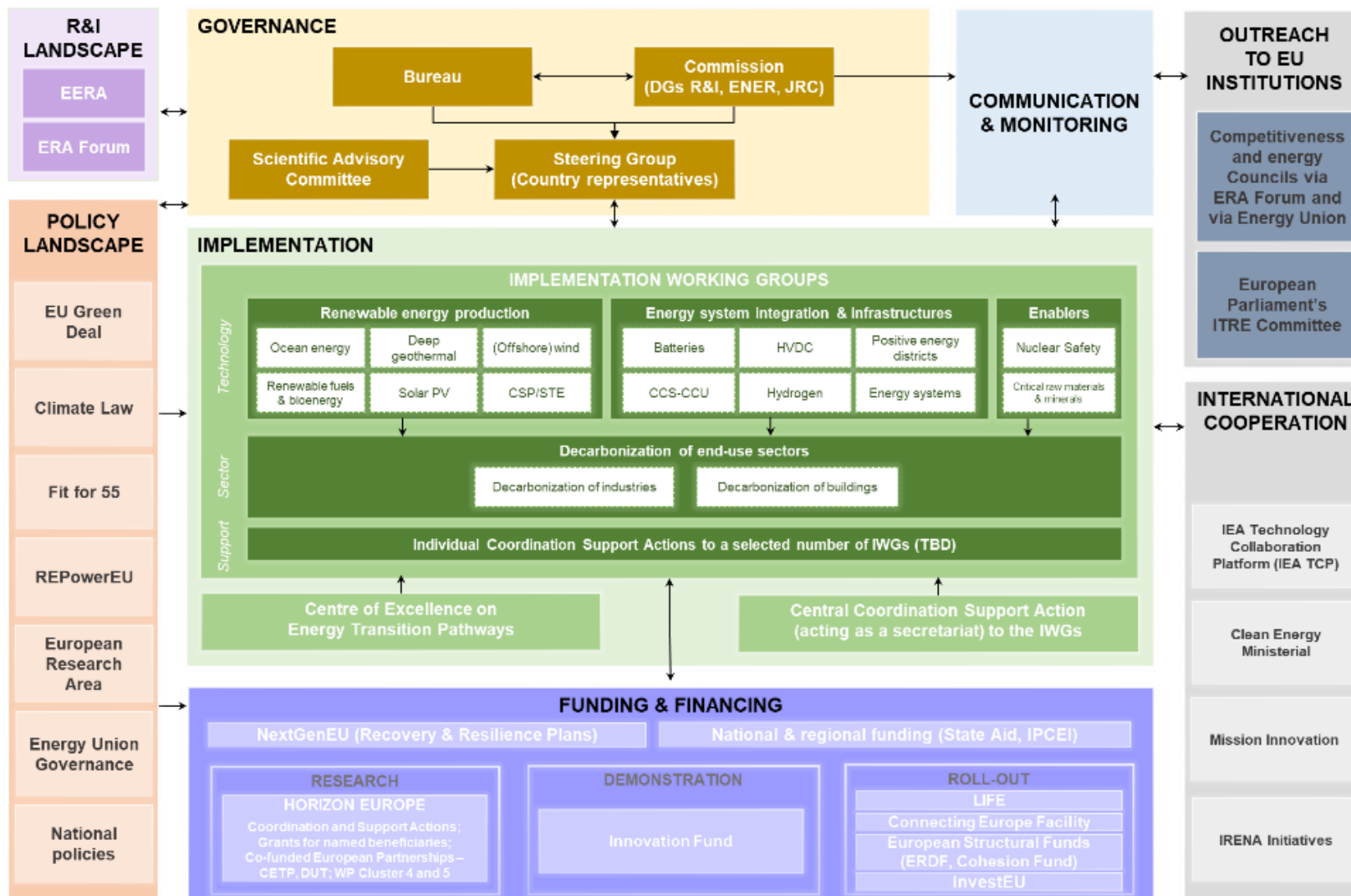


Figure 40. Suggested revised structure of the SET Plan

6.3. Strengthen synergies with other EU R&I initiatives

Conclusion 15: Establish a strong connection between Horizon Europe Cluster 5, the Clean Energy Transition Partnership, Driving Urban Transition Partnership and the SET Plan (IWGs) and make clear the complementary role of these three entities in supporting energy R&I at the EU level

- Request Horizon Europe Cluster 5, the Clean Energy Transition Partnership and the Driving Urban Transition Partnership to **systematically link their calls for projects to the work of the SET Plan**, precisely outlining how the activities of the IWGs provide the foundational framework that substantiates the value of the calls for projects and how these funded projects are expected to address one or more of the IWGs' objectives.
- **Appoint the same national representatives to the Horizon Europe Cluster 5 Committee, the Clean Energy Transition Partnership and the SET Plan Steering Group** as a way to ensure better alignment and thus mutual benefits between the R&I projects funded by these programmes and the SET Plan. Alternatively, representatives of the Horizon Europe Cluster 5 Committee could be part of the SET Plan governance structure (for instance, as formal members or "observers" of the SET Plan Steering Group).

Conclusion 16: Strengthen the link between REPowerEU and the SET Plan

The ambitious low-carbon energy technologies roll-out targets communicated in the REPowerEU plan should translate in the **frontloading of some of the existing R&I targets in the upcoming revised Implementation Plans** of the IWGs on Renewable Fuels and Bioenergy, Energy Efficiency in Buildings, Energy Efficiency in Industry, Solar PV, CSP/STE, Offshore Wind, Energy systems, CCUS/CCU, and Batteries. In particular, consideration should be given to **increase the urgency of investment in R&I, both in low-carbon energy technologies already covered and not (largely) covered yet by the scope of the SET Plan**, in order to align with the deployment of the REPowerEU Plan. The following R&I topics have been assessed as needing to be highly prioritised

- **Sustainable biogas and biomethane production.** A dedicated R&I Activity within the Renewable Fuels and Bioenergy IWG should be created.
- **Biomethane use in the building sector.** A dedicated R&I Activity within the Energy Efficiency in Buildings IWG should be created.
- **Renewable hydrogen value chain.** A new and dedicated IWG covering the whole renewable hydrogen value chain should be created.
- **Hydrogen use in industries.** A dedicated R&I Activity within the Energy Efficiency in Industry IWG should be created.
- **Renewable heating and cooling (storage) solutions,** particularly heat pumps and solar thermal technologies. Dedicated R&I Activities within the Energy Efficiency in Buildings and Energy Efficiency in Industry IWGs should be created.

Conclusion 17: Strengthen the link between the Steering Group and the ERA

Given that the SET Plan revamp is an agreed action (11.2) in the ERA Policy Agenda, greater synergies between the SET Plan Steering Group and the ERA should be developed in the perspective to deepen and contribute to harmonisation of the collaboration between the Commission and Member State's in the field of green energy transformation. In this

context, the revamped **SET Plan and the ERA should define a joint programming framework with communication channels to align on priorities and targets.** To do so, the following actions should be implemented:

- The Terms of Reference of the Steering Group should mention the **requirement for the national representatives members of the Steering Group to exchange with their ERA counterpart and to report on the outcome of their exchange to the SET Plan Bureau.** Such an exchange process would enable the SET Plan Steering Group to make best use of knowledge and networks already existing in Member States that are participating in ERA action 11.
- The ERA action 11 representatives should **participate in the Steering Group meetings as “observers”**, complementing the scientific expertise of the ETIPs and EERA representatives, if necessary.
- When relevant, **SET Plan R&I activities should precisely explain how they are complementing or pursuing the work achieved under the ERA framework** (e.g., Green Hydrogen ERA pilot initiative).
- The ERA framework should be used as a **channel for wider dissemination of the activities and accomplishments of the SET Plan**, thereby contributing to increasing its visibility.

6.4. Strengthen synergies with SET Plan Countries' R&I efforts

Conclusion 18: The SET Plan must become the key tool to improve the updating and monitoring of the Research, Innovation and Competitiveness chapters of the Member States' NECPs in future revisions

This could be achieved by **establishing a predefined prescriptive NECP structure, not only by chapters as it is today, but in more details about what exactly will be implemented and by which means** (what, how, who, when). Such a predefined prescriptive NECP structure for the Research, Innovation and Competitiveness chapters would mandate Member States to:

- Systematically **link the R&I objectives in low-carbon energy technology formulated in the NECPs with the IWG targets** for each low-carbon technology of relevance, with **clear explanation on how national R&I targets will contribute to IWG targets.**
- **Report on the comprehensive set of national R&I programmes and initiatives in place, with their associated investment allocations and time horizon, their stage of progress, and with an explanation on the link (or not) to the SET Plan objectives and targets.** To report on national R&I initiatives and associated R&I investments, the Commission should provide Member States with a **reporting framework and a set of basic key performance indicators applicable to each EU country.** Inspiration can be drawn from the methodology used in the existing IEA annual report on energy technology R&I expenditure.
- Systematically **highlight in the NECPs new R&I areas in the field of low-carbon energy technologies** that are not covered by any of the SET Plan IWGs.

In addition, the process of drafting the NECPs' Research, Innovation and Competitiveness chapters could be made easier by **directly connecting the Steering Group members with the ministries and persons responsible for drafting the NECPs in their respective countries.**

- Such a collaboration could be formalised by establishing a yearly reporting process on the achieved national objectives against the targets of the different IWGs.
- National representatives involved in the Steering Group should preferably have an active role in the drafting of national R&I agenda in low-carbon energy technologies.
- National representatives involved in the IWGs should preferably have an active role in determining the scope and content of associated national funding programs.

Note: Should strengthening the legal basis of the SET Plan and its link with the NECP not be an option, the extent to which the sub-conclusions detailed above will be followed by Member States will depend largely on the nominations to the SET Plan bodies of each country as well as the individual engagement of these nominees (refer to *Conclusion 19* on provisions to implement to ensure that national representatives have the right profile to be nominated to the SET Plan). The Commission could alternatively explore ways to make such integrated reporting approach attractive to national governments.

Conclusion 19: Ensure that national representatives have the right profile to be nominated to the SET Plan

- **The nomination of national representatives should be based on a set of binding minimum criteria, formalised in Terms of Reference**, that need to be fulfilled to be appointed in the IWGs and Steering Group. This binding criteria should mandate national governments to appoint national representatives in the Steering Group and the IWGs who are adequately positioned to effectively inform and influence their national government in defining the key strategic priorities to be addressed in R&I policies and initiatives, hereby contributing to giving the SET Plan the appropriate credibility as vehicle for national governments to fund transnational projects. **These criteria should encompass the position** (e.g., only members of Cabinets or political advisors in R&I and energy), **experience** (e.g. min 5 years of experience) and **qualifications** (e.g., expertise in energy technologies, governance or energy systems). Moreover, the representatives should be appointed **for a limited period** (e.g., 2 years), after which their nomination should be re-evaluated based on the members' participation, contribution and interest. **The central CSA should be in charge of reaching out to governments and assessing the nominations**. A relevant option would be to introduce individual (short) letters of intent of individual members at the inception of their mandate.
- **Formalise in Terms of Reference the specific expectations regarding the role and responsibilities of the IWG stakeholders** (chairs, co-chairs, and other country representatives) **and Steering Group members**. Specifically, these Terms of Reference should delineate the precise scope of individual and collective responsibilities, and the role of each IWG stakeholder in executing the Implementation Plan.
- A setting to further explore would be to **make mandatory for SET Plan Countries to appoint two national representatives to the Steering Group; one representing the R&I ministry and one representing the (energy) policy ministry**. Such a setting could encourage more top-level engagement from national governments, break the silo approach, and help better align national R&I strategies with the SET Plan, from setting strategic priorities to monitoring. Also, greater coordination and communication between national ministries with complementary areas of competence could contribute to better align state aid strategies and priorities.

Conclusion 20: Articulate the specific added value of the SET Plan for the national governments and R&I funding agencies of the participating countries.

For more detailed insights on how to articulate the specific added value of the SET Plan for the national governments and R&I funding agencies of the participating countries, please refer to Conclusion 1.

Conclusion 21: Make the country representative more accountable by organising regular meetings.

For more detailed insights on the organisation of meetings between the SET Plan entities stakeholders, please refer to Conclusion 13.

Conclusion 22: Organise an onboarding for new members of the Steering Group and IWGs

During this onboarding a clear communication on the SET Plan should be provided to **ensure new members of the Steering Group and IWGs have a complete understanding of the overall functioning of the SET Plan** (structure, governance, purpose, objectives, current and future priority focus areas and achievements of all IWGs), **as well as of the various provisions stated in the Terms of Reference that delineate the scope of their responsibilities**. Providing newcomers with adequate training on arrival should enable them to communicate effectively to their respective governments on SET Plan priorities, hereby influencing them on the R&I investment directions in low-carbon energy technologies to prioritise.

Conclusion 23: In collaboration with national R&I agencies, the Commission should seek to standardise the rules applied by national and European R&I instruments that 1) determine whether a project is eligible to receive national and European funding (exclusion criteria) and 2) decide on the allocation of funds (selection criteria).

Such an standardisation of the rules across the R&I schemes in SET Plan Countries should **contribute to ease the barriers to raising the adequate resources to fund transnational projects**, therefore allowing **more effective mobilisation of national and EU funding** through CETP, Horizon Europe, Co-Fund programs, etc.

Conclusion 24: Establish an open repository database mapping all available national and EU funding for low-carbon energy technologies in Europe

In collaboration with national R&I funding agencies, the Commission should seek to **establish an open repository database mapping all available national and EU funding for low-carbon energy technologies in Europe**. The establishment of this open repository should be made easier if the *Conclusion 18*, which proposes to involve the national representatives of the IWGs in determining the scope and content of their national funding programs, is enforced. Additionally, **a "heat map" visually describing the geographical divergence in development and focus on R&I projects per technology for each country could be developed**. Such a repository would ensure continuous monitoring of R&I public investments and help assess the extent to which adequate funding is being mobilised in each country and by technology. It would also help the SET Plan participants in streamlining their efforts and driving the strategic orientation of their respective IWGs. The establishment of this open repository database mapping all available national and EU funding for low-carbon energy technologies in Europe should be **supervised by the horizontal CSA** (see *Conclusion 12*).

Conclusion 25: Increase the efficiency of the reporting process

Building on the SET Plan Information System and its annual progress reports, the implementation of the following key actions should contribute to increase the efficiency of the reporting process on the SET Plan achievements across the participating countries:

- Definition of 3 complementary layers of Key Performance Indicators (KPIs) for all IWGs:
 1. **General cross-IWG KPIs**, such as the number of participating countries in the IWG, the number of members involved in the IWG, the number of projects per category (to start, in progress, finished), the amount of public and private investment in transitional co-funded R&I projects linked to the IWGs, etc. These KPIs need to be **easy to track and be defined by the Commission and IWG chairs and co-chairs** in order to have harmonisation between the different IWGs.
 2. **Specific and technical KPIs on the outcomes of R&I projects (or R&I activities) directly linked to the activities of the IWGs**. These KPIs should be **identified by each IWG** and their relevance should be reassessed on a yearly basis. The European Commission should validate these KPIs prior to their adoption.
 3. **Development of “success stories”, highlighting the key achievements of the IWGs**. This approach, which is already being applied in the latest annual progress reports help to better communicate the key outcome of the SET Plan and make it more tangible for stakeholders (i.e., national governments) to understand its lines of action and added-value.
- **Provide dedicated human resources to the IWGs** which would be in charge of collecting the relevant data to be provided to the SET Plan Information System. This task should be in the **mandate of the horizontal CSA** (see *Conclusion 12*).
- **Require all SET Plan Countries to use a set of common indicators to national R&I funding in low-carbon energy technologies** (see *Conclusion 18*). To use a simple and unified set of indicators across countries and stakeholders, so that the indicators can be easily assessed and compared between SET Plan Countries and/or technologies. The goal is to provide more granular information (than that currently available in national statistics) to track progress across technologies at the national level.

Conclusion 26: Share more regularly the main results of the work of the Steering Group and the IWGs with all SET Plan stakeholders

- Better **integrate the SET Plan reporting within a broader Commission update on the progresses made in the EU Green Deal framework** and make the narrative stronger.
- Organise bi-annual plenary sessions during which the chairs and co-chairs of each IWG would report to the Steering Group on the progress of the annual measurable KPIs against their Implementation Plan (see *Conclusion 13*).
- Develop a SET Plan dedicated website to clearly communicate the progress and achievement of objectives (see *Conclusion 27*).

6.6. Raise the political visibility of the SET Plan and its activities

Conclusion 27: Establish effective communication channels for the IWGs towards the Commission on policy priorities

The IWGs should increase their influence at the European Commission level by **adopting a proactive approach in engaging with the DGs** (i.e., ENER, RTD, GROW) **and specific policy departments within the Commission in order to discuss and influence low-carbon energy technology development needs that need to be pushed to the front of the EU R&I policy agenda**. With the support of the horizontal CSA (see *Conclusion 12*), the Commission should therefore ensure **clear and formal communication channels are established** between the IWGs and relevant DGs.

Conclusion 28: Raise the political visibility of the SET Plan and its activities at the EU, national and private sector levels

Raising the political visibility of the SET Plan and its activities at the EU, national and private sector levels could be achieved by implementing the following key actions:

Action/Level	EU	National	Private
Have a systematic reference to the SET Plan in all energy policy-related EU publications (position papers, communications, directives, regulations, etc.) that have an R&I component (both for official communications and synthetic brochures).	X	X	X
Have a systematic reference to the SET Plan in all R&I policy-related EU publications (position papers, communications, directives, regulations, etc.) that have an energy component (both for official communications and synthetic brochures).	X	X	X
Have a systematic reference to the SET Plan in all European and national R&I calls for funding in the field of low-carbon energy technologies (see <i>Conclusion 15</i>).	X	X	X
Raise the profile of the annual SET Plan conference, increasing participation and making it the annual rendez-vous of the energy R&I community (national ministries, R&I funding agencies, sectorial associations, etc.).		X	X
Develop a user-friendly website that effectively disseminates to the most the work of the IWGs. Developed and managed by the horizontal CSA (see <i>Conclusion 12</i>), the key traits of the website would be the following :			
<ul style="list-style-type: none"> • Communication on the purpose of the SET Plan; • To provide an overview of the R&I projects being developed at national level by each IWG; • To highlight individual success stories of IWGs; • To give a real-time view on the progress made by IWGs towards their targets, in the form of a dashboard (with key numbers and figures). The work currently being done by SETIS could serve here as a basis; 	X	X	X

<ul style="list-style-type: none"> • To provide a calendar with the planned meetings for the year; • To provide a clear webpage showcasing the updated governance of the SET Plan, along with the contact details of representatives for each of the SET Plan entities; • To provide an interactive platform for the R&I community (and potentially all citizens) to connect and discuss R&I shortcomings, ongoing initiatives and progress of the SET Plan and IWG toward objectives. Such a platform would foster active participation of the R&I community, potentially leading to public and private stakeholders sharing best practices and successful use cases. 			
Strengthen the link between the Steering Group and the ERA (see <i>Conclusion 17</i>),	X	X	X
Better connect EU industrial associations (lobbies) with the IWGs and the ETIPs in view of aligning on a common message to convey and combining effort in raising visibility on SET Plan work for each technology at the national policy-makers.		X	X
Systematically include the SET Plan on the agenda of the Energy and Competitiveness Councils in order to gain a higher level of commitment, ensure consistency between various national actions, and mobilise and levy funding from public and private sectors.	X	X	
Give more political visibility at the EU level by giving the responsibility of the SET Plan to a high-level European Commission political figure or to a commissioner.	X		
Set up workshop sessions, exchange platforms and stands, and design brochures dedicated to the SET Plan during the EU days.	X	X	
Establish new R&I alliances and partnerships in low-carbon energy technologies to enhance international visibility (see <i>Conclusion 7</i>).	X	X	
Overcome the reluctance of the private sector to engage in medium- to long-term R&I initiatives by further promoting calls for funding under the CETP that involve public-private partnerships.			X

7. Appendices

Appendix 1: Evaluation matrix

Judgment criteria	Evaluation indicators/topics	Data Source	Coding
<u>Evaluation criterion 1: Relevance and coherence of the SET in the context of the EU and SET Plan Countries national frameworks</u>			
Alignment between the scope of the SET Plan and the EU energy and climate policy objectives	At the EU level, assessment of the current scope of the SET Plan against research and innovation objectives for low-carbon energy technologies and infrastructures.	Desktop research	/
	At the EU level, assessment of stakeholders' perceptions regarding the alignment of SET Plan scope against research and innovation objectives for low-carbon energy technologies and infrastructures.	Interviews Questionnaire	INT-Q3.1 QUE-Q2.1
Alignment between the objectives of the SET Plan's IWGs and the EU energy and climate policy objectives	Assessment of stakeholders' perceptions regarding the alignment of the IWGs' objectives and targets against the research and innovation objectives for low-carbon energy technologies and infrastructures.	Interviews Questionnaire	INT-Q2.1 QUE-Q2.2
Alignment between the scope of the SET Plan and the national R&I agenda formulated in the National Energy and Climate Plans.	Synthetic overview of the extent to which clear links and synergies exist between the SET Plan and the national R&I agenda formulated in the National Energy and Climate Plans.	Desktop research	
	Assessment of stakeholders' perceptions regarding the links and synergies between the SET Plan's scope and the national R&I agenda	Interviews Questionnaire	INT-Q3.2 QUE-Q2.3

	formulated in the National Energy and Climate Plans.		
Adequate mobilisation of energy R&I EU, national and private fundings for SET Plan R&I priorities	Assessment of stakeholders' perceptions regarding the extent to which the SET Plan adequately mobilise EU, national and private fundings dedicated to R&I investment (sufficient, targeted and coordinated fundings).	Interviews Questionnaire	INT-Q2.2 INT-Q3.4 INT-Q4.4 QUE-Q2.4
Evaluation criterion 2: Effectiveness of the SET Plan			
Outcomes of the SET Plan	Assessment of effective results against original objectives at the level of individual IWGs and their activities (reference to Annex B with table).	Desktop research Disclaimer: based on draft 2022 SET Plan Progress Report Ad-hoc interview with representatives of DG RTD/ENER/JRC	
	For each energy technology and sector within the scope of the SET Plan (energy, industry, building, transport), assessment of the extent to which the SET Plan is contributing to the EU's energy and climate targets.	Desktop research Questionnaire	QUE-Q3.1-2
	Assessment of the extent to which the SET Plan contributes to the development of strategic planning that directs research and innovation efforts towards low-carbon energy technologies and infrastructure outlined in EU energy and climate regulatory frameworks, as	Questionnaire	QUE-Q4.1

	well as in key sectoral initiatives and strategies.		
	Assessment of the extent to which the SET Plan is contributing to further mobilising cost-effective, complementary and targeted public and private R&I investments in the field of energy technologies and infrastructures.	Questionnaire	QUE-Q3.4
	Assessment of the extent to which the SET Plan is contributing to the coordination and co-funding of targeted actions at national, regional (?) and community levels.	Questionnaire	QUE-Q3.5
	Assessment of the extent to which the SET Plan is (significantly) contributing to driving down the costs of existing energy-related technologies.	Questionnaire	QUE-Q3.6
Factors	Assessment of the factors with the biggest positive impact on the effectiveness of the SET Plan.	Interview	INT-Q2.4 INT-Q3.6 INT-Q4.1
Barriers	Assessment of existing and potential future barriers to achieving SET Plan objectives and targets.	Desktop research Interviews	INT-Q2.5 INT-Q4.5
(Non)effective activities	For each major stakeholder, assessment of which activities contribute most and least effectively to the achievement of the SET Plan.	Interview	INT-Q2.6 INT-Q3.6-7 INT-Q4.6

Evaluation criterion 3: Efficiency of the SET Plan			
Governance	Assessment of stakeholder perceptions regarding the adequacy and efficiency of the current SET Plan governance structure (Steering Group, Bureau of the SET Plan Steering Group).	Interviews	INT-Q3.8
		Questionnaire	QUE-Q4.1
	Assessment of stakeholder perceptions regarding the adequacy and efficiency of their internal IWG structure as well as overall current SET Plan IWGs structure.	Interviews	INT-Q2.8-9
		Questionnaire	QUE-Q4.2-3
	Assessment of stakeholder perceptions regarding the adequacy and efficiency of synergies between the current SET Plan protagonists 'actors' (parties formally involved) and 1) the supporting R&I organisations (ETIP, EERA and ERA-NETs) and 2) Horizon Europe partnerships (CTP and DUT).	Interviews	INT-Q4.2
		Questionnaire	QUE-Q4.4 QUE-Q4.5
	Assessment of stakeholder perceptions regarding the adequacy of current national government representation on the IWGs.	Interviews	INT-Q2.12
	Assessment of stakeholder perceptions regarding the delineation in scope and actions between the European Technology and Innovation Platforms (ETIPs) and the Implementation Working Groups (IWGs)?	Interviews	INT-Q2.15 INT-Q4.3
Reporting	Assessment of IWG chairs/co-chairs' perceptions regarding the reporting methodology developed by SETIS to	Interviews	INT-Q2.7

	monitor the progress of actions under the Implementation Plans.		
Factors	Assessment of the factors with the biggest impact (positive or negative) on the efficiency of the operation of the SET Plan.	Interviews	INT-Q2.10 INT-Q3.9
Cost-efficiency	Assessment of the activities that are the most and the least cost-efficient and, for the later, assessment of the reasons of cost-inefficiencies (e.g. transaction costs, administrative costs, compliance costs).	Questionnaire	QUE-Q4.6-7
Engagement	Assessment of the level of engagement of individual stakeholders towards the SET Plan and reasons for their (in)activity.	Questionnaire	QUE-Q1.1
Evaluation criterion 4: Added value of the SET Plan at the National and EU levels			
Effects that would not have taken place without the implementation of the SET Plan intervention (incl. subsidiarity justification)	Assessment of stakeholders' perceptions regarding the added value of SET Plan as an EU policy instrument	Questionnaire	QUE-Q5.1-3 INT-Q4.11-13
	Assessment of stakeholders' perceptions of the influence of the SET Plan on R&I orientations for the energy transition at national and European level in the short, medium and long term	Questionnaire Interview	QUE-Q5.4 INT-Q2.14 INT-Q3.12 INT-Q4.9
Evaluation criterion 5: Future-proofing of the SET Plan			
	Identification (at EU level) of energy and climate	Desktop research	/

Future-proofing of the SET Plan	related technology and infrastructure areas that are (potentially) absent from the current scope of the SET Plan.		
	Assessment of stakeholders' perceptions with regards to the energy technology and infrastructure areas that are absent from the current scope of the SET Plan.	Interviews Questionnaire Ad-hoc interview with representatives of DG RTD/ENER/JRC	INT-Q2.3 INT-Q3.5 QUE-Q6.1-2
	Identification and assessment of the opportunities to strengthen the links between the SET Plan's objectives and targets and the Member States' NECPs in future revisions (i.e., reporting of national R&I initiatives and progresses, allocation of national R&I investments).	Desktop research Interviews Ad-hoc interview with representatives of DG RTD/ENER/JRC	INT-Q3.3 QUE-Q6.3
	Identification and assessment of the potential future implications of the rollout of the REPowerEU plan for the SET Plan's objectives and targets.	Desktop research Questionnaire Ad-hoc interview with representatives of DG RTD/ENER/JRC	QUE-Q6.5
	Identification and assessment of non-technological and horizontal areas, that are of significant relevance to the achievement of SET Plan objectives and	Desktop research Interviews	INT-Q2.11

	targets (e.g., critical raw materials, social sciences and humanities, recycling value chain of energy infrastructures).	Ad-hoc interview with representatives of DG RTD/ENER/JRC	QUE-Q6.4
	Identification and assessment of the opportunities to further increase the visibility of the SET Plan to external stakeholder and to the EU and Member State wider energy and climate community.	Desktop research	INT-Q2.13
		Interviews	INT-Q3.10
		Ad-hoc interview with representatives of DG RTD/ENER/JRC	INT-Q4.7
			QUE-Q6.7
	Assessment of stakeholders' perceptions with regards to whether or not the geographical coverage of the SET Plan should be extended to other countries (e.g. Western Balkans, Eastern Partnership, North Africa, North America).	Interviews	INT-Q2.16
		Questionnaire	INT-Q3.11
			INT-Q4.8
			QUE-Q6.6
	Assessment of stakeholders' perceptions with regards to whether or not the SET Plan should be reformed or discontinued	Questionnaire	QUE-Q7.1-2
	Assessment of stakeholders' perceptions with regards to how the SET Plan and ERA should operate together in the future?	Questionnaire	QUE-Q7.3

Communications:

EU energy and climate regulatory framework:

- 'Clean energy for all Europeans' package (including the Regulation on the Governance of the Energy Union);
- 'Delivering the European Green Deal' package;
- European Climate Law;
- 'Fit for 55' legislative proposals (summer and winter package);
- Hydrogen and Gas Market Decarbonisation package;
- Batteries Regulation.

EU energy and climate strategies and initiatives:

- Energy Union;
- REPowerEU;
- Hydrogen;
- Batteries;
- Offshore Renewable Energy;
- Energy System Integration;
- Industrial Strategy;
- Renovation Wave;
- Sustainable Blue Economy;
- Circular Economy Action Plan;
- Action Plan on Critical Raw Materials;
- EU Forest Strategy;
- Smart and Sustainable Mobility.

National Energy and Climate Plans

- Final National Energy and Climate Plans of the 27 EU Member States – sections '2.5 National Objectives and targets - Research, Innovation and Competitiveness' and '3.5 Policies and measures - Research, Innovation and Competitiveness'.
- Commission's individual assessments of the final National Energy and Climate Plans of the 27 EU Member States – section 3 'Assessment of the ambition of objectives,

targets and contributions and of the impact of supporting policies and measures - Research, innovation and competitiveness’.

- Wind Europe, Overview of the targets and measures in the final 2030 National Energy and Climate Plans. Available here.

Energy (policy) reports:

- IEA, 2020. Energy Technologies Perspectives, 2020 (revised version February 2021). Available here.
- World Energy Outlook Report;
- Horizon 2020 final report;
- Low Carbon Energy Observatory technology development and market reports, Clean Energy Observatory.

SET Plan -related programmes and reports:

- C(2015)6317 - Towards an Integrated Strategic Energy Technology (SET) Plan : Accelerating the European Energy System Transformation 2015;
- SEC(2007)1508 - SET Plan Impact Assessment 2007;
- COM(2013)253 - Energy Technologies and Innovation;
- Strategic Energy Technology Plan - Agenda 2018-2023;
- The SET Plan. At the heart of Energy Research & Innovation in Europe 2007-2017 - 10th anniversary;
- Implementation Plans of the IWGs;
- SET Plan implementation progress reports (2019, 2020 and 2021);

Other reports and research papers:

- Dufour, Lisi and Robison, 2019. A guide to the SET Plan Including the role of the Social Sciences and Humanities. Energy-SHIFTS. Available here.
- Manni et al., 2020. Shaping Multi-Level Energy and Climate Policy within the SET Plan Framework. Sustainability 2020, 12, 9545. Available here:
- Erik Liljelund, 2011. The SET Plan From Concept to Successful Implementation. CEPS Task Force Report. Available here.
- Andrade et al., Clean Energy Transition Partnership SET Plan Stakeholder Groups Dialogues Summary Paper. CETP. Available here.
- Eikeland, P.O., Skjærseth, J.B, 2020. Explaining Making of the SET Plan. In: The Politics of Low-Carbon Innovation. Palgrave Macmillan, Cham. Available here.
- Matas Güell & Sandquist, 2021. Report on the State of Play of the SET Plan IP8. Available here

- Ruester et al., 2014. A post-2020 EU energy technology policy: Revisiting the strategic energy technology plan. Energy Policy. Available here.

Other documents:

- Draft Discussion Note on the revision of the SET Plan (2022);
- Documents related to IWG cross-thematic cooperation;
- Input papers prepared for the SET Plan conference 2020.

CODING	TASK AND QUESTION GUIDE
	INTRODUCTION
<i>Introduction</i>	<ul style="list-style-type: none"> • Presentation of the interviewer, his/her organisation and the role in the delivery of the study • Quick presentation of the evaluators (Deloitte and empirica) • Quick presentation of the SET Plan Interim Evaluation objectives (as per section 2.2 of the technical offer) and the state of affairs (reason for the evaluation) • Explanation of the purpose of the interview to gather information from the key stakeholders regarding some key aspects of SET Plan (as per evaluation criteria in section 3.1). • Explanation that <u>we are looking for concise and direct answers to questions</u>. Also it is important to mention that we do not necessarily anticipate that the respondent will be able to provide relevant information for every question, and that this is perfectly fine. • Explanation that the information gathered will be used exclusively for the purpose of the evaluation, and that information will be presented in an aggregated structured way with the purpose of improving SET Plan as a whole
<i>INT-Q1.1</i>	What is your experience with the SET Plan? How have you been involved in the SET Plan?
<i>INT-Q1.2</i>	How would you define the SET Plan objectives?
MODULE 1 - IWGs	
<i>INT-Q2.1</i>	At the EU level, to what extent are your IWGs' objectives and targets aligned against the objectives for low-carbon energy technologies and infrastructures deployment in your sector?
<i>INT-Q2.2</i>	To what extent does the SET Plan adequately mobilise EU, national and private fundings dedicated to R&I investment in your IWG (sufficient, targeted and coordinated fundings)? Any suggestions on how to improve these synergies?

<i>INT-Q2.3</i>	Which energy technology and infrastructure areas relevant for the work of your IWG are absent from its current scope and not covered by other IWGs?
<i>INT-Q2.4</i>	Which are the key factors contributing the most to the achievement of the SET Plan objectives and targets in your IWG?
<i>INT-Q2.5</i>	What are the existing and potential barriers that influence negatively the implementation of your IWG activities and the achievement of its targets?
<i>INT-Q2.6</i>	Which activities contribute most and least effectively to the achievement of your IWG targets?
<i>INT-Q2.7</i>	Could you please comment on how effective the SETIS report is in tracking the progress of your IWG Implementation Plan? Are there any important aspects of your work that are not reflected or reported effectively in the current reporting methodology? How can we improve the reporting?
<i>INT-Q2.8</i>	Is the current internal structure of your IWG adequate and efficient?
<i>INT-Q2.9</i>	Is the current SET Plan IWGs structure adequate and efficient? Do you have any ideas how to increase the engagement of the SET Plan Countries?
<i>INT-Q2.10</i>	What factors have the biggest (positive or negative) impact on the efficiency of the operations of your IWG (with regard to the amount of time, money, efforts necessary)?
<i>INT-Q2.11</i>	Which non-technological and horizontal areas are of significant relevance to the achievement of your IWG objectives and targets? (e.g., critical raw materials, digitalisation, social sciences and humanities, recycling value chain of energy infrastructures)
<i>INT-Q2.12</i>	Should more national governments be represented in your IWG?
<i>INT-Q2.13</i>	What are the opportunities to further increase the visibility of the SET Plan to external stakeholders and to the EU and Member State wider energy and climate community (in this specific technology)?
<i>INT-Q2.14</i>	What do you think about the influence of the SET Plan in supporting and guiding R&I orientations for the energy transition at national and European level in the short, medium and long term?

<i>INT-Q2.15</i>	What is supposed to be, in a nutshell, the delineation in scope and actions between the European Technology and Innovation Platforms (ETIPs) and the Implementation Working Groups (IWGs)?
<i>INT-Q2.16</i>	Should the geographical coverage of the SET Plan be extended to other countries (e.g. Western Balkans, Eastern Partnership, North Africa, North America)? If yes, which countries do you have in mind and why?
<i>INT-Q2.17</i>	Is there any further support from the Commission that would be beneficial for the IWG?
MODULE 2 - STEERING GROUP & MEMBER STATE REPRESENTATIVES	
<i>INT-Q3.1</i>	At the EU level, to what extent are the SET Plan objectives and targets aligned against research and innovation objectives for low-carbon energy technologies and infrastructure?
<i>INT-Q3.2</i>	At the national level, to what extent are the SET Plan objectives and targets aligned against research and innovation objectives for low-carbon energy technologies and infrastructure? Any suggestions on how to improve this alignment?
<i>INT-Q3.3</i>	What opportunities do you see to strengthen the links between the SET Plan's objectives and targets and the Member States' NECPs in future revisions (i.e., reporting of national R&I initiatives and progresses, allocation of national R&I investments).
<i>INT-Q3.4</i>	To what extent does the SET Plan adequately mobilise EU, national and private fundings dedicated to R&I investment (sufficient, targeted and coordinated fundings)? Any suggestions on how to improve these synergies?
<i>INT-Q3.5a</i>	Do you think that there are energy technology and infrastructure areas, which are crucial for the energy transition, that are not included in the SET Plan scope and covered by the IWGs? If yes, which ones?
<i>INT-Q3.5b</i>	(if yes) Should new IWGs be created or should the missing areas be integrated in existing ones (e.g., an IWG on Hydrogen)? Can you please briefly elaborate?
<i>INT-Q3.6</i>	What factors have the biggest positive impact on the achievement of the SET Plan objectives?

<i>INT-Q3.7</i>	Which activities contribute least effectively to the achievement of the SET Plan?
<i>INT-Q3.8</i>	Is the current SET Plan governance structure (Steering Group and Bureau) adequate and efficient?
<i>INT-Q3.9</i>	What factors have the biggest (positive or negative) impact on the efficiency of the operations of the SET Plan (with regard to the amount of time, money, efforts necessary)?
<i>INT-Q3.10</i>	What can be done at the European, national and private sector level to increase the visibility of the SET Plan?
<i>INT-Q3.11</i>	Should the geographical coverage of the SET Plan be extended to other countries (e.g. Western Balkans, Eastern Partnership, North Africa, North America)? If yes, which countries do you have in mind and why?
<i>INT-Q3.12</i>	What do you think about the influence of the SET Plan in supporting and guiding R&I orientations for the energy transition at national and European level in the short, medium and long term?
MODULE 3 – ETIP, EERA, ERA-NETs & Joint Undertakings	
<i>INT-Q4.1</i>	What factors have the biggest positive impact on your collaboration with the IWGs?
<i>INT-Q4.2</i>	Do you believe that the synergies/collaborations between the SET Plan governance and protagonists, and the supporting R&I organisations (ETIP, EERA, ERA-NETs and Joint Undertakings) are adequate and efficient?
<i>INT-Q4.3</i>	What is supposed to be, in a nutshell, the delineation in scope and actions between the European Technology and Innovation Platforms (ETIPs) and the Implementation Working Groups (IWGs)?
<i>INT-Q4.4</i>	To what extent should the SET Plan play a more important role on leveraging EU, national and private fundings dedicated to R&I investment in your IWG (sufficient, targeted and coordinated fundings)?
<i>INT-Q4.5</i>	Which are the existing and potential future barriers influencing your collaboration with the IWGs?
<i>INT-Q4.6</i>	Which activities contribute most and least effectively to the collaboration with IWGs?

<i>INT-Q4.7</i>	What can be done at the European, national and private sector level to increase the visibility of the SET Plan?
<i>INT-Q4.8</i>	Should the geographical coverage of the SET Plan be extended to other countries (e.g. Western Balkans, Eastern Partnership, North Africa, North America)? If yes, which countries do you have in mind and why?
<i>INT-Q4.9</i>	What do you think about the influence or the SET Plan in supporting and guiding R&I orientations for the energy transition at national and European level in the short, medium and long term?
<i>INT-Q4.10</i>	Is there any further support from the Commission that would be beneficial for the ETIPs?
<i>INT-Q4.11</i>	Would similar results have been achieved without the EU intervention via SET Plan? (Question to ask if there is still some time)
<i>INT-Q4.12</i>	Did Member States benefit specifically due to the involvement in the SET Plan activities? (Question to ask if there is still some time)
<i>INT-Q4.13</i>	Did the country you represent benefit specifically due to the involvement in the SET Plan activities? (Question to ask if there is still some time)
<i>INT-Q5</i>	CONCLUSION
	Presentation of the next steps in the evaluation process and timeline
<i>Conclusion</i>	Outline of the final report and structure of study outcomes
	Next steps of the SET Plan study/roadmap/revision
<i>INT-Q5.1</i>	Do you have any questions, comments or recommendations regarding this evaluation?

Introduction

Dear expert,

Welcome to this online questionnaire about the future of the SET Plan. As an expert in this field, you are kindly invited to complete this questionnaire and contribute to the revision of the SET Plan aiming to bring stronger synergies between national and European energy R&I efforts, as well as to contribute to the achievement of our ambitious but necessary targets for the deployment of clean energy solutions.

The questions are designed in a way that you can freely express your views, priorities, and recommendations for policy makers and key stakeholders regarding the relevance, effectiveness, efficiency, coherence and added value of the SET Plan. The survey is conducted by Deloitte and empirica as part of the service contract "SET Plan Interim Evaluation" which is being undertaken for the European Commission (DG RTD).

The length of this questionnaire is approximately 20 minutes. The deadline for survey completion is 30 June 2022. Should you have any questions, please do not hesitate to contact us via email (grskender@deloitte.com).

Thank you for your contribution.

Please note: You may leave the questionnaire at any time before completing it. There are no known risks from your participation and no direct benefit from your participation is expected. There is no cost to you except for your time and you are not compensated monetarily or otherwise for participation in this work. By participating in the questionnaire, you are giving permission to the evaluation team to use your information for research purposes. Only the core project team will have access to the information that you provide.

Questions on general information	Form-Field	Choices
What type of organisation/group do you represent? (Choose the option that applies to you personally.)	Tick-Boxes (multiple choice)	National Ministry National Organisation International Organisation Industry Academia Interest Organisation SET Plan Steering Group SET Plan Bureau One or more IWGs ETIP EERA ERA-NET Joint Undertaking Industry association Other
Which country is your organisation based in?	Drop-down	

In which energy research and innovation area are you active in?	Tick-Boxes (multiple choice)	Solar photovoltaics CSP/STE Offshore wind Deep geothermal Ocean energy Positive energy districts Energy systems Energy Efficiency in Buildings Energy Efficiency in Industry Batteries Renewable fuels and bioenergy CCS-CCU Nuclear safety HVDC All of the above Other Not applicable
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Years of activity:	Insert number
How many years has your organisation been working with the SET Plan? (an approximation is fine)	[...]
How many years have you personally been working with the SET Plan?	[...]

CODING	Level of engagement:	Insert number (1-very low; 5-very high)
QUE-Q1.1	How would you assess the level of engagement of your organisation in the implementation of the SET Plan?	
	Can you briefly elaborate on the reasons for your (in)activity?	Text box

Relevance and coherence of the SET in the context of the EU and Member State frameworks

CODING	In your opinion:	Form-field	Options
QUE-Q2.1	At the EU level, is the SET Plan scope aligned against research and innovation objectives for low-carbon energy technologies and infrastructure?	Tick box	Yes No
QUE-Q2.2	At the EU level, are the SET Plan IWGs' objectives and targets aligned against research and innovation objectives for low-carbon energy technologies and infrastructure?	Tick box	Don't know, N/A

QUE-Q2.3	Are there enough synergies between the SET Plan and the national R&I actions formulated in the National Energy and Climate Plans?	Tick box
QUE-Q2.4	Does the SET Plan adequately mobilise EU, national and private fundings dedicated to R&I investment (sufficient, targeted and coordinated fundings)? (if no) Any suggestions on how to better mobilise EU, national and private fundings dedicated to R&I investment?	Tick box Text box

SET Plan effectiveness and results

CODING	To what extent do you agree or disagree with the following statements?	Strongly disagree	Rather disagree	Rather agree	Strongly agree	I do not know, N/A
QUE-Q3.1	SET Plan significantly contributed to the acceleration of the development and market take-up of low-carbon energy technologies (in your domain)	()	()	()	()	()
QUE-Q3.2	SET Plan contributed to the EU's energy and climate targets	()	()	()	()	()
QUE-Q3.3	SET Plan contributed to the development of strategic planning that directs research and innovation efforts towards low-carbon energy technologies and infrastructure outlined in EU energy and climate regulatory frameworks, as well as in key sectoral initiatives and strategies	()	()	()	()	()
QUE-Q3.4	SET Plan contributed to further mobilising cost-effective, complementary and targeted public and private R&I investments in the field of energy technologies and infrastructures	()	()	()	()	()
QUE-Q3.5	SET Plan is contributing to the coordination of targeted actions at national and EU levels.	()	()	()	()	()

QUE-Q3.6	SET Plan (significantly) contributed to driving down the costs of existing energy-related technologies	()	()	()	()	()
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SET Plan efficiency

CODING	In your opinion:	Form-field	Options
QUE-Q4.1	Do you believe that the current SET Plan governance structure (Steering Group and Bureau) is adequate and efficient? (if no) Why?	Tick box Text box	Yes No Don't know / N/A /
QUE-Q4.2	Do you believe that the current SET Plan IWGs structure is adequate and efficient? (if no) Why?	Tick box Text box	Yes No Don't know / N/A /
QUE-Q4.3	Do the IWGs need reform? (if yes) Do you have suggestions for another management structure?	Tick box Text box	Yes No Don't know / N/A /
QUE-Q4.4	Do you believe that the synergies between the SET Plan and the supporting R&I organisations (ETIP, EERA, ERA-NETs and Joint Undertaking) are adequate and efficient? (if no) Why?	Tick box Text box	Yes No Don't know / N/A /
QUE-Q4.5	What synergies (if any) have already been achieved between the SET Plan and the Clean Energy Transition Partnership (CETP) and Driving Urban Transitions (DUT) programmes under Horizon Europe? What additional synergies can be achieved?	Text box	/
QUE-Q4.6	Which are the most cost-efficient activities (i.e. delivering results with optimal resources) related to the SET Plan in which you are involved?	Text box	/
QUE-Q4.7	Which are the least cost-efficient (i.e. are resource and time wasteful) activities among the activities in which you are being involved related to the SET Plan? Why?	Text box	/

EU and national added value

CODING	In your opinion:	Form-field	Options
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QUE-Q5.1	Would similar results have been achieved without the EU intervention via SET Plan?		
QUE-Q5.2	Did Member States benefit specifically due to the involvement in the SET Plan activities?	Tick box	Yes No Don't know, N/A
QUE-Q5.3	Did the country you represent benefit specifically due to the involvement in the SET Plan activities? (Optional)		
QUE-Q5.4	SET Plan significantly contributed to influence R&I orientations for the energy transition at national and European level in the short, medium and long term.	Tick box	Yes No Don't know, N/A
	Could you give us a brief explanation? (optional)	Text box	/

Future-proofing of the SET Plan

CODING	In your opinion:	Form-field	Options
QUE-Q6.1	Do you think that there are energy technology and infrastructure areas, which are crucial for the energy transition, that are not included in the SET Plan scope and covered by the IWGs?	Tick box	Yes No Don't know / N/A
	(if yes) Which one(s)?	Text box	/
QUE-Q6.2	Should new IWGs be created or should the missing areas be integrated in existing ones?	Tick box	Creation of new IWGs Integration of missing areas in existing IWGs Don't know / N/A None of the above
	Could you give us a brief explanation? Do you have any suggestions?	Text box	/
QUE-Q6.3	Do you think the links between the SET Plan's objectives and targets and the Member States' NECPs should be strengthened (i.e., reporting of national R&I initiatives and progresses, allocation of national R&I investments).	Tick box	Yes No Don't know / N/A
	(if yes) In which form?	Text box	/
QUE-Q6.4	Do you think new Implementation Working Groups should be created to work on targets for cross-sectoral challenges?	Tick box	Yes No Don't know / N/A
	(If yes) Which one(s)?	Text box	/

	(If not) Do you think the SET Plan should have targets for cross-sectoral challenges? If yes, for which cross-sectoral challenges?		
QUE-Q6.5	Do you think that the rollout of the REPowerEU plan will have significant implications for the upgrading of the SET Plan - e.g., on the following IWGs: Renewable fuels and bioenergy (biomethane, hydrogen); Energy Efficiency in Buildings (heat pumps), Solar PV, Offshore wind?	Tick box	Yes No Don't know / N/A
	(if yes) In which form(?)	Text box	/
QUE-Q6.6	Should the geographical coverage of the SET Plan be extended to other countries? (e.g. Western Balkans, Eastern Partnership, North Africa, North America?)	Tick box	Yes No Don't know / N/A
	(if yes) Which countries do you have in mind and why?	Text box	/
QUE-Q6.7	What can be done at the European, national and private sector level to increase the visibility of the SET Plan?	Text box	/

Conclusion

CODING	Final remarks:	Form-field	Options
QUE-Q7.1	Do you think the SET Plan needs a reform?	Tick box	Yes No Don't know / N/A
	(If yes) Can you briefly elaborate?	Text box	/
QUE-Q7.2	Do you think the SET Plan or parts of it should be discontinued?	Tick box	Yes No Don't know, N/A
	(if yes) Can you briefly elaborate?	Text box	/
QUE-Q7.3	Do you have any insights on how you believe the SET Plan and ERA should operate together in the future? (optional)	Text box	/
QUE-Q7.4	Do you have any final remarks or comments for the evaluation team?	Text box	/

Appendix 5: Desk-research methodology used to assess alignment between the scope of the SET Plan and the EU energy and climate policy objectives

To provide an analytical overview of the extent to which the current scope of the SET Plan is aligned with EU energy and climate policy objectives, the following approach based on desk-research has been applied:

- **Step 1:** Identification of EU energy and climate regulatory framework (regulations and directives), including the 'Fit for 55' legislative proposal package, the Hydrogen and Gas Market Decarbonisation package, as well as EU energy and climate strategies and initiatives (e.g., Hydrogen, Offshore Renewable Energy, Batteries, Energy System Integration, Renovation Wave, Circular Economy, REPowerEU, Smart and Sustainable Mobility, etc.).
- **Step 2:** For each of the EU documents identified, identification of the links between the low-carbon energy technologies and infrastructures covered in their scope, and the 14 SET Plan Implementation Working Groups (IWGs).
- **Step 3:** For each of the EU documents identified, assessment of the alignment between low-carbon energy technologies and infrastructures mentioned in EU energy and climate policy documents and low-carbon energy technologies and infrastructures covered by the scope of the SET Plan IWGs.
- **Step 4:** Identification of the low-carbon energy technologies and infrastructures only partially or not at all covered by the SET Plan IWGs, but referenced in the EU's energy and climate policy documents.

Definitions:

- "Good alignment": The low-carbon energy technologies/infrastructures is clearly referenced in the EU energy and climate regulatory framework AND is clearly covered by the current scope of the SET Plan at a comparable level of importance.
- "Partial alignment ": The low-carbon energy technologies/infrastructures is clearly referenced in the EU energy and climate regulatory framework AND is covered by the current scope of the SET Plan but at a relative lower level of importance .
- "No alignment ": The low-carbon energy technologies/infrastructures is clearly referenced in the EU energy and climate regulatory framework AND is not covered by the scope of the SET Plan.

Key findings				
Document	Category	Relevant to the SET Plan	Link to IWG(s)	Key findings
Regulation on the Governance of the Energy Union and Climate Action	Regulatory framework	No	/	/
Directive on common rules for the internal market for electricity	Regulatory framework	Yes	Energy systems	Good alignment

Regulation on the internal market for electricity (EU) 2019/943	Regulatory framework	Yes	Energy systems	Good alignment
Regulation on risk preparedness in the electricity sector (EU) 2019/941	Regulatory framework	Yes	Energy systems	Good alignment
Regulation (EU) 2019/942 establishing a EU Agency for the cooperation of energy regulators	Regulatory framework	No	/	/
Coal regions in transition initiative	Strategy/ Initiative	No	/	/
Clean energy for EU islands initiative	Strategy/ Initiative	Yes	Solar photovoltaic; Offshore wind; Deep geothermal; Ocean energy; Renewable fuels and bioenergy; Energy systems	Good alignment
European Climate Law	Regulatory framework	No	/	/
Revision of the EU Emission Trading System	Regulatory framework	Yes	All the IWGs	Good alignment
Revision of the Effort Sharing Regulation	Regulatory framework	No	/	/
Regulation on Land Use, Forestry and Agriculture	Regulatory framework	No	/	/
Revision of the Renewable Energy Directive	Regulatory framework	Yes	All the IWGs except for CCUS and Nuclear Energy	Partial alignment Quantitative targets for renewable fuels from non-biological origin (RFNBO) and share of renewables in hydrogen consumption in industry.
Revision of the Energy Efficiency Directive	Regulatory framework	Yes	Energy efficiency in Buildings; Energy systems; Positive energy districts	Good alignment
CO2 emission performance standards for cars and vans	Regulatory framework	Yes	Batteries, Renewable fuels and bioenergy	Good alignment
Revision of the Alternative Fuels Infrastructure Regulation	Regulatory framework	Yes	Batteries, Renewable fuels and bioenergy	Good alignment
ReFuelEU Aviation Initiative	Regulatory framework	Yes	Renewable fuels and bioenergy, CCUS - CCU	Partial alignment

				Strong emphasis on synthetic fuels and renewable/low-carbon hydrogen.
FuelEU Maritime Initiative	Regulatory framework	Yes	Renewable fuels and bioenergy, CCUS - CCU, batteries, offshore wind energy, ocean energy	Partial alignment Strong emphasis on ammonia and methanol from renewable hydrogen.
Revision of the Energy Taxation Directive	Regulatory framework	Yes	Renewable fuels and bioenergy, CCUS - CCU, all renewable energy IWGs	Partial alignment Strong emphasis on synthetic fuels and renewable/low-carbon hydrogen
Carbon Border Adjustment Mechanism	Regulatory framework	No	/	/
EU Methane strategy	Regulatory framework	Yes	Renewable fuels and bioenergy (the role of biogas to mitigate methane emissions)	No alignment Strong emphasis on technologies to detect methane leaks, which is outside the current scope of the SET Plan
Proposal for a recast Directive on gas markets and hydrogen	Regulatory framework	Yes	Renewable fuels and bioenergy	Partial alignment In addition to biogas and biomethane (already well covered in the SET Plan scope) there is a strong emphasis on renewable and low-carbon hydrogen as well as synthetic methane.
Proposal for a recast Regulation on gas markets and hydrogen	Regulatory framework	Yes	<i>See above</i>	<i>See above</i>
Revision of the Energy Performance of Buildings Directive	Regulatory framework	Yes	Energy Efficiency in Buildings, all Renewable WGs, Renewable fuels and bioenergy, Ocean energy, energy system, positive energy district	Good alignment

Communication on sustainable carbon cycles	Regulatory framework	Yes	CCS-CCU, Energy Efficiency in Industry	Partial alignment In addition to Bioenergy with Carbon Capture and Storage (already well covered in the SET Plan scope), there is an emphasis on Direct Air Capture with Carbon Storage (DACCS), which is outside the current scope of the SET Plan
Proposal for a Council recommendation on ensuring a fair transition towards climate neutrality	Regulatory framework	No	/	/
Proposal for a revised regulation on TEN-T	Regulatory framework	No	/	/
Communication on extending TEN-T to neighboring third countries	Regulatory framework	No	/	/
Proposal for a Directive on Intelligent Transport Systems	Regulatory framework	No	/	/
Communication on an action plan to boost long distance and cross-border Passenger rail	Regulatory framework	No	/	/
Communication on the new EU urban Mobility framework	Regulatory framework	Yes	Batteries, Renewable fuels and bioenergy, energy systems	Good alignment
CCS directive	Regulatory framework	Yes	CCS	Good alignment
Proposal batteries and waste batteries	Regulatory framework	Yes	Batteries	Good alignment
Ecodesign Directive (Directive 2009/125/EC)	Regulatory framework	No	/	/
Energy Labelling Framework Regulation (Regulation (EU) 2017/1369)	Regulatory framework	Yes	/	/
Energy Union	Strategy/ Initiative	Yes	All the WGs	Good alignment

A hydrogen strategy for a climate-neutral Europe	Strategy/ Initiative	Yes	Renewable fuels and bioenergy, CCS-CCU, Solar PV, Offshore wind	<p>Partial alignment.</p> <p>Strong emphasis on renewable hydrogen (and associated electrolyzer technologies). Also, emphasis on: Distribution and storage infrastructures Repurposing of existing gas infrastructure for transporting hydrogen or hydrogen-based fuels.</p> <p>Large scale end-use applications need to be further developed, notably in industry and in transport</p> <p>Research on, securing the supply of critical raw materials in parallel to material reduction, substitution, reuse, and recycling</p>
REPowerEU	Strategy/ Initiative	Yes	Energy Efficiency in Buildings, Energy Efficiency in Industry, Solar PV, offshore wind, Renewable fuels and bioenergy, energy systems	<p>Partial alignment</p> <p>In addition to RES (in particular solar energy), which is already well covered in the SET Plan scope, there is a strong emphasis on: biogas, biomethane, heat pumps, renewable and low-carbon hydrogen (including nuclear-based H2, which is outside the current scope of the SET Plan)</p>
Strategic Plan on Batteries	Strategy/ Initiative	Yes	batteries	Good alignment

Offshore Renewable Energy	Strategy/ Initiative	Yes	Ocean energy; offshore wind energy; HVDC; Renewable fuels and bioenergy	Partial alignment Emphasis on floating PV, which is outside the current scope of the SET Plan
Energy System Integration	Strategy/ Initiative	Yes	All the IWGs	Partial alignment Emphasis on synthetic fuels, renewable hydrogen and green ammonia.
Communication "Updating the 2020 New Industrial Strategy: Building a stronger Single Market for Europe's recovery "	Strategy/ Initiative	Yes	All the renewable energy WGs, batteries, Renewable fuels and bioenergy	Partial alignment Strong emphasis on critical raw materials substitution, reuse and recycling
Renovation Wave	Strategy/ Initiative	Yes	Energy Efficiency in Buildings, energy system, positive energy districts, all renewable energy IWGs; renewable fuels and bioenergy	Good alignment
Sustainable Blue Economy	Strategy/ Initiative	No	Ocean energy; Offshore wind	Good alignment
Circular Economy Action Plan	Strategy/ Initiative	Yes	Batteries; Energy Efficiency in Industry; Energy Efficiency in Buildings	Good alignment
Action Plan on Critical Raw Materials: COM(2020) 474 (CRM)	Strategy/ Initiative	Yes	Solar photovoltaic; Offshore wind; batteries; CSP/STE; Energy systems	Partial alignment Strong emphasis on critical raw materials substitution, reuse and recycling & sustainable critical raw materials extraction from domestic deposits
EU Forest Strategy	Strategy/ Initiative	Yes	Renewable fuels and bioenergy	Good alignment
Smart and Sustainable Mobility	Strategy/ Initiative	Yes	Renewable fuels and bioenergy; Batteries; Energy Systems	Partial alignment Strong emphasis on

				Hydrogen fuel-cell vehicles (commercial fleets, buses, heavy duty transport and rail transport) hydrogen-based synthetic fuels
EU 'Save Energy'	Strategy/ Initiative	Yes	Energy Efficiency in Industry; Energy Efficiency in Buildings	Good alignment
EU Solar Energy Strategy	Strategy/ Initiative	Yes	Solar PV; CSP/STE	Partial alignment Mention of Floating Solar PV
EU External Energy Strategy	Strategy/ Initiative	Yes	Renewable fuels and bioenergy; Energy Systems; all the RES IWGs; Energy Efficiency in Industry	Partial alignment Mention of small modular reactors & long-duration energy storage
Solar Rooftop Initiative	Strategy/ Initiative	Yes	Solar PV	Good alignment
Biomethane Action Plan	Strategy/ Initiative	Yes	Renewable fuels and bioenergy	Partial alignment Strong emphasis on biogas and biomethane

Appendix 6: Desk-research methodology used to assess alignment between the scope of the SET Plan and the national R&I agenda formulated in the National Energy and Climate Plans

To provide an analytical overview of the extent to which the current scope of the SET Plan is aligned with the national R&I agenda formulated in the National Energy and Climate Plans, the following approach based on desk-research has been applied:

- **Step 1:** Identification for each final NECPs of the low-carbon energy technologies and infrastructures mentioned in the following two sections of the documents: "2.5 National Objectives and targets - Research, Innovation and Competitiveness" & "3.5 Policies and measures - Research, Innovation and Competitiveness".
- **Step 2:** For each low-carbon energy technologies and infrastructures identified in Step 1, assessment of the alignment with low-carbon energy technologies and infrastructures covered by the scope of the SET Plan IWGs.
- **Step 3:** Identification of the low-carbon energy technologies and infrastructures not covered by the SET Plan IWGs, but referenced in the NECPs.

The results of the assessment of the alignments between the scope of the SET Plan and the EU energy and climate policy objectives as well as the national R&I agenda formulated in the NECPs have been merged and integrated in order to present an aggregate overview of the missing low-carbon technologies and infrastructures within the scope of the SET Plan.

Key findings	
Low-carbon energy technologies and infrastructures only partially or not covered by the SET Plan IWGs but referenced in the NECPs	NECP(s)
Hydropower (incl. for electricity storage) ⁴⁷	Slovakia, Czech Republic
Energy (electricity and/or heat) storage and integration of storage systems (incl. Power-to-gas and gas-to-power) storage systems	Belgium; Bulgaria, Croatia, Denmark, Finland, Italy, Latvia, Luxembourg, Poland, Portugal, Romania, Slovakia, Slovenia, Hungary
Infrastructures for high-power electric recharging for local public transport (including charging solutions incorporated along the route)	Italy
Devices for V2H (Vehicle To Home)	Italy
Use of raw materials that combine environmental impact mitigation with energy security	Poland

⁴⁷ The technology readiness level of hydropower is already considered as "mature" by the IEA (2020), which does not make it relevant to the scope of the SET Plan

Onshore wind power	Romania, Slovakia, Spain
Domestic deposits of energy raw materials	Slovakia
Use of solar energy in transport	Latvia
Small modular nuclear reactor ⁴⁸	France

48 Even though the French NECP does not refer to investments in Small Modular (Nuclear) Reactor technologies, the French government announced in October 2021 its intent to invest EUR 1 billion in R&D activities aimed at developing domestic Small Modular Reactor technologies by 2030. Link [here](#).

Appendix 7: Desk-research methodology used to assess the low-carbon energy technologies as missing or not sufficiently represented in the overall work of the SET Plan

The list of low-carbon technologies and infrastructure for electricity, CO₂, bioenergy and hydrogen value chains outlined in the IEA's flagship report "Energy Technology Perspectives 2020" (Figures 2.11, 2.14, 2.18 and 2.22)⁴⁹ has been confronted with the scope of low-carbon energy technologies covered by the work of the SET Plan. Placing the technological scope of the SET Plan in perspective with the IEA's analysis of the low-carbon energy technologies the world needs to meet net-zero emissions targets can ensure that no low-carbon energy technology or infrastructure has been omitted from the scope assessment of the SET Plan.

Definitions:

- "**Good alignment**": The low-carbon energy technologies/infrastructures is clearly referenced in the IEA's low-carbon technologies value chains AND is clearly covered by the current scope of the SET Plan at a comparable level of importance.
- "**Partial alignment** ": The low-carbon energy technologies/infrastructures is clearly referenced in the IEA's low-carbon technologies value chains AND is covered by the current scope of the SET Plan but at a relative lower level of importance .
- "**No alignment** ": The low-carbon energy technologies/infrastructures is clearly referenced in the IEA's low-carbon technologies value chains AND is not covered by the current scope of the SET Plan.

Key findings		
Low-carbon technologies value chains	Link to IWG(s)	Conclusion
Hydropower	None	Hydropower considered as "mature" by the IEA
Geothermal	Deep geothermal	Geothermal is considered as "mature" by the IEA
Nuclear	Nuclear safety	Nuclear is considered as "mature" by the IEA
Solar PV	Solar photovoltaics	Good alignment
Solar thermal	CSP/STE	Good alignment
Wind	Offshore wind	Partial alignment; onshore wind is not covered by the scope of the SET Plan
Coal with CCUS	CCUS - CCU	Good alignment
Ocean energy	Ocean energy	Good alignment
Large-scale heat pumps	Energy Efficiency in Buildings & Energy Efficiency in Industry	Good alignment
Natural gas with CCUS	CCUS - CCU	Good alignment
Biomass with CCUS	CCUS - CCU	Good alignment
Hydrogen turbines	None	No alignment

⁴⁹ Source: IEA, 2020. *Energy Technology Perspectives 2020*. Available here: https://iea.blob.core.windows.net/assets/7f8aed40-89af-4348-be19-c8a67df0b9ea/Energy_Technology_Perspectives_2020_PDF.pdf

Flexible high-voltage or alternating current transmission	HVCD	Good alignment
Ultra-high-voltage transmission	HVCD	Good alignment
Fast frequency response	Energy Systems	Good alignment
Fast charging	Batteries	Good alignment
Dynamic charging	Energy Systems, Batteries	Good alignment
Smart charging	Energy Systems, Batteries	Good alignment
Demand response	Energy Systems, Batteries	Good alignment
Mechanical storage	None	Mechanical storage considered as "mature" by the IEA
Battery storage	Batteries	Good alignment
Electricity use in transports (trains, light-and heavy duty road vehicles, ships, aircraft)	Batteries	Partial alignment ; Batteries for ships, planes, heavy duty road vehicles are not covered by the SET Plan scope
Electricity use in industry (aluminum, steel, chemicals, cement)	Energy Efficiency in Industry	Good alignment
Electricity use in buildings (cooking, heat pumps, evaporated cooling, solid state cooling)	Energy Efficiency in Buildings	Good alignment
Hydrogen from water electrolysis for fuel transformation	Renewable fuels and bioenergy	See below for hydrogen
CO2 capture in chemicals (ammonia, methanol, HVCs)	Energy Efficiency in Industry, CCUS - CCU	Good alignment
CO2 capture in iron and steel	Energy Efficiency in Industry, CCUS - CCU	Good alignment
CO2 capture in cement	Energy Efficiency in Industry, CCUS - CCU	Good alignment
CO2 capture from the air (DAC)	None	No alignment
CO2 capture in fuels production (natural gas processing, hydrogen, biomethane, ethanol)	CCUS - CCU	Good alignment
CO2 capture in power generation (coal, natural gas, biomass)	CCUS - CCU	Good alignment
CO2 transport (pipeline, ship)	CCUS - CCU	Good alignment
CO2 storage (enhanced oil recovery, saline formations, depleted oil and gas reservoirs)	CCUS - CCU	Good alignment
CO2 use (urea, concrete, methanol, synthetic methane, synthetic liquid hydrocarbons)	CCUS - CCU	Good alignment
Double cropping	None	Out of the SET Plan scope
Bioethanol	Renewable fuels and bioenergy	Good alignment
Biomethane	Renewable fuels and bioenergy	Good alignment
Biodiesel	Renewable fuels and bioenergy	Good alignment

Other biogas	Renewable fuels and bioenergy	Good alignment
Bioethanol with CCUS	CCUS - CCU	Good alignment
Biomethane with CCUS	CCUS - CCU	Good alignment
Biodiesel with CCUS	CCUS - CCU	Good alignment
Algae-based biodiesel	Renewable fuels and bioenergy	Good alignment
Algae-based biogas	Renewable fuels and bioenergy	Good alignment
Solid biomass-fired steam-cycle power plant	None	Solid biomass-fired steam-cycle power plant considered as "mature" by the IEA
Solid biomass-fired district heat boiler	None	Solid biomass-fired district heat boiler considered as "mature" by the IEA
Biogas-/bioliquid-fired internal combustion engine	None	No alignment
Solid biomass-fired IGCC	Renewable fuels and bioenergy	Good alignment
Biomass with CCUS	CCUS - CCU	Good alignment
Blending biomethane in natural gas network	None	No alignment
Bioenergy use in industry (fuel, steel, ethylene, methanol, hydrogen chemicals, ammonia, aluminum)	Energy Efficiency in Industry, Renewable fuels and bioenergy	Good alignment
Bioenergy use in transport (passenger vehicles, heavy duty trucks, shipping, aviation)	Renewable fuels and bioenergy	Good alignment
Bioenergy use in buildings (heating, cooking stoves)	Energy Efficiency in Buildings	Good alignment
Electrolysis	Renewable fuels and bioenergy	Partial alignment ; Electrolysis is covered by the current scope of the SET Plan but at a relatively low level of importance
SMR with CCUS	None	No alignment
Coal gasification with CCUS	CCUS - CCU	Good alignment
Methane splitting	Renewable fuels and bioenergy	Good alignment
Pipeline	None	No alignment
Ammonia tanker	None	No alignment
Blending in natural gas network	None	No alignment
Liquid hydrogen tanker	None	No alignment
Liquid organic hydrogen carrier	None	No alignment
Refueling stations	None	No alignment
Tanks	None	No alignment
Storage in salt caverns	None	No alignment
Hydrogen use in fuel transformation (oil refining, synthetic methane, synthetic liquid hydrocarbons)	Renewable fuels and bioenergy, CCUS - CCU	Partial alignment; Hydrogen use in fuel transformation is covered by the current scope of the SET Plan but at a relatively low level of importance

Hydrogen use in industry (ammonia, methanol, iron and steel)	Renewable fuels and bioenergy, CCUS – CCU, Energy Efficiency in Industry	Partial alignment; Hydrogen use in industry is covered by the current scope of the SET Plan but at a relatively low level of importance
Hydrogen use in transport (fuel cell light and heavy duty road vehicles, fuel cell ships, fuel cell trains, hydrogen-fuelled engines for road and ships, ammonia-fuelled ships)	Renewable fuels and bioenergy, CCUS - CCU	Partial alignment; Hydrogen use in transport is covered by the current scope of the SET Plan but at a relatively low level of importance
Hydrogen use in buildings (boiler, fuel cells, heat pumps)	None	No alignment
Hydrogen in power generation (high-temperature fuel cells, gas turbines, co-firing ammonia in coal power plants)	None	No alignment

Based on the main outcomes of the comparative analysis of the EU energy and climate policy/regulatory frameworks (appendix 5), the EU Member States' NECPs (appendix 6) and the IEA's low-carbon technology value chains (see above) with the scope of the SET Plan IWGs, the following conclusions can be drawn.

Definitions:

- "**Good alignment**": The low-carbon energy technology or infrastructure is clearly formulated in EU energy and climate policy/regulatory frameworks and/or EU Member States' NECPs and/or IEA's low-carbon technology value chains AND is clearly covered by the current scope of the SET Plan at a comparable level of importance.
- "**Partial alignment** ": The low-carbon energy technology or infrastructure is clearly formulated in EU energy and climate policy/regulatory frameworks and/or EU Member States' NECPs and/or IEA's low-carbon technology value chains AND is covered by the current scope of the SET Plan but at a relative lower level of importance.
- "**No alignment** ": The low-carbon energy technology or infrastructure is clearly formulated in EU energy and climate policy/regulatory frameworks and/or EU Member States' NECPs and/or IEA's low-carbon technology value chains AND is not covered by the current scope of the SET Plan.

Low-carbon energy technologies and infrastructures	Good alignment	Partial alignment	No alignment	Link with a SET Plan IWGs
Solar PV	X			Solar PV
Solar thermal (CSP/STE)	X			CSP/STE
Floating Solar PV			X	
V2H (Vehicle To Home)			X	
Onshore wind power			X	
Fixed offshore wind	X			Offshore wind
Floating offshore wind	X			Offshore wind
Deep geothermal (both for heat and electricity)	X			Deep geothermal
Ocean energy (tidal and wave energies)	X			Ocean Energy

Positive Energy districts	X			Positive Energy districts
All the technologies linked to energy system integration, flexibility and security	X			Energy Systems
HVDC	X			HVDC
AC/DC hybrid grid system	X			HVDC
Waste heat in buildings	X			Energy Efficiency in Buildings
New materials/technologies for energy efficiencies in buildings	X			Energy Efficiency in Buildings
Heating and cooling + thermal energy storage technologies (incl. Heat pumps) for buildings		X		Energy Efficiency in Buildings
Large scale end-use applications of H2 in industries	X			Energy Efficiency in Industry
Heating and cooling technologies (incl. waste heat) for industries	X			Energy Efficiency in Industry
Circular economy in industries	X			Energy Efficiency in Industry
Energy and process efficiency in industries	X			Energy Efficiency in Industry
CCS and CCU in industries	X			Energy Efficiency in Industry
Electrification of industrial processes	X			Energy Efficiency in Industry
Biomass and waste as a feedstock in industries	X			Energy Efficiency in Industry
Hydrogen as a feedstock in industries	X			Energy Efficiency in Industry
Batteries for road vehicles	X			Batteries
Batteries for other transport applications (ships, planes, heavy duty road vehicles)			X	
Stationary batteries (electricity storage)	X			Batteries
Recycling of batteries	X			Batteries
Use of solar energy in transport			X	
Biogas-/bioliquid-fired internal combustion engine			X	
Renewable hydrogen (water electrolysis technologies)		X		Renewable fuels and bioenergy
Hydrogen storage and transport (ammonia, liquid H2 and liquid			X	

organic H2 carrier tankers, salt caverns, pipelines)				
Biogas from non-recyclable human and agricultural waste		X		Renewable fuels and bioenergy
Biomethane from non-recyclable human and agricultural waste		X		Renewable fuels and bioenergy
H2 production from marine algae	X			Renewable fuels and bioenergy
H2 from direct solar water splitting	X			Renewable fuels and bioenergy
H2 from pyrolysis processes with solid carbon as side product	X			Renewable fuels and bioenergy
Nuclear-based hydrogen			X	
Large scale end-use applications of H2 in transports (fuel cell and H2-fuelled heavy-duty transport, ships, trains)		X		Renewable fuels and bioenergy
Refueling hydrogen stations			X	
Hydrogen use in fuel transformation (oil refining, synthetic methane, synthetic liquid hydrocarbons)		X		Renewable fuels and bioenergy; CCU-CCS
Hydrogen use in industry (ammonia, methanol, iron and steel)		X		Renewable fuels and bioenergy; Energy Efficiency in Industry
Hydrogen use in power generation		X		Renewable fuels and bioenergy
Bioenergy (biofuels) from algae	X			Renewable fuels and bioenergy
Renewable ammonia and methanol as a fuel		X		Renewable fuels and bioenergy
Advanced liquid and gaseous biofuels	X			Renewable fuels and bioenergy
Bioenergy from biomass for heat and power	X			Renewable fuels and bioenergy
Intermediate Bioenergy Carriers (solid, liquid and gaseous)	X			Renewable fuels and bioenergy
Solid biomass-fired Integrated Gasification Combined Cycle	X			Renewable fuels and bioenergy
Low-carbon hydrogen (blue H2)			X	

Synthetic methane		X		CCU-CCS
CCS (in the power and industry sectors)	X			CCU-CCS
CCU (urea, methanol, synthetic methane, concrete)	X			CCU-CCS
Fuels from non-biological origin (e-fuels/synthetic fuels)		X		CCU-CCS
Direct Air Capture with Carbon Storage			X	
Bioenergy with Carbon Capture and Storage (BECCS)	X			CCU-CCS
Retrofitting of existing gas infrastructures (for hydrogen and biomethane)			X	
CO2 transportation	X			CCU-CCS
CO2 storage	X			CCU-CCS
Nuclear safety	X			Nuclear safety
Nuclear waste disposal and storage	X			Nuclear safety
Small nuclear modular reactors (SMR)		X		Nuclear safety
Nuclear fusion	X			Nuclear safety
Critical raw materials substitution, reuse and recycling			X	
Critical raw materials extraction from domestic deposits			X	
Detection of methane leaks			X	
Energy (electricity and/or heat) storage and integration of storage systems (incl. Power-to-gas and gas-to-power) storage systems		X		Positive energy districts; Energy systems; Energy Efficiency in Buildings; Energy Efficiency in Industry; Batteries
Infrastructures for high-power electric recharging for local public transport (including charging solutions incorporated along the route)			X	

Appendix 8: Identification and assessment of the potential future implications of the rollout of the REPowerEU plan for the current SET Plan's objectives and targets^{50;51;52}

Low-carbon energy technologies and infrastructures	REPowerEU targets for 2030	Link with SET Plan IWGs	Assessment of the implication(s)
Energy efficiency in buildings (incl. retrofitting/renovation)	Annual renovation rate (medium and deep renovation) (as % of entire housing stock): 2.1%	Energy Efficiency in Buildings - R&I Activity #5.1	Frontloading of existing targets and definition of new targets for 2030
Heat pumps in buildings	Cumulative 10 million units by 2027 and 41.5 million units in 2030	Energy Efficiency in Buildings - R&I Activity #5.2	
Energy Efficiency in Industry (industrial processes)	/	Energy Efficiency in Industry - R&I Activity #3.1, 3.2, 4.6, 5.3, 6.3	
Integration of renewables in industries	Average yearly increase of RES share in electricity consumption for 2020-2030 at EU level: 1.9%	Energy Efficiency in Industry - R&I Activity #1.1-1.4, 2.1-2.4, 6.5	
Electrification of industrial processes	/	Energy Efficiency in Industry - R&I Activity #4.1, 5.2, 6.3	
Digitalisation and industrial symbiosis in industries	/	Energy Efficiency in Industry - R&I Activity #2.1-2.4	

50 Source: REPowerEU Communication: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2022%3A230%3AFIN&qid=1653033742483>

51 Source: Annexes to REPowerEU Communication: https://eur-lex.europa.eu/resource.html?uri=cellar:fc930f14-d7ae-11ec-a95f-01aa75ed71a1.0001.02/DOC_2&format=PDF

52 Source: Staff Working Document: Investment needs, hydrogen accelerator and bio-methane plan: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=SWD%3A2022%3A230%3AFIN&qid=1653033922121>

Heat pumps in industries	/	Energy Efficiency in Industry - R&I Activity #1.1	
Biomethane production	35 bcm of biomethane production	Renewable fuels and bioenergy - R&I Activity #1-3 and #11-13	<p>Need to further emphasise on the development of biogas/biomethane production = creation of a dedicated R&I Activity aiming at:</p> <p>Developing innovative technologies for the production of sustainable biogas and biomethane (based on gasification of biogenic residues and wastes from all sectors and industries, biogenic CO2 effluents and waste, organic part of industrial waste waters and municipal sludge, as well as feedstock from marginal and contaminated lands through phytoremediation)</p> <p>Developing innovative technologies for the upgrade of sustainable biogas to biomethane (i.e., biological or catalytic conversion of the biogenic CO2 in the biogas to biomethane). Special focus should be given to increasing cost effectiveness and efficiency of small-scale upgrading technology</p> <p>Developing innovative solutions</p>

			<p>and research on barriers and integration of sustainable biomethane to the gas grid</p> <p>Supporting the expansion of the sustainable biomass potential to ensure availability of resources for reaching the biomethane production target</p>
Solar PV (incl. solar rooftop)	320 GW of Solar PV installed capacity in 2025, and 600 GW in 2030 (more than half expected to be solar-rooftop capacities)	Solar PV, CSP/STE - all R&I activities	Frontloading of existing targets and definition of new targets for 2030
Onshore wind	510 GW (onshore and offshore wind installed capacity combined)	/	/
Offshore wind	510 GW (onshore and offshore wind installed capacity combined)	Offshore wind - all R&I activities	Frontloading of existing targets and definition of new targets for 2030
Energy system integration (incl. power grid, storage)	EUR 29 billion of additional investments in the power grid (on the top of the 554.4 billion in the Fit for 55) and EUR 10 billion in storage	Energy systems - all R&I activities	
Renewable hydrogen production	10 Mt of renewable hydrogen production in the EU (65 GW of installed electrolyzer capacity)	Renewable fuels and bioenergy - R&I Activity #7	<p>Frontloading of existing targets and definition of new targets for 2030</p> <p>Given the importance of the large-scale expansion of renewable hydrogen,</p>

			the creation of a new and dedicated IWG
Nuclear-based hydrogen	/	/	
Renewable hydrogen infrastructures (transport, storage, terminal imports, ports etc..)	EUR 28 – 38 billion for EU-internal pipelines and 6 - 11 billion for storage 6.16 Mt of net import of renewable hydrogen	/	Need to account for this R&I topic in a new IWG specifically dedicated to renewable hydrogen production and distribution
Retrofitting existing gas networks to biomethane and H2	/	/	
End-use renewable H2 appliances in industries and transports	Use by sector: Iron and steel (1.5 Mt), Refineries (2.8 Mt), Industrial Heat (3.6 Mt), Ammonia (3.2 Mt), Synthetic fuels (1.8 Mt), Blending (1.3 Mt), Transport (2.3 Mt), Ammonia as a fuel from imports (4 Mt)	Energy Efficiency in Industry - R&I Activities #4.2 and 5.1 CCUS/CCU – Target #8	Frontloading of existing targets and definition of new targets for 2030 Need to further expand the perspectives of hydrogen end-uses to refineries, ammonia, industrial heat and transport, which is currently not covered in the IWGs Need to scale-up R&I investments in synthetic fuels
End-use biogas/biomethane appliances in households, industry and agriculture	6.9 ktoe of biogas used as transformation input in industry and in district heating	Energy Efficiency in Industry - R&I Activities #4.2, 5.3, 6.5 Energy Efficiency in Buildings	Frontloading of existing targets and definition of new targets for 2030 The IWG Energy Efficiency in Buildings needs to further consider the perspectives of

			biomethane end-uses to district heating, which is currently not in its scope.
Enhancement of energy savings and efficiencies in the transport sector and acceleration of the transition towards zero-emission vehicles (electrification of renewable hydrogen)	Greening of Freight Package to be presented soon	Batteries - all R&I activities Renewable fuels and bioenergy - R&I Activity #7	Need to further consider the topic of energy savings and efficiencies in the transport sector (similarly to Energy Efficiency in Industry and Energy Efficiency in Buildings)

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The Strategic Energy Technology (SET) Plan launched in 2007 as a first step to establish an energy technology policy for the EU, provides a common vision, goals, and coordination for accelerating the development and deployment of efficient and cost-competitive low-carbon energy technologies. The SET Plan has played a central role in implementing the Research, Innovation & Competitiveness dimension of the Energy Union, and in guiding national research efforts in the National Energy and Climate Plans. However, after 15 years of operation and a last update in 2015, the EU energy agenda has changed considerably. In this context, a revamp of the SET Plan, with a review of its objectives, governance, scope, and activities is required to make the SET Plan fully fit to the Green Deal and the REPowerEU objectives. This evaluation contributes to the ambitions of the European Commission to conduct a revision of the SET Plan by providing an unbiased review of the SET Plan through a structured interim evaluation.

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