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EXECUTIVE SUMMARY

This deliverable D3.3 “Interim report on the translation of new EU policies into concrete actions for EERA members and SET-Plan community” is a preliminary result of the activities carried out in Task 3.2 “Translating new EU policies into concrete actions for the EERA and SET-Plan community”. It is the first interim report on D3.3 (M18), which will be then followed by a second one in M24 and a final one in M42.

After an introductory section aimed at summarising the essentials of the SUPEERA project with reference to the specificities of D3.3, the report continues with a part dedicated to the deliverable’s objectives, which are presented also in the context of the broader EU policy landscape. The document then develops through its two main chapters: 1) The report on how EU selected policies translate into research challenges and industrial opportunities; 2) The summary of webinars and discussions held with EERA members.

The first chapter starts with setting forward the methodology followed to fulfil the project’s Task 3.2, with particular reference to the use of the 'mission definition' approach. Inspired by the Research Council of Norway¹, this method is in line with the EC's mission-oriented R&I policy framework, which aims at maximising the reach of investments by setting more precise targets and expected impact when addressing global challenges. Building on the methodology part, the report then continues with the presentation of the work done in the drafting, publication and dissemination of the four Policy Briefs which have been so far finalised in the framework of the project, i.e. on Energy Systems Integration Strategy, Hydrogen Strategy, the Circular Economy Action Plan and The New European Research Area. For each Policy Brief, the report outlines the policy context in which it is rooted and the recommendations relevant to the energy research community derived from the analysis of the topic under examination.

The second chapter is then dedicated to the presentation of a summary of the webinars organised so far in the framework of the project as well as of the discussions held in the context of the 2020 and 2021 Summer Strategy Meetings (SSMs). The first webinar was titled “The European Green Deal: What role for Energy Research?” and focused on the aspects directly related to research and innovation in the energy sector whereas the second one – “A European Green Deal fit for the Digital Age: What is in for Clean Energy Research?” – was aimed at discussing the challenges and opportunities of the clean energy transition – digital transformation nexus. As far as the policy discussions during the SSMs are concerned, the report details how these resulted to be key in understanding the view of the EERA community on topical research challenges and industrial

¹ <https://www.forskningsradet.no/en/>

opportunities and translate them into recommendations also to the benefit of the broader SET-Plan community, respecting this way provisions settled down in the DoA.

The report is finally closed by a section on upcoming actions, which illustrates the initiatives currently in the pipeline until the end of the year, when a second interim report will be due (M24). The document is complemented by an annex (Annex I) which includes in full length the four Policy Briefs above-mentioned to ensure information completeness.

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I INTRODUCTION

In 2008 the European Commission launched the Strategic Energy Technology (SET) Plan, as an instrument to boost R&I in the field of low carbon technologies. Building on the SET Plan 10 priorities, 14 Implementation Plans (IPs) were written in order to cover all the Energy Union R&I priority areas, and Implementation Working Groups put in charge of executing the R&I activities listed under the IPs. The SET Plan is supported by the open-access SET Plan Information System (SETIS – Joint Research Centre, European Commission) that provides up-to-date information on its activities covering all R&I priorities of the Energy Union.

Within this context, the SUPEERA project - SUPport to the coordination of national research and innovation programmes in areas of activities of the European Energy Research Alliance -was launched on January 1st, 2020, and aims at reaching four high-level objectives:

- 1) Facilitating the coordination of the research community in support of the execution of the SET Plan towards the Clean Energy Transition;
- 2) Accelerating innovation and uptake by industry;
- 3) Providing recommendations on R&I priorities and policy frameworks through the development and analysis of the energy and macroeconomic indicators;
- 4) Supporting and promoting the connection of the SET Plan and the Clean Energy Transition with all stakeholders.

In order to realise the third high objective and as described in Task 3.2, the project stipulates for the realisation of a series of webinars, the holding of a presentation session at each annual EERA Summer Strategy Meeting as well as the publication of a series of Policy Briefs on selected European policies applicable to the climate and energy fields. These actions are continuously carried out under the scrutiny and quality assurance provided by the EERA Policy Working Group, which gathers senior researchers and policy workers active in the energy policy landscape and which meets with a monthly frequency.

This interim report details precisely on the actions above-mentioned from M1 until M18 and provides a perspective on upcoming actions based on current policy assessment and priority setting.

II OBJECTIVES

The European Union's commitment to reach climate neutrality by 2050 and meet the objectives of the Paris Agreement entails no less than a complete redefinition of the European energy system. To achieve this ambitious but necessary goal, new policies are in the process of being drafted and existing ones reassessed in order to comply and inform this rapidly changing environment.

Based on the continuous analysis of the above-mentioned policy landscape, the fulfilment of Task 3.2 aims at providing the EERA community with tailored recommendations on concrete research areas and industrial challenges. This interim report therefore presents how this has been concretely achieved from M1 until M18 by detailing the actions undertaken, their uptake and reach and outlines the basis for future work.

III REPORT ON HOW EU SELECTED POLICIES TRANSLATE INTO RESEARCH CHALLENGES AND INDUSTRIAL OPPORTUNITIES

3.1 Methodology

The task aims to provide the EERA community with tailored recommendations on concrete research areas and industrial challenges to contribute to implementing selected new European policies applicable to the climate and energy fields. Based on the initial discussion on relevance and capacity, it was decided to focus on the European Green Deal and the policy files that followed this initiative. Currently, policy papers on the Hydrogen Strategy, the Energy System Integration Strategy, the Circular Economy Action Plan and the new European Research Area have been analysed. Additional new policies to be examined will be selected yearly depending on the priorities of the European Commission (EC).

The recommendations will be based on a 'mission definition' approach. The approach is inspired by a methodology used by the Research Council of Norway² to detail research challenges and industrial opportunities related to subsets of the overall challenge of climate change. The method is in line with the EC's mission-oriented R&I policy framework, aimed at maximising the impact of investments by setting more precise targets and expected impact when addressing global challenges. This approach is illustrated in Figure 1, where the Mission "World leading supplier of

² <https://www.forskningsradet.no/en/>

zero-emission transport" is split into a set of solutions needed to realise it. Then each solution is analysed to identify research and innovation challenges employing a qualitative expert gap analysis.

From the analysis of the selected Green Deal policies and priorities, EERA experts will define concrete missions that will be translated into a set of interdisciplinary solutions. These solutions will be split into a list of R&I challenges and industrial opportunities, responding to specific European R&I needs.

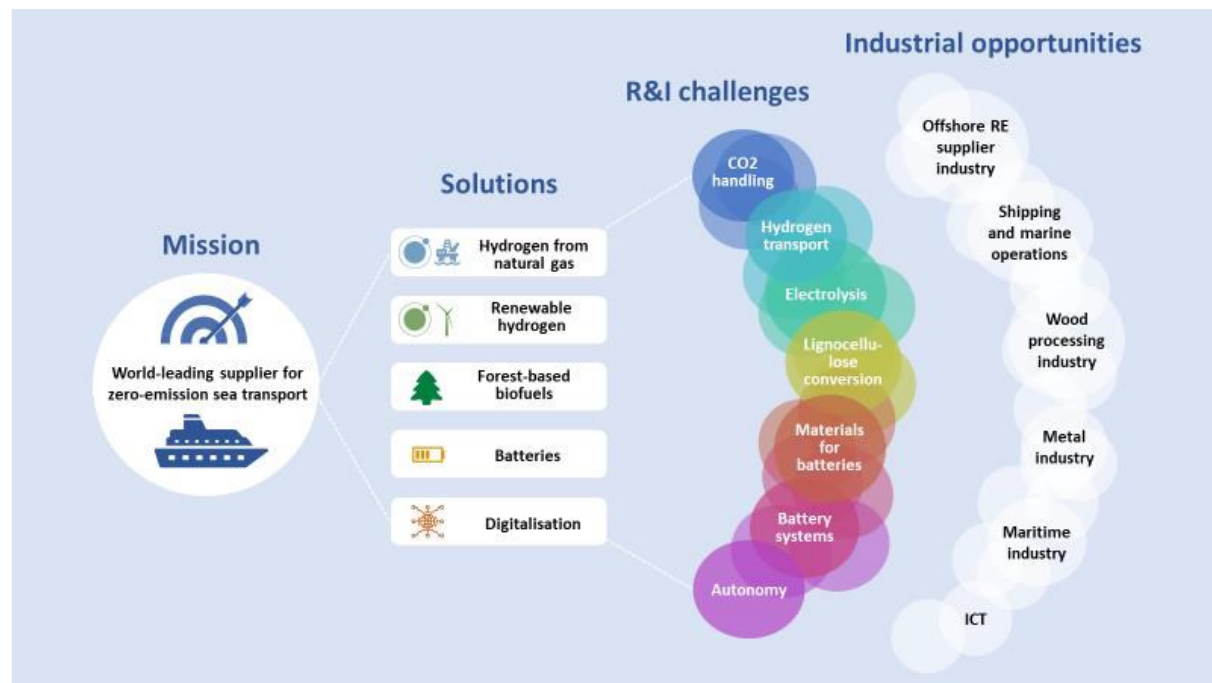


Figure 1. Mission definition approach: Translating policies into research challenges

Since the European Green Deal aims to solve the challenges posed by climate change and at the same time build a new Green Industry, the research challenges are held up against fields where Europe has solid competencies and industry to identify industrial opportunities with significant potential.

The method translates policy objectives into identifiable research challenges and firm actions for EERA members. In the EERA context, the Missions from the Norwegian model is the topic of the policy paper. The structured approach to the Green Deal policy papers is shown in Figure 2.

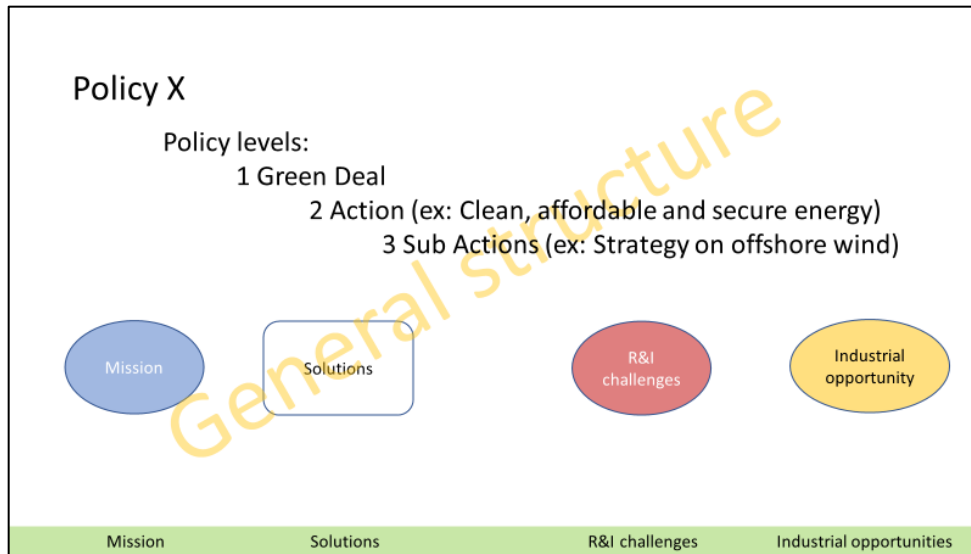


Figure 2. The hierarchical structure of policies to be analysed

At the top level, the Green Deal is divided into high-level areas to be addressed by policy papers, shown in Figure 3.

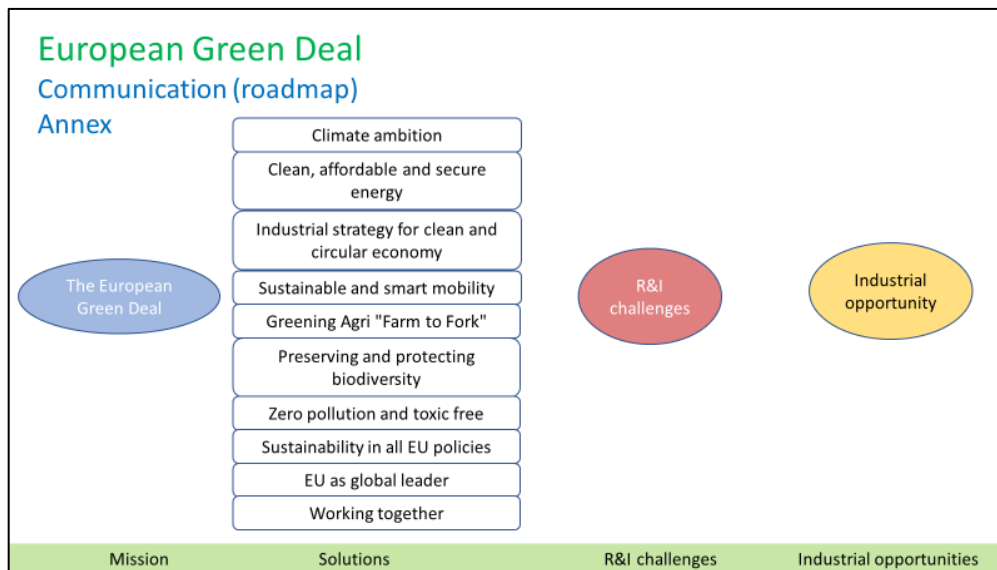


Figure 3. Policy paper areas addressed under the Green Deal

The analysis will benefit from the involvement of the EERA Policy Working Group. Active inside the EERA structure, this group gathers senior researchers and policy workers from a broad set of Member States and Associated Countries who are engaged in the national and European energy policy landscape. The group members will provide intelligence on the latest developments at the

EU level and the scientific base to translate the missions identified into concrete research challenges and industrial opportunities for the EERA community.

An example is the Energy System Integration Strategy shown in Figure 4. The critical issues underlined in the document are:

- 1) Creating a more efficient and circular energy system
- 2) Accelerating the use of electricity produced from renewable sources
- 3) Promoting renewable and low-carbon fuels, including hydrogen, for sectors that are hard to decarbonise
- 4) Adapting energy markets and infrastructure to a more complex, integrated energy system

These identified issues are translated into the need for five solutions within defined areas, which are again structured into concrete research challenges.

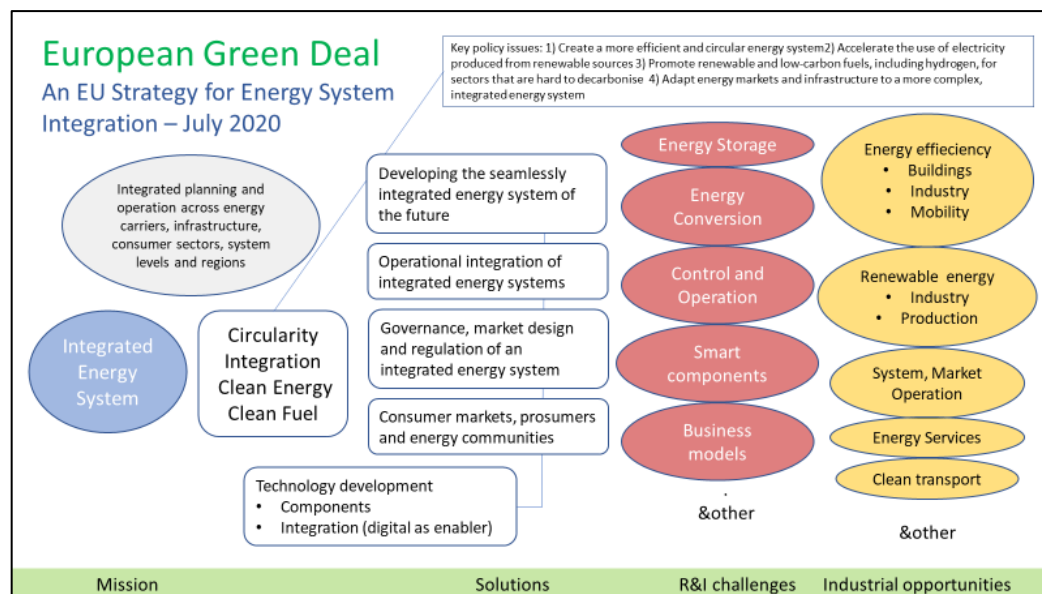


Figure 4. Analysis of EU strategy for Energy System Integration

For each policy document selected, a compact summary in text format of 4 to 5 pages documents the analysis. The results are widely disseminated and discussed with the EERA membership to align and engage them in realising the policies both at the EU and national level.

3.1 Policy Briefs

The process identified in the previous section provided the basis for producing a series of documents named "Policy Briefs" (PBs). The ultimate goal of the Briefs is to analyse the policies of the European Union and identify concrete research questions relevant to the energy research community. The analysis of the policies identified has the two-fold objective of supporting recommendations towards the EERA membership and the SET Plan ecosystem at large, as well as identifying potential areas for investments in energy R&I for EU policymakers.

The identification of the documents was conducted inside the SUPEERA consortium and involved the Secretariat of EERA as the project's main beneficiary. In addition, the EERA Policy Working Group (POL WG) was consulted in the decision process, given the expertise its members can bring to the discussion. Finally, the documents were selected among those published under the scope of the European Green Deal after ensuring that the associated research and innovation challenges would be of interest to the EERA community. This section outlines the policy context in which each of the four Policy Brief published so far - Energy Systems Integration Strategy, Hydrogen Strategy, the Circular Economy Action Plan and The New European Research Area - is rooted and details on the recommendations relevant to the energy research community derived from the analysis of the topic under examination. The full versions of the PBs with detailed recommendations (in the following sections only examples of recommendations are reported) can be accessed in the Annex 1 to the report by clicking at this [link](#).

3.1.1 Energy Systems Integration Strategy

The European Commission's Energy System Integration Strategy outlines the Commission's vision of accelerating the transition towards a more integrated energy system to achieve higher decarbonisation objectives by 2030 and climate neutrality by 2050. Yet, the critical measures planned by the Commission services for implementing these strategic areas rarely mention Research and Innovation as an essential means to address the energy system integration challenge more deeply.

Among the recommendations brought forward in the Policy Brief are:

- To step up research on technology and methods to integrate fluctuating renewable energy sources in the energy system
- To conceptualise an innovative and robust open cross-sectoral modelling in the hydrogen sector
- To set-up accessible and reliable databases with the relevant datasets for cross-sectoral modelling

3.1.2 Hydrogen Strategy

In its Communication on a Hydrogen Strategy for Europe, the EU Commission presented a roadmap for developing renewable hydrogen, leading to its widespread industrial deployment by the year 2050. However, despite its ambitious long-term objectives, the Strategy fails to address some of the crucial issues linked to renewable hydrogen production and use.

The main recommendations put forward in the Policy Brief include:

- The need for the European Commission to address the low efficiency of hydrogen technologies, as well as the complexity of the retrofitting and carbon capture processes
- To carefully reassess the possibility to carry out considerable investments for the production of fossil-based hydrogen as this risks enhancing its production to the detriment of green hydrogen
- To consider the environmental impact of hydrogen integration that would follow the construction of new infrastructure and the removal of already existing fuel networks. Hydrogen should take into account the already existing infrastructure and alternatives to avoid production of waste, such as recycling and repurposing.

3.1.3 Circular Economy Action Plan

The European Commission's Circular Economic Action Plan (CEAP) outlines the strategy to reduce waste and increase the environmental soundness of production processes in the EU, in an attempt to decouple economic growth from resource use.

Many are the recommendations set out in the document. These include:

- The need to outline a plan for the development of energy-efficient processes, advanced digital tools for life-cycle assessment, and strategic use of raw materials.
- To develop advanced/innovative materials and fabrication processes to increase lifetime efficiency and facilitate reuse/recycling.
- To implement waste-to-energy and energy efficiency (e.g., repurposing of biological waste into biofuels) processes.

3.1.4 The New European Research Area

The European Commission's Communication on "A new ERA for Research and Innovation" puts forward a set of policies promoting cooperation and mobility of ideas and researchers across the

EU. While the focus of this Policy Brief shifts from the energy sector, it is critical for the research community to understand the way forward and the priorities of the European Commission.

The main recommendations of the authors encompass:

- The inclusion of researchers' contributions into national plans, bringing the scientific community's perspective to the policymaking process.
- The creation and support of new opportunities for training and researchers' mobility across institutions.
- The promotion of open access to research results.

The Policy Briefs were drafted in a collaborative process that involved members of the EERA Secretariat, representatives from SUPEERA's Third-Linked Parties (e.g., SINTEF, DTU) and members of the EERA Policy Working Group. Experts in the specific topics were consulted beyond these groups, with researchers from EERA Joint Programmes contributing to the writing process. The possibility of involving such a diverse audience in the drafting activities ensured a diversity of options crucial to recognise different aspects and a high degree of collaboration developed through the EERA community. This collaboration was essential to make sure that researchers felt included throughout the entire process, increasing the effective representation of the research community.

Once edited and proofread, the Briefs were published and distributed across the EERA audiences. The Briefs were sent to all EERA members and included in various editions of the EERA newsletter. The newsletter targets more than 3000 people interested in energy R&I activities and provided an excellent platform to expand the outreach of the Briefs. In addition, these were shared on the SUPEERA website³ in a specific section⁴ accessible in the website's main menu and on the EERA social media profiles. Through publication on Twitter and LinkedIn, the posts regarding the publication of the Briefs gathered more than 4500 visualisations and attracted more than 100 interactions.

³ <https://supeera.eu/>

⁴ <https://supeera.eu/news-and-resources/policy-briefs.html>

IV SUMMARY OF WEBINARS AND DISCUSSIONS HELD WITH EERA MEMBERS

4.1 Webinars

Alongside the drafting and publication of the aforementioned Policy Briefs, the task entailed a series of webinars aiming to discuss the most recent and relevant policy developments in the EU climate and energy arena. The SUPEERA consortium identified the topics covered by such webinars, and their relevance was discussed by the POL WG members during the group's monthly meetings. The EERA Secretariat, as the project's main beneficiary, was involved in identifying relevant topics to be covered, as well as in the process of producing a concept note and an agenda for the webinar.

Regarding the latter, the speakers were invited based on their expertise on the specific topics covered and included officials from the European Institutions (European Commission and European Parliament), researchers from the EERA community, and senior policy workers from Brussels-based policy associations. The official invitation to the event was sent out to the whole SUPEERA community and was disseminated through SUPEERA's website⁵, as well as EERA's main website⁶, and social media channels (LinkedIn, Twitter).

Targeting the entire SUPEERA and EERA research communities, the webinars were organised around presenting the policy analysis conducted and respective research and innovation challenges identified. Each webinar included a high-level introduction delivered by an official from the European Institutions. More specifically, the webinars organised benefitted from the participation of the European Commission and European Parliament.

Since the start of the project, the following are the two webinars that have taken place:

4.1.1 The European Green Deal: What role for Energy Research?

The first SUPEERA policy webinar organised within task 3.2 took place virtually on April 24th 2020, from 11:00 AM to 12:00 PM. The event, titled "The European Green Deal: What role for Energy Research?", gathered 82 attendees, among whom policymakers, researchers from the EERA and SET Plan communities, and other interested stakeholders for a discussion on the European Green Deal and its policy priorities. The webinar focused on the aspects directly related to research and innovation in the energy sector.

⁵ <https://supeera.eu/>

⁶ <https://www.eera-set.eu/>

The event speakers were: Petter Støa, Vice President Research at SINTEF Energy, Matthijs Soede, Research Policy Officer, DG Research & Innovation, European Commission, and Alessia Clocchiatti, Policy Officer, DG Energy, European Commission. The keynote speakers from the European Commission set the scene and pointed at measures and procedures of interest to the EERA community. Alongside a detailed presentation on the European Green Deal and its priorities, the webinar featured an in-depth analysis of how the measures included in the policy package concretely translate into opportunities and research challenges for energy researchers across the broader spectrum of energy technologies and horizontal sectors contributing to the clean energy transition.

For further information on the webinar, the presentations can be accessed here⁷.

4.1.2 A European Green Deal fit for the Digital Age: What is in for Clean Energy Research?

"A European Green Deal fit for the Digital Age: What is in for Clean Energy Research?" was the second SUPEERA policy webinar aiming to inform the community about the latest EU policy updates in the field of climate and energy. Held on May 28th 2021, from 10:00 to 11:30 AM, the webinar gathered 56 participants, among whom policymakers, researchers, and representatives from the IT sector, to discuss the challenges and opportunities of the clean energy transition – digital transformation nexus. The event aimed to highlight the research and innovation, policy, and business priorities regarding the Clean Energy Transition in Europe in their complex relations with the unfolding digital landscape and develop innovative solutions to address these challenges.

The event was opened by Rosita Zilli, EERA Senior Policy Officer, who gave an overview of the SUPEERA project and its objectives. The introductory remarks were followed by a panel discussion that brought together transversal expertise across the EU energy and digitalisation policy landscape. In particular, the panel session was moderated by Adel El Gammal, EERA Secretary General, and the speakers were: Vincent Berrutto, Head of Unit Innovation, Research, Digitalisation, and Competitiveness, DG Energy, European Commission, Claudia Gamon, Member of the Committee on Industry, Research, and Energy (ITRE), European Parliament, Rafael Mayo-García, Senior Researcher at CIEMAT and Coordinator of EERA transversal Joint Programme Digitalisation for Energy, and Olena Kushakovska, Senior Development Manager at SAP Labs France and member of the Integrated Civil and Infrastructure Research Centre (ICAIR) at the University of Sheffield.

⁷ https://www.supeera.eu/component/attachments/?task=download&id=360:SUPEERA-Webinar_Slide-deck_final

The discussion held during the webinar showed that the interconnection between research on clean energy and digitalisation is still largely unexplored and further work in the field is needed. Key areas for prospective work in this field include, among others, energy decentralisation, as well as consumer engagement and empowerment.

For further information on the webinar, the recording and the presentations are available online and can be accessed respectively [here](#)⁸ and [here](#)⁹.

4.2 Summer Strategy Meeting Discussions

In 2020, the EERA Summer Strategy Meeting (SSM) was held online for the first time due to the limitations posed by the Covid-19 pandemic. On this occasion, the main SUPEERA project's activities and objectives were presented to the EERA audiences invited to the event, touching upon many topics, including widening strategies and policy initiatives. At the time, the first Policy Briefs had not been completely drafted yet, but during the SSM many panels revolved around EU policy specific topics. These panels included discussions between the different EERA members there represented and touched upon themes such as the European Green Deal, the Clean Energy Transition and the SET Plan. The exchanges of views and the main conclusions reached in the panels provided a crucial base for the research challenges identified in the SUPEERA Policy Briefs published later in the year, and the opinions of the experts who intervened at the SSM were later on taken into consideration when analysing the policy documents published by the European Commission.

The 2021 edition of the meeting outlining EERA's strategic priorities, denominated Annual Strategy Meeting (ASM), was held online on 29 and 30 June featuring a discussion on the SUPEERA project and its activities. Among other priorities within the EERA community, the ASM discussed the Alliance's interdisciplinary strategy starting from the "New European Bauhaus" approach, as well as the role of the Clean Energy Transition in the context of the United Nations Sustainable Development Goals (SDGs) and broader Societal Sustainability. Furthermore, the role of EERA as a trusted advisor to the SET Plan (and Clean Energy Transition Partnership) ecosystem was thoroughly discussed, as well as its positioning within the international arena. Such discussions will now inform the policy work to be carried out within the SUPEERA project until the end of the year,

⁸ https://zoom.us/rec/play/Z_GWI-Jo4Yt8FISwu5Nz0P9mOTf7HTi6l8xPsvWiHgTxUOoxnVLIJ5YIVtCrS42OV06davJwhV-Xu.sn2xivtBgozsKdRy

⁹ https://supeera.eu/index.php?option=com_attachments&task=download&id=625:SlideDeck_SUPEERAWebinar_May28

namely in the definition on the second webinar to be held in the autumn and further planned Policy Briefs.

V UPCOMING ACTIONS

In line with the actions identified in the Grant Agreement, Task 3.2 will continue to be active in the translation of EU policies into research challenges for the EERA community.

Over the course of 2021, the SUPEERA team plans to publish four additional Policy Briefs, analysing and discussing R&I challenges related to:

- the new EU Strategy on Adaptation to Climate Change
- the New European Bauhaus initiative
- the European Climate Law
- the Updated EU Industrial Strategy

This list is indicative and subject to changes following the evolution the EU policy scene.

In addition to the next Policy Briefs, a second webinar will be organised in the fall of 2021, to comply with the proposed objective of two webinars per year.

ANNEX 1 – SUPEERA Policy Briefs

ENERGY SYSTEM INTEGRATION: RESEARCH CHALLENGES AND OPPORTUNITIES AHEAD

Setting the scene

These are unprecedented times for the future of Europe: the need to drive the post-COVID recovery on a sustainable path and the parallel preparation of the 2021-2027 EU budget and R&I programmes have the potential to give a real boost to the achievement of the European climate-neutrality objective by 2050.

EU policymakers have confirmed their commitment to drive the economic recovery through sustainable, green investments and digital development by reaching an agreement on a bold EU budget and Recovery Plan. Despite the heavy cuts to the Horizon Europe budget, the energy sector remains one of the main areas of action to significantly reduce CO₂ emissions while boosting economic recovery. As part of the European Green Deal¹⁰, the adoption of new political strategies will help guiding investments and regulation in the fields of energy system integration, industrial policies, circular economy and more.

There is therefore a momentum to identify the R&I challenges and industrial opportunities of tomorrow and to coordinate efforts towards the achievement of new energy and climate priorities in Europe. **The research community has a key role to play**, both in advancing research on identified political priorities, as well as in advising policymakers on the way forward through excellent fundamental research and focus on low TRLs for the advancement of new breakthrough technologies, materials and systemic approaches.

Prepared within the framework of the SUPEERA project¹¹, this series of policy briefs aims at identifying in latest EU policies relevant to the energy research community concrete R&I challenges towards the achievement of the Clean Energy Transition. The analysis of the policies identified will have the two-fold objective of supporting recommendations towards the EERA membership and the SET-Plan ecosystem at large, as well as to identify potential areas for investments in energy R&I for EU policymakers. Specifically, this paper will focus on the Energy System Integration strategy, published on 8 July 2020 by the European Commission, as a key European Green Deal measure for a cleaner energy sector.

¹⁰ COM(2019) 640 final

¹¹ <https://www.supeera.eu/>



Energy system integration strategy: rethinking the system to achieve climate neutrality

The European Commission’s Energy System Integration Strategy³ is a policy document outlining its **vision on how to accelerate the transition towards a more integrated energy system** to achieve higher decarbonisation objectives for 2030 and climate neutrality by 2050.

The strategy is organised around six major pillars that will guide EU actions in the months and years to come. The table below provides an overview of the strategic pillars and the related areas for development as defined by the European Commission in the document. They are reported as identified R&I challenges, as our analysis focuses only on the areas for future EU action with the highest potential for further improvements through research and innovation actions. The measures involving actions outside of the scope of R&D activities, e.g. related to market regulation or deployment of already existing technologies, are not included in this analysis.

Pillar of the strategy	Identified R&I challenges
A more circular energy system, with ‘energy-efficiency-first’ at its core	Apply the energy-efficiency-first principle consistently across the whole energy system , including giving priority to demand-side solutions whenever they are more cost effective, but also properly factoring in energy efficiency in generation adequacy assessments. Increase use of local energy sources in buildings and communities by applying the principle of circularity and reuse of waste heat from industrial sites, data centres, or other sources. Untap use of wastewater and biological waste and residues for bioenergy production , including biogas.
Accelerate the use of electricity produced from renewable sources	Tackle barriers preventing massive roll-out of renewable electricity : high costs for some less mature technologies, lack of public acceptance, underdeveloped supply chains, smarter grid infrastructure at national and cross-border level. Development of technologies for higher temperature heating (such as microwave or ultrasound) and for electrifying processes by electrochemistry. Offshore technology : become a global leader by increasing offshore electricity production and creating opportunities for the nearby localisation of electrolyzers for hydrogen production. Electric mobility : develop smart charging and Vehicle-to-Grid (V2G) services to manage grid congestion and limit costly investments in grid capacity.
Promote renewable and low-carbon fuels, including hydrogen, for hard-to-decarbonise sectors.	Unlocking the potential of low-carbon fuels (biofuels and synthetic fuels), including through hybridisation projects linking biofuels and renewable hydrogen production. Promoting the use of renewable hydrogen in hard-to-decarbonise sectors , in particular as a fuel in certain transport applications and as a fuel or feedstock in certain industrial processes Enabling carbon capture, storage and use to support deep decarbonisation , including combining it with renewable hydrogen to produce synthetic gases, fuels and feedstock.
Adapt energy markets and infrastructure to a	Making electricity and gas markets fit for decarbonisation , also by projecting the future mix of gaseous energy carriers – biogas, biomethane, hydrogen or synthetic gases – depending on the chosen decarbonisation pathway.

³ COM/2020/299 final



more complex, integrated energy system	Develop system flexibility by means of small and large scale storage technologies to appropriately handle varying production and consumption balancing needs
Achieving a more integrated energy infrastructure	Facilitate integration of various energy carriers through infrastructure planning, including both the development of new infrastructure and re-purposing of existing ones. Consider alternatives to network-based options , especially demand-side solutions and storage. Develop new dedicated infrastructure , including those for large-scale storage and transportation of pure hydrogen; CO ₂ -dedicated infrastructure, transporting CO ₂ across industrial sites for further use, or to large scale storage facilities.
A digitalised energy system and a supportive innovation framework	Further unleash the potential of digitalisation in relation to: dynamic and interlinked flows of energy carriers; provision of data to match supply and demand at a more disaggregated level and close to real time; enabling a flexible energy consumption to contribute to the efficient integration of more renewables.

Short-term measures should not take over the research for long-term solutions

The table above summarises some of the main areas for action, where research can play a substantial role to bring forward energy system integration towards the 2050 climate objectives. Yet, the key measures planned by the Commission services for the implementation of these strategic areas rarely mention Research and Innovation as an important means to further address the energy system integration challenge. However, Horizon Europe as well as other R&I oriented funding programme (Innovation Fund, Invest EU, LIFE) are specifically mentioned as tools for advancing the strategic actions identified mainly in relation to the promotion of renewable and low-carbon fuels, including hydrogen, and for the electrification of low-temperature process heat in industrial sectors.

Easily deployable innovation measures, and the relative changes to legislation to make them possible in the short-term, have the potential to provide a boost to the energy transition and the green recovery, however they should not take over research for long-term solutions.

For instance, research on technology and methods to integrate fluctuating renewable energy sources in the energy system can improve aspects related to the limited predictability of **renewable energies** feed-in.

With reference to the development of the **hydrogen market** in Europe, innovative and robust open cross-sectoral modelling is needed to identify the optimal share of hydrogen in the overall energy system. Models should be formulated in a technology-neutral way, including considerations on the associated infrastructure needed, or on the roles and potentials of other energy vectors so to avoid missing other relevant options. Accessible and reliable databases with the relevant datasets for cross-sectoral modelling should be developed, especially industry- and processes-related datasets.



Similarly, the development of an integrated all-renewable **energy market**, its design and regulation, will need to ensure system adequacy, short-term (operational) efficiency and an optimal mix of different energy sources, energy carriers and flexibility options. Therefore, analyses on market structures and incentives for system friendly investment will need to be continuously developed. This research goes hand in hand with the need for a long-term vision for **energy infrastructures** in Europe that could combine electricity, hydrogen, heat, liquid fuels and other energy carriers in the best suited mix to connect energy sources with consumers. The development of new technologies should also consider already at the start social and energy system aspects, as well as their indirect cross-influences on other technologies.

Conclusions

The Energy System Integration strategy put forward in the wider framework of the European Green Deal identifies clear areas for coordinated actions in the years to come to move from an energy system developed vertically and in silos to a truly integrated and efficient circular system. It does not mean that it is a task for system researchers and developers to do alone in their silo, but in close dialogue with developing the contributing technologies. The concrete measures indicated in the document to follow up on each strategic area of actions provide additional clarity to the path undertaken to achieve the objectives set.

Yet, the measures implemented will have to ensure that long-term research at low TRLs is supported in the upcoming Horizon Europe Framework Programme, as well as in other innovation-driven funding programme to both benefit from research advancements in the field as well as to inform knowledge-based policymaking to meet long-term climate objectives.

The publication of a new impact-oriented **clean energy research and innovation outlook** for the EU presented in the strategy is also welcome as a useful tool to capitalise on existing research and to ensure that findings to R&I take up innovative challenges for the future of Europe.



HYDROGEN STRATEGY: RESEARCH CHALLENGES AND OPPORTUNITIES AHEAD

Setting the scene

In recent years, hydrogen has gained growing attention, both at the EU and International level. Pure hydrogen can be used in fuel cells where an oxidation reduction reaction occurs, producing electricity without any CO₂ emission. It can also be used as a fuel in industrial processes, in the transport sector with electrical vehicles (EVs), as well as an energy carrier and storage in the power sector, supporting global electrification where it is not possible to install it directly. Hydrogen has, therefore, the potential to positively impact on some of the most greenhouse gas (GHG) emitting sectors, making its deployment of crucial importance in order to achieve the EU's goal of a carbon-neutral society by 2050.

Nevertheless, hydrogen represents less than 2% of the EU energy mix, and it is still mostly produced from fossil fuels, using a so-called steam reforming process which, by releasing between 70 and 100 million tonnes of CO₂ every year, strongly contributes to GHG emissions. Pure hydrogen produced by electrolysis represents only 4% of the total hydrogen production.

In recent months, the urgency of the environmental challenge, coupled with the latest technology developments, led hydrogen to gain an increasing momentum in the energy field. The EU objective, as set out in its strategic vision for a climate-neutral society published in November 2018, is to grow the share of hydrogen in the energy mix to at least 13-14% by 2050. In order to set out the strategic roadmap to make this possible, on the 8th of July 2020, the EU Commission has released its Hydrogen Strategy, specifically targeting hydrogen technologies for a clean energy transition. The latter is complementary to and supportive of the Energy System Integration Strategy, as well as of the EU Industrial Strategy. The objective of the Hydrogen Strategy is to make clean hydrogen, produced using renewable electricity, cost-competitive against fossil-based hydrogen. Within this framework, the priority should be to develop renewable hydrogen produced using primarily wind and solar energy, and to be able to deploy it at an industrial scale in approximately a decade.

The project is colossal, and a full value chain approach is needed for its implementation. Multiple aspects and issues need to be considered in parallel, from the different stages of the production of clean hydrogen, to the development of proper infrastructures to the end-consumer, including the creation of market demand.

Hydrogen strategy: The R&I challenges

In its Communication on a Hydrogen Strategy for Europe, the EU Commission presented a roadmap for the development of renewable hydrogen, leading to its widespread industrial deployment by the year 2050. The roadmap is divided in three important phases, these are:

- 2020-2024: Hydrogen production and carbon-intensive sectors decarbonization.



- Installation of 6 GW of renewable hydrogen electrolyzers and 1 million tonnes production of renewable hydrogen.
- In this phase, the so-called **European Green Hydrogen Alliance** will be set up with the objective of facilitating and implementing the actions of the Strategy by supporting investments to scale-up hydrogen production and demand. The Alliance will serve as a first step in building an EU global leadership in the hydrogen sector.
- 2025-2030: Full integration of hydrogen into the energy system.
 - Installation of 40 GW of renewable hydrogen electrolyzers and 10 million tonnes production of renewable hydrogen.
- 2030-2050: Renewable hydrogen technologies maturity and large-scale deployment in hard-to-decarbonize sectors.
 - One quarter of renewable electricity to be used for renewable hydrogen production.

The table below provides an overview of the areas of development identified in the EU Commission’s strategic document. They are reported as R&I challenges, as our analysis focuses solely on the areas for future action holding the highest potential for further improvements through research and innovation actions. The measures involving actions outside of the scope of R&D activities (e.g., related to market regulation or deployment of already existing technologies) are not included in this analysis.

Pillar of the strategy	Identified R&I challenges
Pure hydrogen generation	<ol style="list-style-type: none"> 1) Identify and improve other forms of hydrogen, such as low-carbon and hydrogen-derived synthetic fuels based on carbon neutral CO₂ using carbon capture and storage to create negative emissions (e.g., sustainable biogas) 2) Upscale hydrogen generation to larger size, more efficient and cost-effective electrolyzers in the range of gigawatts connected to clean electricity production (for instance in industrial areas) <ol style="list-style-type: none"> a. Mature the electrolyser-linked technologies to decrease the cost of hydrogen production. b. Enlarge electrolyzers up to 100 MW. c. Solutions at lower technology readiness level also need to be incentivised and developed. 3) Study the raw materials required by electrolyzers and fuel cells production. <ol style="list-style-type: none"> a. Analyse with a full life-cycle approach to minimise the negative climate and environmental impacts of the production chain. b. Ensure security of the raw materials supply.
Infrastructure development	<ol style="list-style-type: none"> 1) Install electrolysers infrastructures next to demand sites (e.g., larger refineries, steel plants and chemical complexes coupled with local renewable sources). <ol style="list-style-type: none"> a. Develop Hydrogen Valleys concept (e.g., local hydrogen clusters as remote areas/regional ecosystems with a hydrogen production based on decentralised renewable energy generation, responding not only to local demand as industrial and transport applications, but also with heat provision for residential and commercial buildings).



	<ul style="list-style-type: none"> 2) Develop a network of hydrogen refuelling stations with local electrolysers for the transport sector. <ul style="list-style-type: none"> a. Analyse the fleet demand and the requirement for light- and heavy-duty vehicles. 3) Decarbonise the already existing hydrogen production plant by retrofitting them using carbon capture and storage technologies. 4) Develop larger scale storage facilities. 5) Elaborate freight technologies and a backbone transmission infrastructure to transport pure hydrogen (under liquid or gaseous form). <ul style="list-style-type: none"> a. Set up a network of pipelines coupled with non-network-based options. b. Repurpose the existing natural gas infrastructures for long distances. c. Develop and improve efficient hydrogen transport technologies as pressurized or cryogenic hydrogen transport, hauling of hydrogen bound in heavier molecules (e.g., ammonia or liquid organic hydrogen carriers).
<p>Large scale end-use applications</p>	<ul style="list-style-type: none"> 1) Develop large-scale end-use applications in the industry and in the transport sector. <ul style="list-style-type: none"> a. Industry sector: reduce or replace fossil fuels in hard-to-decarbonise sectors (e.g., steelmaking) and the use of carbon-intensive hydrogen in refineries. b. Transport sector: decarbonise the transport sector by improving already existing technologies and searching for new solutions (e.g., local city buses, commercial fleets, long-haul road freight, hydrogen fuel cell trains as well as in aviation and maritime sectors). c. Building sector: develop the provision for residential and commercial buildings. d. Storage sector: research and innovate storage facilities.
<p>Policy making</p>	<ul style="list-style-type: none"> 1) Write dedicated demand side policies to integrate renewable hydrogen into the energy system. <ul style="list-style-type: none"> a. Lower the cost of renewable hydrogen production and use at different levels (e.g., cost of renewable energy/electricity, electrolysers and production infrastructure, storage, and bunkering facilities) b. Study the impact of supply chain risks and cope with market uncertainty on raw materials through well-placed investments and various options for EU-level incentives. 2) Enable improved and harmonised (safety) standards and monitoring and assess social and labour market impacts. <ul style="list-style-type: none"> a. Settle a common low-carbon threshold/standard for the promotion of hydrogen production installations based on their full life cycle GHG performance and sustainability

EERA Analysis

Hydrogen is gaining an increasing momentum as an important low-carbon replacement for gas and fossil fuels in the energy system. In its Hydrogen Strategy, the EU Commission sets out an ambitious vision for the production and deployment of hydrogen, aiming at its large-scale use by the year 2050. However, despite its ambitious long-term objectives, the Strategy fails to address some of the crucial issues linked to renewable hydrogen production and use.

First of all, while the long-term aim is to deploy hydrogen at a large industrial scale by the year 2050, the Commission also acknowledges the role of low carbon hydrogen in the short and



medium term. Taking into consideration the latter, the Commission does not properly address the low efficiency of hydrogen technologies, as well as the complexity of the retrofitting and carbon capture processes. Indeed, according to recent studies, no steam methane reforming coupled with carbon capture and storage can sequester 90% of the CO₂ emissions, the percentage which would enable the produced hydrogen to be considered as low carbon. Moreover, hydrogen transport also presents some difficulties in terms of efficiency.

Furthermore, while the investments provided for boosting of the hydrogen sector will prioritize hard-to-decarbonize sectors, the strategy also foresees consistent investments for the production of fossil-based hydrogen, which is already available at a large industrial scale. The risk is that of strengthening the production of the latter and, consequently, making clean green hydrogen uncompetitive in the EU market.

Finally, the Hydrogen Strategy does not consider the environmental impact of hydrogen integration that would follow the construction of new infrastructure and the removal of already existing fuel networks. Besides an in-depth study on raw materials, the full-cycle approach on renewable hydrogen needs to take into account the already existing infrastructure and alternatives to avoid production of waste, such as recycling and repurposing.

The EU Hydrogen Strategy relies on new technologies that, until now, did not prove their efficiency and feasibility. Nevertheless, the urgency of the climate emergency does not permit to count on future technologies that still have not reached maturity. What is needed today is stricter regulations, such as carbon quotas or carbon taxes, as well as a concrete follow up of carbon-intensive sectors.

Conclusion

The Hydrogen Strategy presented by the EU Commission sets out ambitious long-term goals for the production and deployment of hydrogen. Nevertheless, as above described, it fails to address important issues and key challenges that need to be overcome in order to fully exploit the potential of hydrogen in the decarbonization of the environment.

Alongside the R&I challenges listed in the above table, a non-exhaustive list of additional key issues that should be addressed are:

- Clear explanation of the strict conditions to be met at each level of the renewable life cycle and concrete follow-up.
- Full cycle approach and study on recycling and repurposing of already existing gas grids and infrastructure.
- Detailed strategy to deploy renewable electricity production within Member States.
- Optimal and efficient hydrogen infrastructure development in coordination with the power system – existing and planned.

While the EU Hydrogen Strategy represents an important step towards the large-scale production and use of hydrogen, much work still needs to be done, both at the EU and national level, in order to be able to efficiently develop a proper hydrogen infrastructure, demand and supply.



CIRCULAR ECONOMY ACTION PLAN: RESEARCH CHALLENGES AND OPPORTUNITIES AHEAD

Setting the scene

These are unprecedented times for the future of Europe: the need to drive the post-COVID recovery on a sustainable path and the parallel preparation of the 2021-2027 EU budget and R&I programmes have the potential to give a real boost to the achievement of the European climate-neutrality objective by 2050.

EU policymakers have confirmed their commitment to drive the economic recovery through sustainable, green investments and digital development by reaching an agreement on a bold EU budget and Recovery Plan. Despite the heavy cuts to the Horizon Europe budget, the energy sector remains one of the main areas of action to significantly reduce CO₂ emissions while boosting economic recovery. As part of the European Green Deal¹, the adoption of new political strategies will help guiding investments and regulation in the fields of energy system integration, industrial policies, circular economy and more.

There is therefore a momentum to identify the R&I challenges and industrial opportunities of tomorrow and to coordinate efforts towards the achievement of new energy and climate priorities in Europe. **The research community has a key role to play**, both in advancing research on identified political priorities, as well as in advising policymakers on the way forward through excellent fundamental research and focus on low TRLs for the advancement of new breakthrough technologies, materials and systemic approaches.

Prepared within the framework of the SUPEERA project², this series of policy briefs aims at identifying in latest EU policies relevant to the energy research community concrete R&I challenges towards the achievement of the Clean Energy Transition. The analysis of the policies identified will have the two-fold objective of supporting recommendations towards the EERA membership and the SET-Plan ecosystem at large, as well as to identify potential areas for investments in energy R&I for EU policymakers. Specifically, this paper will focus on the Circular Economy Action Plan, published on 11 March 2020 by the European Commission, as a key European Green Deal measure for a cleaner and safer environment

¹ COM(2019) 640 final

² <https://www.supeera.eu/>



“A new Circular Economy Action Plan – For a cleaner and more competitive Europe”

The European Commission’s Circular Economy Action Plan outlines the strategy to reduce waste and to increase the environmental soundness of production processes in the EU, with the aim to decouple economic growth from resource use.

The Circular Economy Action Plan revolves around 3 main areas for action and 7 key value chains where improvements in the management of materials, waste and services can be implemented.

Action Area	Identified R&I challenges
Designing sustainable products	<ol style="list-style-type: none"> 1) Increasing recycled content in products. 2) Mobilising the potential of digitalisation of product information. 3) Reducing carbon and environmental footprints. 4) Establish a common European Dataspace for Smart Circular Applications
Empowering consumers and public buyers	<ol style="list-style-type: none"> 1) Public procurement as a means of pushing circular products and services 2) Consumer involvement through shared economy and repairs as part of product and service development
Circularity in production processes	<ol style="list-style-type: none"> 1) Promoting circularity in industrial processes. 2) promoting the use of digital technologies for tracking, tracing, and mapping of resources

Key Value Chains	Identified R&I challenges
Electronics and ICT	<ol style="list-style-type: none"> 1) Improving the energy efficiency of electric and ICT devices
Batteries and vehicles	<ol style="list-style-type: none"> 1) Improving performances of rechargeable batteries, to phase out non-rechargeable ones. 2) Increasing the use of recycled materials in battery production. 3) Increasing the use of alternative fuels in place of fossil ones. 4) Advancing, more in general, the development of batteries, in order to increase the sustainability of the sector
Packaging	<ol style="list-style-type: none"> 1) Studying and developing new materials or combinations of materials for packaging purposes
Plastics	<ol style="list-style-type: none"> 1) Developing and harmonising methods for measuring unintentionally released microplastics. 2) Increasing the use of bio-based, biodegradable, and compostable plastics
Textiles	<ol style="list-style-type: none"> 1) Concepts for reuse and extended lifetime for textile-based goods involving consumers
Construction and buildings	<ol style="list-style-type: none"> 1) Addressing the sustainability performance of construction products, including the possible introduction of recycled content requirements for certain construction products 2) Improving the durability and adaptability of built assets



	3) Improving the energy efficiency of buildings , so to increase their sustainability and to increase energy savings
Food, water, and nutrients	No R&I challenge identified

In addition, the Commission has identified a series of **cross-cutting issues** related to the development of a circular economy, in particular the relationship between circularity and climate neutrality:

- Analyse how the **impact of circularity on climate change mitigation and adaptation** can be measured in a systematic way.
- improve **modelling tools to capture the benefits of the circular economy on greenhouse gas emission** reduction at EU and national levels.
- Incentivise the **uptake of carbon removal** and increased carbon circularity.

Research is needed before market-ready solutions are deployed:

Building on the work started in 2015 with the first Circular Economy Action Plan (CEAP), which introduced many important legislative actions such as the EU Eco-design Directive, the main and most recognizable goal of the new CEAP is to facilitate recycling and create a space for recycled products within the production process. In this framework, research and innovation (R&I) play a relevant role in setting the modalities of the transition towards a circular economy model. Nevertheless, the European Commission fails to mention R&I in several areas where it has the potential to contribute greatly. Indeed, alike its predecessor, the new CEAP is mainly focused on policy objectives, leaving only a **marginal space to R&I strategies**, especially if compared to the prominence given to market- and customer-oriented objectives.

This is true for example for **carbon capture and storage**. While reducing emissions is important, further action can be taken regarding the current levels of carbon dioxide in the environment and, in this respect, R&I could play a central role in advancing developments in many sectors. These include but are not limited to the strategic use of raw materials, energy-efficient processes, and advanced digital tools for life-cycle assessment.

Other areas of high importance are **materials, alternative fuels, and batteries**. Concerning the first one, it is important to stress the role of more environmentally friendly and circular extraction technologies. The development of advanced/innovative materials and fabrication processes to increase lifetime efficiency and facilitate reuse/recycling is also crucial and cannot be properly completed without a boost in research activities.

The role of **digitalization** in the energy sector is also of pivotal importance in order to reach the EU's objectives. The inclusion of cutting-edge technologies (e.g., advanced manufacturing,



automated microstructural characterization) is central to the transition to a sustainable, circular economy. Nevertheless, their development is very technology-specific and requires significant research efforts.

Furthermore, the Commission fails to mention other two areas of strategic importance. These are the **waste-to-energy** process and **energy efficiency**. As for the first one, R&I could provide helpful support towards system that use municipal and industrial waste to produce energy in a clean and sustainable way. Research into repurposing of biological waste into biofuels could be an important asset for the successful transition to circularity in the EU. On this matter, the Commission published a report in 2017 highlighting the role of waste-to-energy in the circular economy, which reads *“improving the energy efficiency of waste-to-energy processes and promoting those processes which combine material and energy recovery can **contribute to decarbonising** key sectors such as heating and cooling or transport and to reducing greenhouse gas emissions from the waste sector”*. However, no mention of this is made in the new Circular Economy Action Plan.

In sum, these issues highlight the need to look at circularity not only limited to specific value chains but take a systemic view across the value chains.

Conclusions

The Circular Economy Action Plan will play a crucial role in the success of the European Green Deal in years to come. Reaching higher levels of recycling and better manufacturing design can be fundamental instruments in the fight against carbon emissions.

In this context, it is more important now than ever to consider the role that R&I can play in developing and deploying solutions that will accelerate the circular transition. In particular, to make sure that market-level developments can be introduced, research at low TRLs is needed to ensure their sustainability and functionality. It is crucial for the next research framework programme Horizon Europe to contribute towards the overall goal of climate-neutrality, by pushing forward research and innovation towards a completely circular economy.





Support to the coordination of national research and innovation programmes
in areas of activity of the European Energy Research Alliance

SUPEERA

Policy Brief



THE NEW EUROPEAN RESEARCH AREA

CHALLENGES AND
OPPORTUNITIES AHEAD



Setting the scene

The European Green Deal celebrates its first year in 2021, testifying the renovated push from the European institutions to focus the attention of policymaking on the threats posed by climate change. To reach climate neutrality by 2050, the EU will need to incorporate several initiatives in energy and climate to develop a stable and coherent framework for concerted action. Within this framework, the recent agreement reached by the Council of the EU and the European Parliament on the European Climate Law, the centrepiece of the EU Green Deal, represents a key milestone for the EU's ambitions and sets the bloc on a green path towards carbon-neutrality.

The recently approved EU budget and the creation of Next Generation EU, a plan to boost the post-pandemic recovery of Europe, ensure substantial backing to many projects and initiatives supporting the reduction of emissions and promoting the EU's digital ecosystem and its competitiveness. Green investments and collaboration on transnational projects are now crucial to ensure that the efforts of the Member States, industry, and research organisations will not fall short of the set objectives.

To complement the efforts made by policymakers, it is vital to ensure that R&I challenges are addressed in parallel, increasing the collaboration between research and industry to achieve the goals towards a climate-neutral energy system in the EU. The research community has undoubtedly a pivotal role in this process, supporting identified political priorities with empirical findings and developments. It can also advise policymakers on the way forward through fundamental research, particularly focused on low TRLs, for the advancement of breakthrough technologies, materials, and systemic approaches.

In the context of the SUPEERA project, a series of policy briefs are currently being developed to identify concrete R&I challenges in EU policies relevant to the energy research community. The final goal is to support the achievement of the Clean Energy Transition. The analysis of the policies identified has the two-fold objective of supporting recommendations towards the EERA membership and the SET-Plan ecosystem at large, also identifying potential areas for investment in energy R&I for EU policymakers. Specifically, this paper focuses on the new European Research Area, as outlined in the [Communication](#) published on 30 September 2020 by the European Commission, as a critical measure supporting the European Green Deal for a cleaner and safer environment.



A new ERA for Research and Innovation

The [European Commission's Communication on "A new ERA for Research and Innovation"](#) puts forward a set of policies promoting cooperation and mobility of ideas and researchers across the EU.

The Communication revolves around four strategic priorities that will guide the EU actions in the months and years to come. The table below provides an overview of these priorities and the related areas for development defined by the European Commission. They are reported as identified R&I challenges. Our analysis focuses only on the areas with the highest potential for further improvements through European R&I actions. As opposed to more thematically focused R&I policies, "A new ERA for R&I" tasks the research community with incorporating new ways of working and communicating with the EU, the Member States, and the industry.

Key priorities	Identified R&I challenges
Prioritising investments and reforms	<ol style="list-style-type: none"> 1) Guarantee an enhanced alignment of R&I investments and reforms at national and EU level. 2) Step up the financial support for constructing the ERA through robust and balanced R&I investments to support researchers to carry out fundamental research, boosting the collaboration between the EU, industry, and Member States to deliver research and innovation that has an impact on the ground in key policy areas, and support the production of breakthrough and market-creating innovation. 3) Coordinate R&I investment and reforms efforts by setting funding targets that can have a mobilising effect over national R&I budgets and leverage private R&I investments. 4) Develop better synergies and strategic alignment among funders and funding programmes.
Improving access to excellence	<ol style="list-style-type: none"> 1) Support the less performing Member States to strengthen their research and innovation capacity. 2) Stimulate policy reforms through regular dialogue and more robust interaction with the Member States. 3) Upgrade existing initiatives providing strategic and coordinated support to regions and cities (e.g., <i>Knowledge Exchange Platform</i>) to a strategic level, ensuring an effective dialogue for setting priorities and promoting synergies between R&I instruments and education and training. 4) Ensure that all EU researchers, regardless of their geographical location, can produce and have access to excellent results. 5) Strengthen mobility opportunities of researchers through dedicated mobility schemes between industry and academia. 6) Strengthen international cooperation and promote an open research environment to cooperate with the best international talents. Global cooperation is to address global challenges.
Translating R&I results into the economy	<ol style="list-style-type: none"> 1) Develop a framework conducive to ambitious long-term investments from the EU budget, Member States, and the private sector. 2) Guide the development of common technology roadmaps with industry to include R&I investment agendas from basic research to deployment. 3) Develop and test a networking framework in support of Europe's R&I ecosystem.



	4) Update and develop guiding principles for knowledge valorisation and a code of practice for the smart use of intellectual property.
Deepening the ERA	<ol style="list-style-type: none"> 1) Define with the Member States a European Competence Framework and a taxonomy of researchers' skills. 2) Reinforce inter-sectoral mobility and strengthen academic-business cooperation and the involvement of the private sector in training and skills development of early career researchers. 3) Launch a peer-reviewed open access publishing platform and ensure a European Open Science Cloud offering findable, accessible, interoperable, and reusable research data. 4) Support the European Strategy Forum on Research Infrastructures (ESFRI) to work towards a world-class research infrastructures ecosystem. 5) Establish a new governance structure for Technology Infrastructures. 6) Develop a roadmap of actions for creating synergies between higher education and research. 7) Develop inclusive gender equality plans with the Member States and stakeholders (gender equality plans are a requirement in the new R&I framework programme, Horizon Europe).

Harnessing the potential of the research community

The relaunch of a European Research Area (ERA) had been discussed extensively already before the Covid-19 pandemic. The previous ERA had missed most of its targets, particularly the main one: reaching average spending across Europe of 3% of the Member States' GDP in research and development (R&D) activities. While few countries achieved such a goal, many have underperformed in the years 2000-2020, triggering a process to revise the strategy to create a unique and effective space for research in Europe.

There are two main reasons why this new attempt might prove to be more effective in the following years. Firstly, the EU budget for 2021-27 is now larger than ever, with the Member States ready to channel more money towards R&I after the disruption brought by the Covid-19 pandemic. In addition, the EU Commission under the presidency of Ursula von der Leyen has laid out ambitious plans for climate, digitalisation, and industry. These three areas will require increased efforts from research and innovation, encouraging collaboration to reach the common goals targeted. Particularly in these areas, measures slowly adopted in the past will need a boost to ensure that the R&I community does not lose momentum.

In the scope of this new ERA, some key actions are recognised as fundamental by the energy R&I community to create a better ecosystem in which researchers can provide crucial input to industry and policymakers.

First of all, it is encouraging to see that the European Commission is planning to include diverse stakeholders in its [ERA Forum for Transition](#), aiming to support the Member States in coordinating and prioritising national research and innovation funding and reforms. In this context, it will be



relevant for the European institutions to increase collaboration with the research community. Researchers can contribute to national plans bringing the scientific community's perspective, ensuring that funds are allocated to areas where technological breakthroughs are crucial to reach net-zero carbon emission. Making sure that this exercise is carried out in full transparency is also of critical importance.

The willingness to expand the participation to joint European efforts is also underlined in the proposal to voluntarily commit **5%** of national public R&D investments to **common programmes and European partnerships** by 2030. In concert with the [Horizon Europe Missions](#), increased funding in pan-European initiatives will foster the creation of collaborative processes to spread the efficient use of resources to the countries that joined the European Union as of 2004 (EU-13), where funding for R&I activities is in some cases lagging behind other priorities.

The imbalance, in turn, links to the goal of supporting the Member States that perform worse than peers in terms of researchers' education. This is important for the EU-13 countries, where the performance in training is lower than in the rest of the EU¹². New opportunities for training and researchers' mobility across institutions should be encouraged, creating stronger links between institutions from different countries. Open access to research results and publications can also play a vital role in disseminating training and knowledge, enabling additional co-creation activities in innovation ecosystems.

In addition to more extensive inclusion, a **more robust collaboration** among EU-level instruments and funding opportunities is needed. Systematic and structural cooperation at various levels between established and new initiatives is pivotal for researchers and innovators. An example is the collaboration between the [European Institute of Innovation and Technology \(EIT\)](#) and the [European Innovation Council \(EIC\)](#) to accelerate the development and scale-up of breakthrough innovations. The EU should develop these initiatives with a solid cross-cutting nature to create synergies that maximise support for researchers and innovators across Europe.

Furthermore, **stronger links between research and industry** are needed. Scientific investigation at low TRLs level must be continuously supported, but it is also necessary to create ecosystems to support European innovation. The collaboration between research institutions and [industrial alliances](#), or other similar initiatives closer to the market, should be increased to favour the development of common technology roadmaps for key sectors, e.g., hydrogen, offshore wind, and energy systems integration.

Spaces for **research and industry to discuss** are available today, but there is room for improvement. The [European Technology and Innovation Platforms \(ETIPs\)](#) launched in the framework of the SET-Plan activities work to implement its priorities along the innovation chain

¹² European Commission. 2020. "Science, research and innovation performance of the EU, 2020 - A fair, green and digital Europe". Luxembourg: Publications Office of the European Union. doi:10.2777/534046



represent. These industry-led communities are a first important step towards more integrated innovation ecosystems.

The following steps will require strengthening the **lab-to-fab process** to speed up the transition of ideas from research to market. A solid approach is crucial for successfully integrating the Clean Energy Transition principles in the European industrial arena, ensuring that the climate neutrality by 2050 goal will not be delayed further. The EU industrial strategies shall reflect the contribution of the research community to the Clean Energy Transition.

Still, change will be hardly implemented without proper terms and conditions for the collaborations proposed. The ERA Communication puts forward **new guiding principles** for creating value from knowledge, a good step in the direction of standardising processes. However, these guidelines will prove to be insufficient if not sound, precise and efficient. Bureaucratic hurdles hamper R&I transfer, discouraging partnership and investments¹³. Calls to reduce requirements and rules were presented as early as a decade ago¹⁴ and continue to be supported¹⁵.

The Commission, through the ERA, also intends to install a **code of practice** for the smart use of **intellectual property**, and it will be crucial to see how this proposition will fit with the new focus on technology sovereignty in the EU. The decision to focus on homegrown ideas and to protect them has already sparked intense discussions with the closest research partners of the EU, mainly Israel and the UK¹⁶. Tensions will not be easily appeased unless openness and transparency criteria, crucial to fostering innovation, are defended.

Eventually, the new ERA will support institutions through the **update of research infrastructures** to reach state-of-the-art quality. It will be essential to support infrastructure investments as openly as possible to avoid creating clusters inaccessible to some researchers and Member States. Investment in this area should continue to be treated as **Important Projects of Common European Interest (IPCEIs)**, as they will contribute to many Union objectives and bring positive spill-over effects to the internal market. This process is particularly relevant for energy research, key to achieve climate neutrality by 2050.

¹³ <https://sciencebusiness.net/framework-programmes/news/international-horizon-projects-criticised-convoluted-bureaucracy>

¹⁴ <https://sciencebusiness.net/news/75480/EU's-top-research-official-calls-for-less-bureaucracy-in-future-Joint-Technology-Initiatives>

¹⁵ <https://www.ncpbrussels.be/news/443-call-for-less-red-tape-in-horizon-europe-rebutted-by-eu-official.html>

¹⁶ <https://sciencebusiness.net/news/switzerland-pencilled-back-quantum-plans-no-access-uk-israel>



Conclusions

The new ERA follows its unsuccessful predecessor, which failed to align R&D spending across the European Union and create an effective, open single market for research. As aforementioned, two reasons support this new attempt to be more effective: 1) a higher R&I budget for the years 2021-2027, and 2) a more robust focus on climate, digitalisation, and industry.

Researchers and innovators must engage in different activities to increase inclusion and dissemination mechanisms throughout Europe. In this sense, SUPEERA partners recommend closely following the development of multiple portfolios, including the ERA Forum for Transition, the European Pact for Research and Innovation, and the launch of new Partnerships and Important Projects of Common European Interest (IPCEIs).

Two other aspects will be essential to understand and improve the performance of the EU in R&I activities. Collaboration between researchers and industry actors must be fostered to boost innovation through shorter lab-to-market processes. The launch of the European Innovation Council under the scope of Horizon Europe is a first step that shall become the centre of a system linking research, industry, and citizens. Similarly crucial is the increase of researchers' mobility across the Member States to close the gap between different EU regions. A substantial imbalance still exists, and shared infrastructures and programmes to encourage exchange between institutions could go a long way in empowering existing networks and joint projects.

The new ERA carries a heavy burden on its shoulders and unfolds in a post-crisis context. In such a scenario, it will be essential to match the green and digital transition while ensuring sustainable competitiveness. The bar is high, but the role of the research community will be critical to achieve the proposed goals of the new ERA and ensure that Europe is well-placed to excel in the global innovation race.

