

# Case study on cross-border and multi-country projects, with specific focus on Important Projects of Common European Interest (IPCEIs)

## 1 Introduction

As per article 18(4) of the RRF Regulation (2021/241)<sup>1</sup>, cross-border and multi-country projects are one of the elements that Member States shall consider when defining their national Recovery and Resilience Plans (NRRPs). This is specifically addressed in recital 39 and Article 14(4)(h) of the RRF Regulation, which emphasises that the plans should contain information on whether any cross-border or multi-country projects are foreseen. While there is no obligation to include cross-border projects, Member States are encouraged to consider these as such projects reflect common concerns and shared priorities of (a number of) Member States and are, therefore, aligned with the objective of promoting further integration and cooperation within the EU<sup>2</sup>.

This is especially the case for Important Projects of Common European Interest (IPCEIs), which are seen as strategic instruments for the implementation of the European Union (EU) Industrial Strategy<sup>3</sup>. They are usually set up in large-scale consortia aimed at research and development, specifically, for the first industrial applications in strategic value chains. Their legal framework is defined by Article 107(3)(b) of the Treaty on the Functioning of the European Union (TFEU)<sup>4</sup>. The eligibility requirements for IPCEI projects are further specified in the Commission's 2014 IPCEI Communication ([European Commission 2014](#))<sup>5</sup>, which was further revised in autumn 2021 ([European Commission 2021](#))<sup>6</sup>. To qualify for support under the IPCEI Communication, a project must: **(i) contribute to strategic EU objectives, (ii) involve several Member States, (iii) involve private financing by the beneficiaries, (iv) generate positive spillover effects across the EU that limit potential distortions to competition, and (v) be highly ambitious in terms of research and innovation.** IPCEIs are funded through a combination of public and private investments and allow Member States to provide direct financial support to companies to stimulate private sector investments in key areas. Companies and projects selected at national level need to undergo an assessment by the European Commission, specifically by the Directorate General for Competition (DG COMP), which, if positive, allows the issuing of national funding to the companies partaking in the IPCEI.

Important Projects of Common European Interest are deemed to have an important Single Market dimension. The Commission guidance ([European Commission, 2021a](#)) encourages Member States to work together to integrate value chains, strengthen the resilience of industrial ecosystems, and deepen the Single Market. This is supposed to increase the potential spill-over effects that the RRF – as a coordinated investment and reform programme across the EU - can foster.

## Case study objectives

A lack of coordination in the EU countries' recovery could "lead to negative spill-over effects of shocks between the Member States or within the Union as a whole, thereby posing challenges to convergence and cohesion in the Union" (Recital 6, Regulation 2021/241). Due to their important contribution to sustainable economic growth, jobs,

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<sup>1</sup> Regulation (EU) 2021/241 of the European Parliament and of the Council of 12 February 2021 establishing the Recovery and Resilience Facility

<sup>2</sup> Cristina Dias, Kristina Grigaitė, Inês Cunha, Directorate-General for Internal Policies of the European Parliament (2021), In-Depth analysis: Recovery and Resilience Plans – Thematic overview on cross-border projects, see [https://www.europarl.europa.eu/RegData/etudes/IDAN/2021/689472/IPOL\\_IDA\(2021\)689472\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/IDAN/2021/689472/IPOL_IDA(2021)689472_EN.pdf)

<sup>3</sup> Communication from the Commission Criteria for the analysis of the compatibility with the internal market of State aid to promote the execution of important projects of common European interest 2021/C 528/02, OJ C 528, 30.12.2021, p. 10–18

<sup>4</sup> OJ C 115, 9.5.2008, p. 91–92, <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A12008E107>

<sup>5</sup> OJ C 188, 20.6.2014, p. 4–12, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52014XC0620%2801%29>

<sup>6</sup> COMMUNICATION FROM THE COMMISSION Criteria for the analysis of the compatibility with the internal market of State aid to promote the execution of important projects of common European interest, C/2021/8481 final, available at [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=PI\\_COM%3AC%282021%298481](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=PI_COM%3AC%282021%298481)

competitiveness, and resilience for industry and the economy in the Union, cross-border projects can be seen as a key facilitator in bringing Europe closer to the green and digital transition while cushioning the effects of the pandemic. Thus, reflecting on the results of such projects, their spillover effects, and the broader contribution to European policy objectives can provide insight into the outcomes of the RRF. The objective of this case study is to assess the contribution of the RRF to cross-border projects, and the extent to which (foreseen) results are related to contributing to the developing technologies and systems in key EU value chains and, in particular, for a functioning clean hydrogen market. The analysis will aim to identify any challenges and barriers posed to the implementation of cross-border projects as well as the extent to which external factors hindered their implementation. Furthermore, we reflect on the extent to which the proposed RRP measures are guided by the European objectives and check for synergies with other EU funding mechanisms. Lastly, we reflect on whether cross-border projects contribute to strengthening the Single Market dimension and whether they will remain relevant until 2026.

## Thematic coverage

Member States can decide to include in their NRRPs investments in cross-border projects in the digital, transport, energy, or waste sectors. Given the RRF's emphasis on helping support the EU in reaching its climate neutrality targets and the digital transition, the measures to be examined for this case study fall under two main pillars, namely green transition and digital transformation. Concerning the green transition chapter, all the selected NRRPs we analyse include a specific investment in the hydrogen IPCEI. The multi-country projects with the highest take-up in RRFs are the eleven potential IPCEIs on hydrogen (included in 8 RRFs). The IPCEI on hydrogen includes specific projects focused on building a European hydrogen ecosystem, including increased support for hydrogen production, storage, and applications in particular in energy-intensive industrial and mobility sectors that are difficult to decarbonise and aims to contribute to the EU's climate objectives.

Regarding the digital transition, we take a deep dive into the semiconductor value chain. The recent Council approval of the EU Chips Act<sup>7</sup> shows the importance that microchips hold for the European economy. Thus, we analyse the second wave of the IPCEI on Microelectronics and reflect on lessons learned from the first wave<sup>8</sup>. In this case study, we will look at a handful of countries that decided to invest even in microelectronics, where areas such as low-power electronics, sensors, and process technologies will be strengthened.

While we acknowledge that there are further areas to explore in light of cross-border and multi-country projects, the focus of the case study will be limited thematically to the two areas described above. Other areas for further investigation could include cloud infrastructure, quantum computing, health, etc. For instance, Spain followed a more diversified approach, by including a cross-border infrastructure railway investment to develop the European Corridors and Trans-European Network for Transport and a stronger focus on the policies connected to the digital transition. In particular, cross-border project investments in connectivity are foreseen along with multi-country projects in research and innovation, pan-European research infrastructures, and multi-country projects for health purposes. In light of the above, this case study will focus on investments and reforms regarding IPCEI on Hydrogen and IPCEI on Microelectronics and connectivity.

## Country coverage

For the purpose of this case study, we selected four countries for the analysis: Austria, Germany, France, and Spain. The selection is based on the inclusion of projects with a cross-border element in NRRPs, with a specific focus on IPCEI projects. Germany, France, Austria, and Spain are among the countries that strongly invested in Projects of Common European interest. The national plans of the selected countries include the following IPCEI-related measures:

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<sup>7</sup> <https://www.consilium.europa.eu/en/press/press-releases/2023/07/25/chips-act-council-gives-its-final-approval/#:~:text=The%20Chips%20Act%20aims%20to,any%20future%20chip%20supply%20crisis.>

<sup>8</sup> We reflect on other IPCEIs (e.g., IPCEI on batteries) when relevant for the analysis.

- Austria: IPCEI Hydrogen, IPCEI on Microelectronics and Communication Technologies, IPCEI cross-border Research for Quantum Computing
- France: IPCEI for the promotion of Hydrogen technology, IPCEI on Microelectronics and Communication Technologies and IPCEI on Cloud technology
- Germany: Hydrogen IPCEI, IPCEI on Microelectronics and Communication Technologies, IPCEI Next Generation Cloud Infrastructure and Services (CIS)
- Spain: IPCEI on hydrogen.

## 2 Methodology

Through this case study, we aim to answer the following research questions:

### Effectiveness:

- ▶ What is the current state of play of the implementation of the IPCEI measures? Which results have been achieved?
- ▶ What proportion of measures and results achieved are related to contributing to the developing technologies and systems for a functioning clean hydrogen market?
- ▶ What barriers have been encountered?
- ▶ To what extent have external factors such as rising material prices hindered the implementation of the cross-border measures?

### Coherence:

- ▶ To what extent were the proposed RRP measures guided by the European objectives, in particular the European Green Deal, the REPowerEU, the EU Hydrogen Strategy, the Digital Strategy and the Digital Decade, the New Industrial Strategy for Europe and its update, the European Strategy for Data, the European Health Union, the new European Research Area for research and innovation, the new Circular Economy Action Plan?
- ▶ To what extent have synergies between the RRP cross-border projects and other EU funds (e.g. InvestEU) been insured?

### EU added value:

- ▶ By definition, IPCEI must contribute in a concrete, clear, and identifiable manner to one or more Union objectives and must significantly impact the Union's competitiveness, and sustainable growth, addressing societal challenges or value creation across the Union. To be eligible, an *IPCEI project must demonstrate that it is designed to overcome important market or systemic failures*, preventing the project from being carried out to the same extent or in the same manner in the absence of the aid, or societal challenges, which would not otherwise be adequately addressed or remedied (see C(2021) 8481 final).

### Relevance:

- ▶ To what extent will the RRP cross-border projects remain relevant and feasible to implement until 2026?

To answer these questions, we conduct a comprehensive evaluation of the IPCEI measures in the four sampled Member States (Austria, France, Germany, Spain). A multi-method approach that includes both desk research and primary data collection is employed. The first step in our data collection process is to conduct extensive desk research relying on a range of sources, including the relative national plans, EU websites, national websites, and academic

publications. The desk research is complemented by semi-structured interviews, which allow us to gather more information on the implementation progress of measures and results, as well as aspects of coordination.

As IPCEIs are designed to bring together the public and private sectors to undertake large-scale projects of significant benefit to the Union and its citizens, we place significant emphasis on assessing the cooperation between all actors involved in the design and implementation of IPCEIs. To do so, we will build on the feedback provided in semi-structured interviews. Additionally, these allow us to identify the progress in implementation, as well as any potential challenges or bottlenecks. As for the other case studies, we organised a Roundtable with representatives in charge of the implementation of the measures in the countries under study.

### 3 Important Projects of Common European Interest (IPCEI) – context

As outlined in the Commission's Communication<sup>9</sup>, IPCEIs can make a very important contribution to sustainable economic growth, jobs, competitiveness, and resilience for industry and the economy in the European Union. IPCEIs are large and ambitious cross-border projects by multiple Member States aimed at overcoming important market or systemic failures. They enable breakthrough innovation and support infrastructure investments of great importance for the Union and have clearly defined positive spill-over effects on the internal market and society as a whole<sup>10</sup>. As such, IPCEIs are not necessarily suited to tackle urgent or crisis-related support measures that require swift approval of State aid.

An IPCEI can be defined as a group of single projects inserted in a common structure, roadmap, or programme aiming at the same objective and based on a coherent systemic approach. The individual components of the integrated project may relate to separate levels of the supply chain but must be complementary and necessary for the achievement of the important European objective. In other words, IPCEIs will gather a broad range of economic actors (most notably larger and smaller scale companies), competent authorities from a minimum of four Member States, and the relevant Commission services.

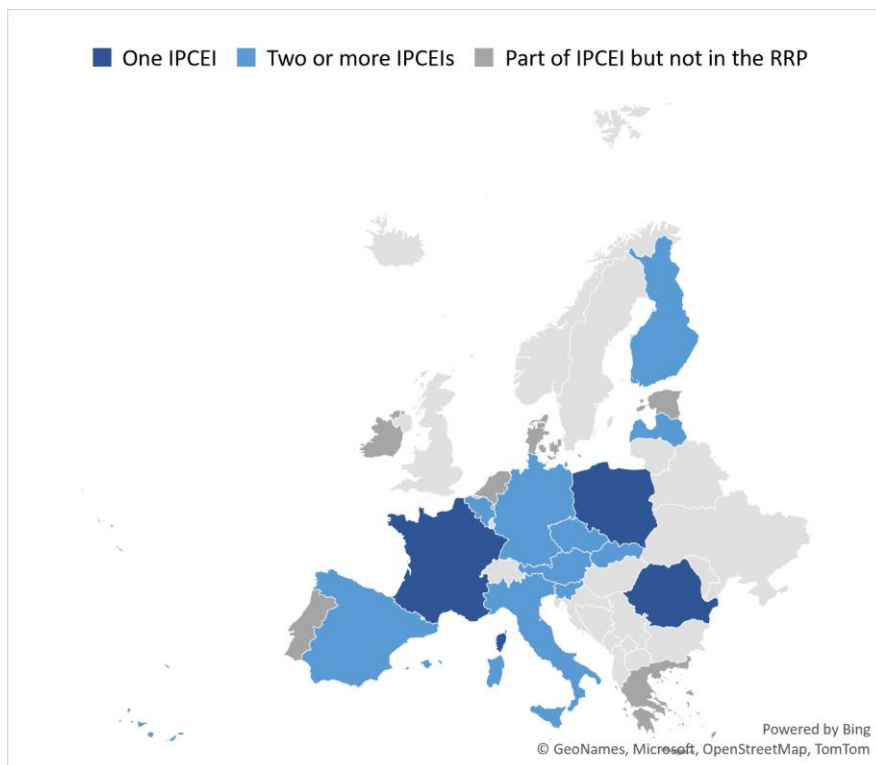
Launching an IPCEI is a lengthy process that commences with several ( a minimum of four) Member States identifying a potential value chain that would benefit from multi-country collaboration. The initiating decisions are taken at higher political instances, with Ministers announcing the strategic relevance behind the initiative. Although the RRF presented an opportunity for countries to allocate funds to IPCEIs, not all of them opted to do so. In general, **whenever the IPCEI aligned with national strategies included in the NRRP, the RRF seemed to be a suitable funding source for IPCEI**. However, the decision to use RRF funding for IPCEI measures was primarily influenced by the timing of the Facility. Most MS had already committed national funds to the projects before the COVID-19 crisis but in its aftermath, most countries either encountered difficulties in securing national funds or had decreased financial capacity to support such projects. Thus, the RRF was considered a good funding mechanism to compensate for this. The figure below shows the countries taking part in one or more IPCEIs and those allocating RRF resources to the support of one or more IPCEIs. The majority of IPCEI participating countries have made use of RRF funding to some extent, with six countries foregoing the opportunity.

*Figure 1: Overview of countries using RRF funds to support IPCEIs*

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<sup>9</sup> OJ C 528, 30.12.2021, p. 10–18, available at [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021XC1230\(02\)](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021XC1230(02))

<sup>10</sup> DG COMP (2023), Code of good practices for a transparent, inclusive, faster design and assessment of IPCEIs, [https://competition-policy.ec.europa.eu/system/files/2023-05/IPCEIs\\_DG\\_COMP\\_code\\_of\\_good\\_practices.pdf](https://competition-policy.ec.europa.eu/system/files/2023-05/IPCEIs_DG_COMP_code_of_good_practices.pdf)



Source: own elaboration based on Eisl, [2022.a](#)

## IPCEIs on Hydrogen

In December 2020, 23 Member States and Norway agreed to jointly pursue ambitious low-carbon and renewable hydrogen goals through public and private incentives aimed at guaranteeing Europe’s technological leadership in the sector. The Manifesto<sup>11</sup> for the development of a European “Hydrogen Technologies and Systems” value chain showed the countries’ commitment to promoting cross-border cooperation and large-scale joint investment projects covering the full clean hydrogen value chain, from production to storage, transmission, distribution, and application, especially in industrial sectors.

According to the information collected through desk analysis and during the interviews, the high number of applicants to the IPCEI on Hydrogen has created the necessity to differentiate several ‘waves’ which together with their projects and narratives form a bigger overall narrative of the IPCEI on hydrogen. Four waves have been identified: **Technology, Industry, Infrastructure, and Mobility**. Each wave has its specific focus along the hydrogen value chain and is therefore equally important.

The first wave, called **Hy2Tech**, addresses challenges related to the development of particular hydrogen technologies. It was prepared and notified to the European Commission by **fifteen Member States**, namely Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Italy, Netherlands, Poland, Portugal, Slovakia and Spain. This first set of clean hydrogen projects was approved in July 2022, following a positive assessment<sup>12</sup> by the

<sup>11</sup> Available at <https://www.bmwk.de/Redaktion/DE/Downloads/M-O/manifesto-for-development-of-european-hydrogen-technologies-systems-value-chain.pdf?blob=publicationFile&v=10>

<sup>12</sup> Based on the 2021 State aid IPCEI Communication [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.C\\_.2021.528.01.0010.01.ENG&toc=OJ%3AC%3A2021%3A528%3ATOC](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.C_.2021.528.01.0010.01.ENG&toc=OJ%3AC%3A2021%3A528%3ATOC)

European Commission<sup>13</sup>. Member States planned to provide up to EUR **5.4 billion** in public funding, which is expected to unlock an additional EUR 8.8 billion in private investments and create approximately 20,000 direct jobs.

In total, Hy2Tech comprises **41 projects from 35 companies**, including 8 small and medium-sized enterprises (SMEs) and start-ups. In addition, the IPCEI will foster cooperation with external partners such as Universities and research organizations. The Project is divided into four fields, covering a wide part of the Hydrogen technology value chain:

- **Hydrogen Generation Technology**
- **Fuel Cells Technology**
- **Storage, Transportation, and Distribution Technology**
- **End User Technology**

A second wave called **Hy2Use** comprises **thirteen Member States** and was approved in September 2022<sup>14</sup>. Austria, Belgium, Denmark, Finland, France, Greece, Italy, Netherlands, Poland, Portugal, Slovakia, Spain, and Sweden agreed on allocating EUR **5.2 billion** of public funding to **35 projects carried out by 29 companies**, including 3 SMEs. This second set of projects aims at covering the areas along the hydrogen value chain not fully covered by the Hy2Tech especially related to the decarbonisation of the industry, namely:

- **Hydrogen-related infrastructure** (for the production, storage, and transport of renewable and low-carbon hydrogen)
- **Hydrogen applications in the industrial sector**, addressing especially those sectors that are more challenging to decarbonise, such as steel, cement, and glass.

The two remaining waves related to infrastructure and mobility are still in the pre-notification status.

## IPCEIs on Microelectronics and Communication Technologies

The first IPCEI in the field of Microelectronics was originally approved by the European Commission in December 2018<sup>15</sup>, following Germany, France, Italy, and the United Kingdom's willingness to jointly support research and innovation in the microelectronics field with EUR **1.75 billion** of public investments. The project aimed at developing innovative microelectronics technologies and components for automotive, Internet of Things (IoT), and other key applications (such as space, avionics, and security), maintaining and further expanding European competencies in the field. Moreover, it ensured that the entire microelectronics value chain was reliably available to local players. While this project did not benefit from RRF funding, reflecting on the results and lessons learned from the first IPCEI on microelectronics can be useful for assessing the effectiveness of cross-border projects as well as the sustainability of their effects.

In 2021, Austria expressed its willingness to participate in the project, contributing to the planned investments with an additional EUR **146.5 million** and **three companies** carrying out research and innovation in the areas of security, energy efficiency, and integration of packaging technologies for microelectronics. This addition to an already established and ongoing IPCEI required a complex assessment by the Commission to verify that the new projects were properly integrated into the structure and roadmap of the IPCEI and that significant value was added to the IPCEI.

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<sup>13</sup> [https://ec.europa.eu/commission/presscorner/detail/en/ip\\_22\\_4544](https://ec.europa.eu/commission/presscorner/detail/en/ip_22_4544)

<sup>14</sup> [https://ec.europa.eu/commission/presscorner/detail/en/ip\\_22\\_5676](https://ec.europa.eu/commission/presscorner/detail/en/ip_22_5676)

<sup>15</sup> [https://ec.europa.eu/commission/presscorner/detail/en/IP\\_18\\_6862](https://ec.europa.eu/commission/presscorner/detail/en/IP_18_6862)

Chips are usually supplied as part of an integrated system, requiring a combination of processes and technologies. Therefore, the project participants and their partners focused their work on **five different technology areas** that are complementary and interlinked:

1. **Energy efficient chips:** developing new solutions to improve the energy efficiency of chips. For example, the goal is to reduce the overall energy consumption of electronic devices including those installed in cars.
2. **Power semiconductors:** developing new technologies of components for smart appliances as well as for electric and hybrid vehicles, to increase the reliability of final semiconductor devices.
3. **Smart sensors:** working on the development of new optical, motion, or magnetic field sensors with improved performance and enhanced accuracy. Smart sensors contribute to improving car safety through more reliable and timely reaction, allowing a car to change lanes or avoid an obstacle.
4. **Advanced optical equipment:** developing more effective technologies for future high-end chips
5. **Compound materials:** developing new compound materials (instead of silicon) and devices suitable for more advanced chips.

Following this first one, to ensure continuation and complementarity a second **IPCEI on Microelectronics and Communication technologies** has been formally approved in June 2023<sup>16</sup> to support research, innovation, and the first industrial deployment of microelectronics and communication technologies across the value chain, from materials and tools to chip design and manufacturing processes. The project contributes to the twin transitions by:

- Creating innovative microelectronics and communication solutions
- Developing energy-efficient and resource-saving electronics systems and manufacturing methods.

The project called **IPCEI ME/CT** was prepared by **fourteen Member States**, namely Austria, Czechia, Finland, France, Germany, Greece, Ireland, Italy, Malta, Netherlands, Poland, Romania, Slovakia, and Spain. They committed to providing up to EUR 8.1 million in public funding, which will be likely complemented by an additional 13.7 billion in private investments.

The project structure is quite elaborate as it includes direct, associated, and indirect participants. Direct participants include **56 companies** which will implement 68 projects. The IPCEI includes also more than 30 associated participants. This is a new partner status exempt from Commission assessment, which includes companies, universities, and research centres from the participating Member States as well as **five additional Member States** (Belgium, Hungary, Latvia, Portugal, and Slovenia) and **Norway**. Financial support provided to research organizations does not qualify under state aid and thus, is not subject to notification and approval by the Commission. Therefore, their projects are not considered part of the IPCEI as such, but rather part of the wider IPCEI ecosystem. In addition, there are about 600 indirect partners, both firms and organisations, that will benefit from the project dissemination activities thanks to their links to one or more direct participants.

The project is organized into four areas:

- **Sense:** novel sensors to collect data
- **Think:** chips to process and store data
- **Act:** microelectronic systems performing actions

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<sup>16</sup> [https://ec.europa.eu/commission/presscorner/detail/en/IP\\_23\\_3087](https://ec.europa.eu/commission/presscorner/detail/en/IP_23_3087)

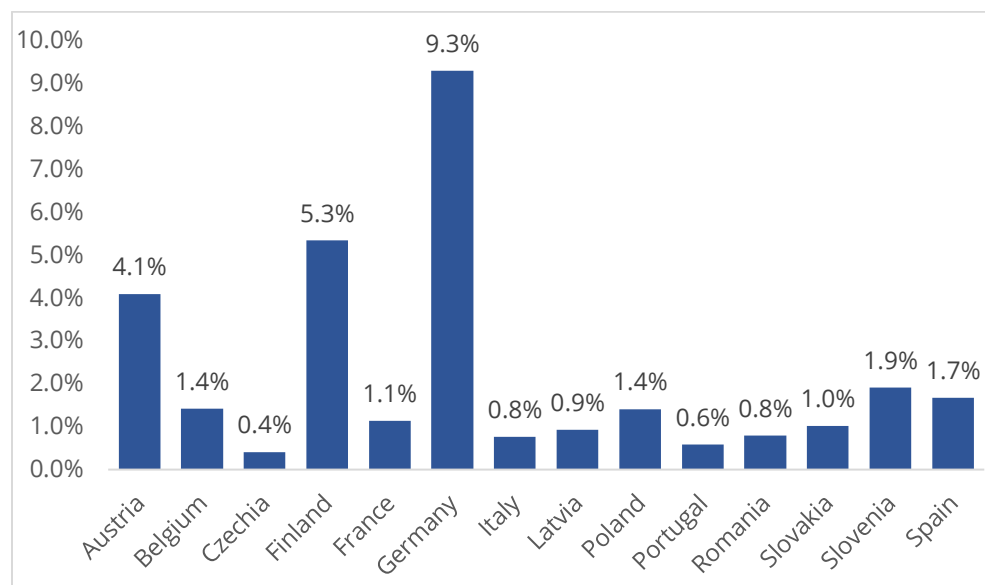
- **Communicate:** systems for fast, secure, and reliable transmission of information

## 4 Effectiveness

### Assessment of the implementation and impact of the measures

Overall, the international dimension of RRFs is rather limited (Pilati, 2021)<sup>17</sup>, with cross-border and multi-country projects being considered overly complex and risky as many beneficiaries from different countries are involved. The Commission Staff Working Documents and the RRF Scoreboard database, allow us to extrapolate the share of milestones and targets that hold a cross-border dimension – these amount to about 3% of the total milestones and targets planned (204 out of 6,324). If only IPCEI-related milestones are considered, the share is even lower (about less than 1%). The figure below shows the country's number of milestones and targets against the total planned at the national level.

Figure 2: Share of IPCEI-related milestones and targets out of the total planned



Source: own elaboration based on RRF Scoreboard

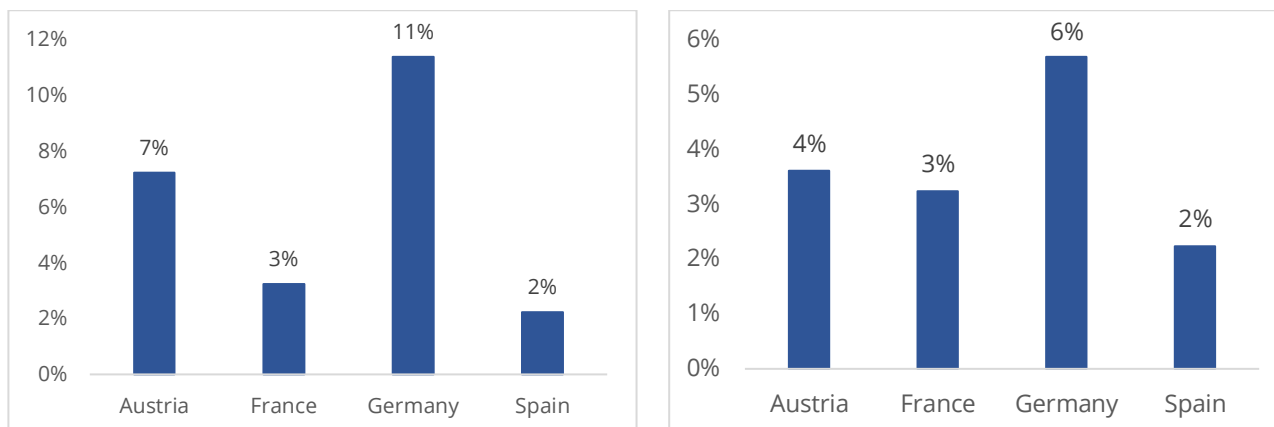
In terms of budgetary effort put into cross-border projects, Spain is the country investing more in absolute values, with an overall amount of EUR 8.675 billion, equal to 12.48% of RRF spending. Germany invested EUR 3.75 billion but exhibits the highest relative share of RRF spending on cross-border projects (14.64%), suggesting the strategic role played by IPCEIs in the German plan. Lastly, France invested EUR 1.875 billion, equal to 4.76% of the country's RRF spending, while Austria budgeted in its plan EUR 0.357 billion, which corresponds to 10.31% of the respective RRF envelope.

As mentioned, for the purpose of this analysis, the focus is placed on the IPCEI on hydrogen and IPCEI on microelectronics as these two IPCEIs exhibit the highest share of total RRF budget allocation (see figure below). It is worth mentioning that France and Spain included investments for the IPCEI hydrogen exclusively, while Austria and Germany used RRF funds for both IPCEIs. When considering overall shares of investments in cross-border projects in the four countries, it is visible that IPCEIs account for more than 70% of RRF financing in Germany, Austria, and France.

<sup>17</sup> Marta Pilati, European Policy Centre (2021), National Recovery and Resilience Plans: Empowering the green and digital transitions? Available at [https://www.epc.eu/content/PDF/2021/National\\_RRFs\\_DiscussionPaper.pdf](https://www.epc.eu/content/PDF/2021/National_RRFs_DiscussionPaper.pdf)



Figure 3: IPCEI hydrogen and microelectronics-related investments out of total RRF allocation (left) and share of IPCEI hydrogen investments out of total RRF allocation (right)



Source: own elaboration based on Eisl (2022, a) and NRRPs

By taking into account IPCEI hydrogen only, Germany is still the country investing most both in absolute (EUR 1.5 billion) and in relative numbers (6%), followed by Austria, France, and last Spain.

To be able to reflect on the effectiveness of selected measures, we need to assess the proposed implementation strategy, i.e., assess the milestones and targets (M&T) included in the plans and the proposed timeline. The first step of the desk research activities focuses therefore on providing a detailed description of the IPCEI measures included in the Recovery and Resilience Plans, including their intermediate milestones and targets. Our approach carefully identifies specific projects that are likely to have a large impact.

As cross-border projects tend to be large investment projects, with multiple entities involved in implementation, a slow uptake up is not surprising. This might be explained by several reasons, notably, the limited time available for Member States to coordinate and structure a cross-border project vis-a-vis the lifespan of investments and reforms under the RRF<sup>18</sup>. On the other hand, we see that several milestones have been completed (although pending assessment). Table 1 shows the selected measures related to IPCEI for the four countries whose milestones and targets have been fulfilled by July 2023.

Table 1: Fulfilled and Completed milestones and targets

Country	Related Measure Name	Measure Type	Milestone or Target	Milestone/Target Name	Timeline	Status
Austria	IPCEI Hydrogen	Investment	Milestone	National selection of projects to support the development of hydrogen production, storage, and applications.	Q3 2021	Fulfilled

<sup>18</sup> Cristina Dias, Kristina Grigaitė, Inês Cunha, Directorate-General for Internal Policies of the European Parliament (2021), In-Depth analysis: Recovery and Resilience Plans – Thematic overview on cross-border projects, see [https://www.europarl.europa.eu/RegData/etudes/IDAN/2021/689472/IPOL\\_IDA\(2021\)689472\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/IDAN/2021/689472/IPOL_IDA(2021)689472_EN.pdf)

Country	Related Measure Name	Measure Type	Milestone or Target	Milestone/Target Name	Timeline	Status
Austria	IPCEI Microelectronics and Connectivity	Investment	Milestone	Climate-related eligibility criteria established in call documents	Q4 2021	Fulfilled
Austria	IPCEI Microelectronics and Connectivity	Investment	Milestone	National selection of projects to support the development of innovative microelectronics and connectivity technologies	Q4 2021	Fulfilled
Germany	Hydrogen projects within the framework of IPCEIs	Investment	Milestone	Completion of expression of interest procedure	Q2 2021	Completed <sup>19</sup> (not assessed)
Germany	Hydrogen projects within the framework of IPCEIs	Investment	Milestone	Issuance of first grant decisions	Q1 2022	Completed <sup>20</sup> (not assessed)

Source: Author's elaboration based on RRF Scoreboard data, Last update: 5<sup>th</sup> September

In the sections below, we list the measures that fall within the scope of this case study, including the associated measures and targets (as per the RRF Scoreboard database). Further progress needs to be made to assess the results of these measures and the status of implementation.

## Description of measures and uptake per country

### Austria

Austria's National Recovery and Resilience Plan envisages the country's participation in cross-border innovation initiatives through Component 3 - Knowledge-based recovery. This component aims to address several challenges: digital transformation, strategic value chains, and autonomy in semiconductor production in Europe; energy transformation, building the hydrogen economy in Europe, and decarbonisation of energy-intensive sectors. In particular, it includes three Important Projects of Common EU interest, namely IPCEI on Hydrogen (component 3D), IPCEI on Microelectronics and Connectivity (Component 3D), and IPCEI Quantum Sciences (Component 3A). IPCEIs represent an important instrument of RTI and industrial policy under state aid law, as they also set out overarching goals for the next ten years (Austrian RRP, 2021). The final objective is twofold: promoting Europe's autonomy in semiconductor production while strengthening Austria's position in this area and also promoting integrated projects along the hydrogen value chain, to accelerate energy transformation and decarbonisation of energy-intensive sectors. Under component 3D 'Strategic Innovation', IPCEIs account for EUR **250 million** of funds allocated (EUR 125 million per each IPCEI, excluding Quantum).

The subcomponent contributes to addressing the country-specific recommendations to stimulate the digitalisation of businesses and sustainability (Country Specific Recommendation 3 in 2019) and to focus the investment of the

<sup>19</sup> Milestones and targets are considered "completed" by the Member States. Nevertheless, they are yet to be assessed by the European Commission.

<sup>20</sup> Milestones and targets are considered "completed" by the Member States. Nevertheless, they are yet to be assessed by the European Commission.

green and digital transitions, in particular on innovation, sustainable transport, clean and efficient production and use of energy (Country Specific Recommendation 3 in 2020).

## Hydrogen

The IPCEI Hydrogen aims to integrate projects along the entire Hydrogen value chain, which contributes to the achievement of national and European energy and climate goals and the development of a renewable hydrogen economy. Hydrogen plays a key role in achieving the national climate neutrality target set for 2040. In particular, the measure intends to focus on those sectors that are energy-intensive but difficult to decarbonize while also promoting integrated projects along the hydrogen value chain, especially covering hydrogen production, storage, and application.

The target group is Austrian companies and Research institutions along the entire value chain of renewable hydrogen. The measure is coordinated nationally by the **Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology** and it is in synergy with the national Hydrogen Strategy<sup>21</sup>. More in detail, the NRRP includes three investments divided into one milestone and two targets.

The milestone “**National selection of projects to support the development of hydrogen production, storage, and applications**” foresees a call for interest in the selection of projects regarding activities along the hydrogen value chain, covering hydrogen production, storage, and applications. This milestone was set to be completed by Q3 2021 and it has been fulfilled under the first payment request<sup>22</sup>. According to this assessment and the semi-structured interviews conducted as part of the case study, a two-stage open call for expression of interest has been jointly conducted by the Ministry for Climate Action (BMK) and the Ministry of Labour and Economy (BMAW) in autumn 2020 and spring 2021, respectively. The first stage functioned as an assessment of demand and interest and constituted the basis for the country's political decision on participation in the IPCEI. The second stage set stricter requirements and built the basis for the selection of highly innovative projects for further participation in the notification process at the European level as well as for the political decision on the budget to allocate. The final list of eight projects was selected based on recommendations of an independent expert panel which assessed the 20 submitted project applications. The Panel was composed of independent experts from Germany, Italy, the Netherlands, and France. The selection was based on (i) the recommendation of the international expert as well as (ii) relevant national strategies, and (iii) budgetary constraints.

Austria then pre-notified the selected projects under the EU state aid rule. Two of the selected projects decided to withdraw from the IPCEI Hy2Use. On 15 July 2022, the European Commission approved under the EU state aid rules the first wave of the IPCEI Hydrogen (Hy2Tech), including all four selected and pre-notified Austrian projects by companies: AVL List GmbH, Robert Bosch AG, Christof Industries Austria GmbH and Plastic Omnium New Energies Wels GmbH. On 21 September 2022, the European Commission approved the second wave of the IPCEI Hydrogen (Hy2Use), which includes two projects of companies Borealis Agrolinz Melamine GmbH and Verbund AG. In total, six out of eight selected projects have been approved under EU state aid rules as part of the IPCEI Hy2Tech and IPCEI Hy2Use.

This first milestone is followed by two targets: the first requires that at least 66% of approved projects be started by Q2 2024, while the second one sets EUR 125 million allocated and at least 80% of the aid disbursed for the approved projects. The investment has a final expected date for implementation on 30 September 2026.

Given that projects were allowed to start after the pre-notification phase, three out of the six selected ones have already started their activities. Therefore, the **first target of 66% is very likely to be achieved** even before its planned

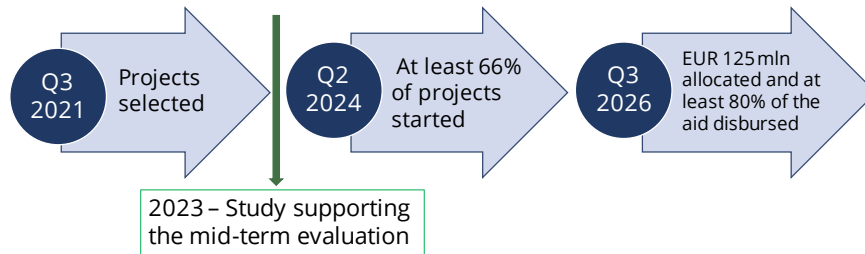
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<sup>21</sup> Available at : <https://www.bmk.gv.at/themen/energie/energieversorgung/wasserstoff/strategie.html>

<sup>22</sup> [https://commission.europa.eu/system/files/2023-03/C\\_2023\\_1727\\_1\\_EN\\_annexe\\_acte\\_autonome\\_nlw\\_part1\\_v3.pdf](https://commission.europa.eu/system/files/2023-03/C_2023_1727_1_EN_annexe_acte_autonome_nlw_part1_v3.pdf)

timeline. According to the interviewee, the Austrian government is currently **re-negotiating downward the second target**, in particular the share of funds distributed to projects, **from the planned 80% to 55%**.

Figure 4: Summary of IPCEI Hydrogen measures timeline



Source: own elaboration based on RRF Scoreboard

## Microelectronics and Communication Technologies

Other Austrian measures of interest include the IPCEI on Microelectronics and Connectivity, whose goals are twofold:

- Boosting those areas already considered to be strong areas in Europe in the field of microelectronics (e.g. power electronics, sensor technology, process technologies)
- Promoting fields in which Europe has so far been dependent on imports from other countries (e.g. the development of innovative network/microelectronics technologies based on smaller structures and the combination of functionalities and materials).

The project is jointly managed by the **Federal Ministry for Digital and Economic Affairs (BMDW)** and the **Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK)**. It is partially funded by the RRF (EUR 125 million) out of which EUR 50 million comes from the Austrian Promotional Bank (AWS) as well as from funding agencies of the federal states. Moreover, it is included in the framework of other EU programs, in particular of the Joint Undertaking ECSEL (Electronic Components and Systems for European Leadership). The NRRP includes four IPCEI-related investments, namely two milestones and two targets.

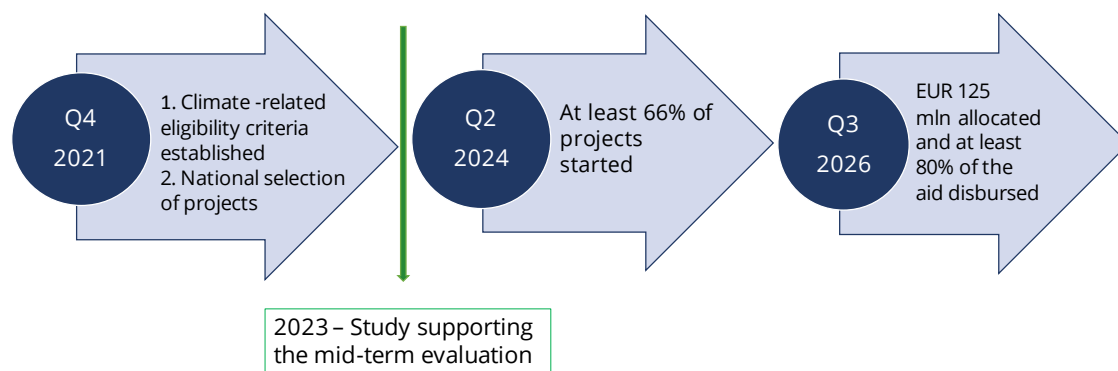
Both of the milestones were planned to be fulfilled by Q4 2021. They have been positively assessed by the Commission with the first payment request<sup>23</sup>. The milestone **Climate-related eligibility criteria established in call documents** included a two-stage open call for expression of interest and it has been jointly conducted by the Ministry for Climate Action (BMK) and the Ministry of Labour and Economy (BMAW). In particular, the second call included climate-related eligibility criteria that obliged potential beneficiaries, i.e., recipient companies, to **explicitly commit to the reduction of greenhouse gas (GHG) emissions within their project portfolios and estimate the extent of GHG savings**. Therefore, only projects with the commitment to reduce GHG emissions over their lifecycle and providing the estimation of the extent of GHG savings were eligible under the Call for Expression of Interest. The assessment aimed to investigate two criteria: first, whether a contribution to the targets within the Integrated National Energy and Climate Plan for Austria could be expected from the project and how/whether this contribution could be quantified; second, project integration into existing national and European climate, digital and technology strategies. The latter was considered mandatory. These two together ensured the selected projects' contribution to the climate objective.

<sup>23</sup> Available here: [https://commission.europa.eu/system/files/2023-03/C\\_2023\\_1727\\_1\\_EN\\_annexe\\_acte\\_autonome\\_nlw\\_part1\\_v3.pdf](https://commission.europa.eu/system/files/2023-03/C_2023_1727_1_EN_annexe_acte_autonome_nlw_part1_v3.pdf)

The second milestone is the **National selection of projects to support the development of innovative microelectronics and connectivity technologies**. As for the hydrogen projects, the selection was carried out by a jury including experts in the field who had previously participated in jury committees for other national programmes and instruments, funded by the Research Promoting Agency. Six out of the nine submitted projects were positively assessed by the jury as they contribute to the two goals of the project: strengthen those areas where Europe is performing well and further develop those areas where Europe is still highly dependent on imports.

These two milestones are complemented by two targets: the first requires that at **least 66% of approved projects** will have been started by Q2 2024, while the **second one sets EUR 125 million allocated and at least 80% of the aid disbursed** for the approved projects. The investment has a final expected date for implementation on 30 September 2026.

Figure 5: Summary of IPCEI Microelectronics and Communication Technologies measures timeline



Source: own elaboration based on RRF Scoreboard

## France

France's National Recovery and Resilience Plan envisages investments to support innovation in green technologies through **Component 4 – Green energies and technologies**. In this context, investments are included in the fourth 'Programme d'investissements d'avenir' (PIA4), by defining strategies in key selected sectors related to the green transition, and supporting the industry to take steps to implement those strategies. More in detail, measures aim at (i) promoting the development of renewable and low-carbon hydrogen, as a way to support the decarbonisation of the economy, and (ii) supporting the aeronautics industry to overcome present economic difficulties and transition towards a low-carbon industry.

These measures contribute to the green transition objective and to reaching the climate target. They also contribute to addressing the country-specific recommendations addressed to France on the need to focus investment-related policy on the green and digital transition, in particular on sustainable transport, clean and efficient production and use of energy, and research and innovation (Country Specific Recommendation 3, 2019 and Country Specific Recommendation 3, 2020).

The French NRRP foresees France's participation in Important Projects of Common European Interest (IPCEI) in cooperation with other Member States to promote hydrogen technology. The measure aims at fostering renewable and low-carbon hydrogen production and use, by increasing the demand for renewable energy, which calls for additional renewable energy generation capacity to match this demand. In addition, the RRP refers to the Act to Accelerate and Simplify Public Action (ASAP law), which contains elements to facilitate administrative requirements for

the deployment of renewables. According to the Commission's assessment<sup>24</sup>, French participation in hydrogen IPCEI is largely in line with France's 2020-2030 Hydrogen Strategy and with the Commission's own 2020 Hydrogen Strategy.

France decided to invest EUR 2 billion in the development of decarbonised hydrogen (EUR 1.925 billion will come from the RRF, while the remaining EUR 75 million from other financing sources). In particular, for IPCEI, France planned **EUR 1.575 billion** in investments, of which EUR 1.275 billion are from the NRRF and EUR 300 million from the Programme d'investissements d'avenir (PIA).

## Hydrogen

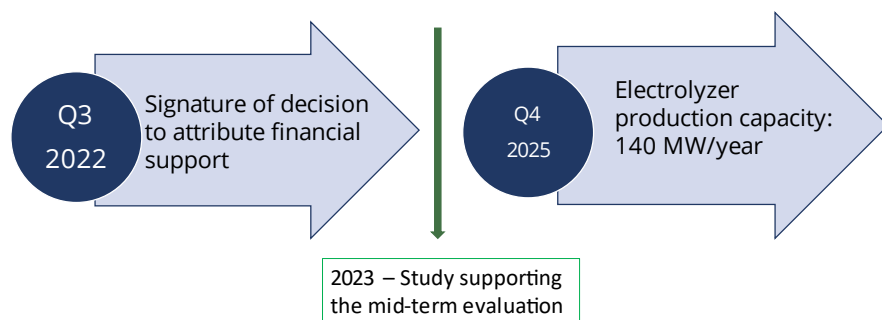
France's RRP puts a strong focus on energy efficiency and clean mobility, targeting specifically diversification of the French energy mix by supporting innovation in hydrogen. The measure is coordinated nationally by the **Ministry of Economy** with the involvement of national agencies such as Banque Publique d'Investissement and Agence De la Transition Ecologique. The project is aligned with the national France 2030 strategy, especially objective 3, related to the de-carbonisation of the industry.

The NRRP includes several hydrogen-related measures to address hydrogen production under **Develop decarbonised hydrogen**: the support mechanism for the production of carbon-free hydrogen. Under this framework, three different lines of measures can be differentiated:

- The support mechanism for the production of carbon-free hydrogen is solely dedicated to hydrogen production supporting projects greater than 30 MW and is meant to build more widely upon the projects of the IPCEI
- The territorial ecosystems for hydrogen operate at a very different scale within the GBER framework (i.e. EUR <15 M subsidy) and are meant to support the deployment of small hydrogen ecosystems, mostly towards mobility uses, by financing fully integrated projects
- In line with IPCEI's guidelines of fundamental innovation, the IPCEI supports first-mover precursor projects in hydrogen, covering both hydrogen equipment and hydrogen production projects. This allows the support of projects of different sizes, including massive ones (>400 MW in one case).

The investments related to the IPCEI are two: one milestone and one target. The milestone **Signature of the decision to attribute financial support** is to be completed by Q3 2022 while the target **Electrolyser production capacity** to be achieved by Q4 2025 sets a production capacity of 140MW per year produced thanks to the IPCEI on hydrogen.

Figure 6: Summary of IPCEI Hydrogen measures timeline



Source: own elaboration based on RRF Scoreboard

<sup>24</sup> COMMISSION STAFF WORKING DOCUMENT Analysis of the recovery and resilience plan of France Accompanying the document Proposal for a COUNCIL IMPLEMENTING DECISION on the approval of the assessment of the recovery and resilience plan for France, SWD/2021/173 final

According to semi-structured interviews, the inclusion of the IPCEI within the NRRP did not impact the work of the IPCEI but rather affected NRRP implementation. In particular, the milestone for the “signature of the decision to attribute financial support to private promoters under the IPCEI on hydrogen” in Q3 2022 assumed that all projects would have been reviewed and approved by then. However, delays in the IPCEI formal notification negatively impacted the fulfilment of the milestone, requiring additional adjustments with SG RECOVER ex-post. Similarly, the “electrolyser production capacity” milestone in Q4 2025 (140 MW) has been fragilized as the concerned businesses generally delayed by one year of their industrial planning to integrate the IPCEI’s delays.

## Microelectronics and Communication Technologies

France participated in the first IPCEI on Microelectronics and is currently participating in the second IPCEI on Microelectronics and Connectivity with 10 companies and their relative projects. France's contribution to this project should be included in the measures relating to support for the development of digital acceleration strategies in the PIA4, particularly the acceleration strategies for electronics and 5G. However, contrary to hydrogen, the NRRP does not include IPCEI-related measures, which is linked primarily to the distinct timing of the programming and budgeting of the IPCEI.

## Germany

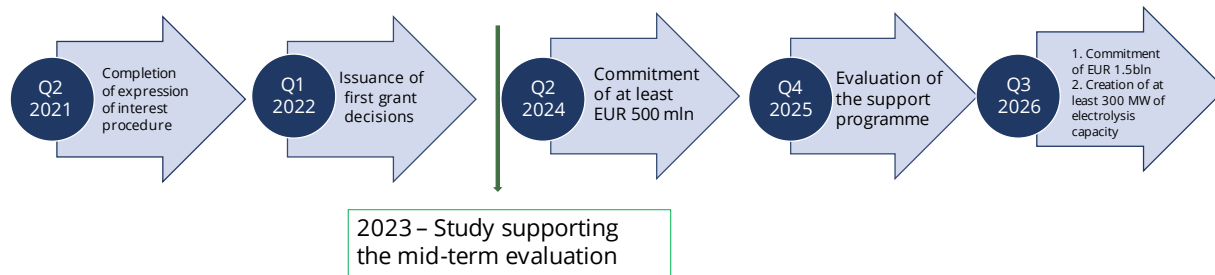
Germany's National Recovery and Resilience Plan has a strong cross-border dimension, with its central elements focusing on IPCEIs in the areas of hydrogen (EUR 1.5 billion), microelectronics (EUR 1.5 billion), and cloud and data processing (EUR 0.75 billion) open for participation to all interested Member States.

## Hydrogen

**Component 1.1 Decarbonisation using renewable hydrogen** in particular addresses climate change mitigation challenges to reduce greenhouse gas (GHG) emissions. To do so, the plan envisages support for the use of hydrogen produced from renewable sources and contribution of GHG emission reduction, as planned also in the National Energy and Climate Plan (NECP). The component supports addressing the Country Specific Recommendation on investment in the green transition and constitutes one building block in the design of a clean, efficient, and integrated energy system (Country Specific Recommendation 2 in 2019 and Country-Specific Recommendation 1 in 2020).

Within this component, there are six measures related to **Hydrogen Projects within the framework of IPCEIs** in the form of financial support to projects along the entire value chain. More in detail, there are three milestones and three targets. The milestone **Completion of the expression of interest procedure** planned for Q2 2021 aimed at identifying potential projects and project participants leading to milestone **Issuance of first grant decisions** by the Ministry for Economic Affairs and Energy (BMWi), Ministry of Transport and Digital Infrastructure (BMVI), Ministry of the Environment (BMU), enabling the start of the implementation of the selected projects, planned for Q1 of 2022. A first financial commitment target of **at least EUR 500 million** is to be met in Q2 2024. The plan envisages the milestone **Evaluation of the support programme** for Q4 2025, containing an initial assessment of the direct and indirect effects of the aid and an assessment of the appropriateness and proportionality of the support measure. Moreover, it aims to assess the success of the development of electrolytic capabilities, their systemic integration into the energy system (avoidance of network bottlenecks), the development of demand-driven infrastructure, implementation of hydrogen decarbonisation technologies. Last, hydrogen technology market uptake and its relevance in the energy system should be analysed as well. The last two targets for Q3 2026 foresee the commitment of **EUR 1.5 billion** and the creation of **at least 300 MW of electrolysis capacity**.

*Figure 7: Summary of IPCEI Hydrogen measures timeline*



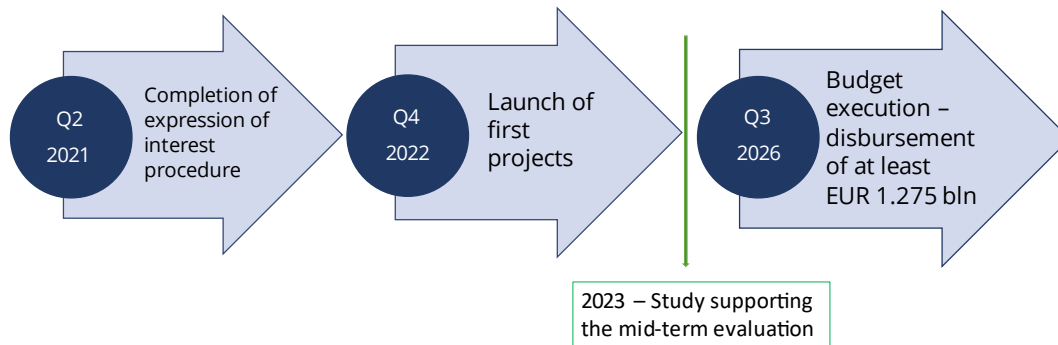
Source: own elaboration based on RRF Scoreboard

## Microelectronics and Communication Technologies

Measures related to IPCEI Microelectronics and Communication Technologies are included in **Component 2.1: Data as the raw material of the future**. The objective is to contribute to a cross-border initiative aiming at endowing the European Union with capabilities in electronics design and deployment of the next generation of low-power trusted processors and other electronic components. The component supports addressing the Country Specific Recommendations on investment in the digital transition (Country Specific Recommendation 1 in 2019 and Country Specific Recommendation 2 in 2020).

The investment consists of a milestone and two targets. Milestone **Completion of the expression of interest procedure** was planned for Q2 2021 and aimed at identifying potential projects and project participants through a national call. The projects selected through the call will be ten grant decisions issued under the target **Launch of the first projects** planned for Q4 2022. Last, the financial target **Budget execution** with the allocation of EUR 1.5 billion to the measure, with at least EUR 1.425 billion committed through signatures of grant decisions and at least EUR 1.275 billion disbursed.

Figure 8: Summary of IPCEI Microelectronics and Connectivity measures timeline



Source: own elaboration based on RRF Scoreboard

## Spain

Spain's National Recovery and Resilience Plan includes measures that are expected to contribute to progress on existing or future cross-border or multi-country projects. Importantly, the plan includes measures that would facilitate the participation of Spanish firms in planned cross-border projects, including IPCEIs.



## Hydrogen

**Component 9** of the Spanish NRRP aims to position the country as a technological benchmark in the production and use of renewable hydrogen, facilitating the conditions that allow renewable hydrogen to contribute significantly to the decarbonisation of the economy and the technological and industrial positioning of Spain and the European Union in this future sector. The total allocation for the component amounts to EUR 1.555 billion.

The component contributes to the green transition and the implementation of the Strategic Energy and Climate Framework (Marco Estratégico de Energía y Clima), especially related to some objectives of the National Energy and Plan, as well as the 2050 Long Term Strategy (Estrategia a Largo Plazo), which considers renewable hydrogen as one of the main vectors to decarbonise various economic sectors. Being part of a global strategic approach, this component has also interactions and synergies with other components: Components 1 and 6 are related to the use of hydrogen in certain specific areas of the mobility sector, and Component 7 is for the mass deployment of the renewable generation park. It also contributes to addressing the Country Specific Recommendation 2020.3.3 related to the sustainable promotion of employment and activity for its contribution to the generation and consolidation of the industrial value chain in energy technologies with growing European and global demand.

The component includes a reform **Hydrogen roadmap** and investments under the **Renewable hydrogen: a country project**. The reform for the roadmap was finalised in 2020<sup>25</sup> with the approval of the Council of Ministries and establishes the guidelines defined by Spain for the development of the renewable hydrogen sector. To this end, it identifies the goals to be achieved in terms of installed capacity, industry, and mobility by 2030. The investment in *Renewable hydrogen: a country project* includes six investments, out of which five are expected to contribute to the implementation of the IPCEIs.

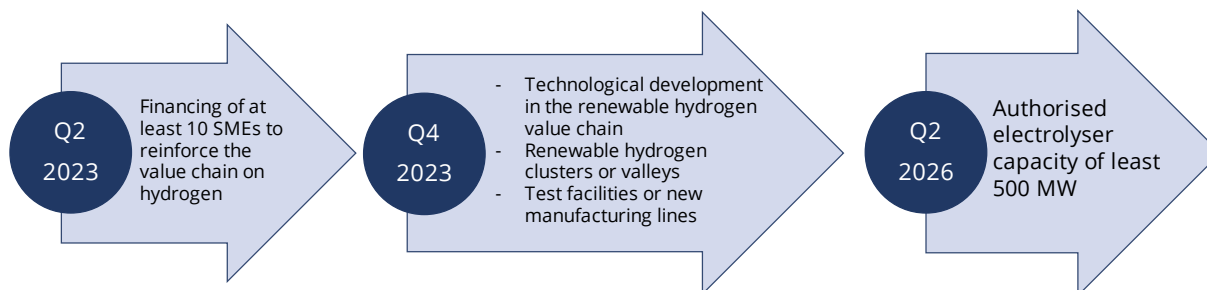
The target **Financing of at least 10 SMEs to reinforce the value chain of hydrogen** is planned for Q2 2023 and aims at strengthening and reinforcing the existing Spanish value chain on hydrogen using enhancing one or several of the following features: production capabilities, skills, competitiveness, knowledge and technology transfer, international dimension. Three other targets are planned for Q4 2023. **Technological developments in the renewable hydrogen value chain** with the financing of at least five technological developments or prototypes throughout the renewable hydrogen value chain. These (such as electrolyzers, compressors, storage vessels, fuel cells, and hydrogen-based transport systems) may include “first of a kind” developments to enable validating a new upscaled design or prototype associated with production, logistics, and hydrogen consumption. **Renewable hydrogen clusters (or valleys)** (#133) foresee the financing of at least two renewable hydrogen clusters (or valleys) for sectoral integration. Clusters or large hydrogen valleys concentrate and integrate locally the supply, distribution (logistics), and demand of renewable hydrogen in specific locations to displace grey hydrogen and fossil fuels. The target **Test facilities or new manufacturing lines** requires financing at least ten interventions targeting the improvement of test facilities or implementing new manufacturing lines. These can either: improve R&D&I-related test facilities or laboratories and/or related equipment; or improve facilities and/or procurement of new equipment (such as machine tools) or techniques to manufacture hydrogen and fuel cell-related systems, equipment, or components.

Lastly, the target of **at least 500 MW of total electrolyser capacity authorised** (#136), including complementary infrastructure, is planned for Q2 of 2026. Accreditation is verified by one of the three following means: insertion into the registry of the national system for guarantees of origin of renewable gases, administrative authorisation of the plant issued by the competent body, or final investment decision provided by the beneficiary.

*Figure 9: Summary of IPCEI Hydrogen measures timeline*

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<sup>25</sup> <https://commission.europa.eu/system/files/2021-12/rrf-preliminary-assessment-1st-payment-request-spain.pdf>



Source: own elaboration based on RRF Scoreboard

## Microelectronics and Communication Technologies

Spain is currently participating in the second IPCEI on Microelectronics and Connectivity with four companies and their relative projects. However, contrary to hydrogen, the NRRP does not include IPCEI-related measures.

## Effectiveness – progress, and results

According to the information collected via desk research and through semi-structured interviews, the general progress of projects is slower than originally expected. **Progress of IPCEI-related implementation of reforms and investments within the NRRPs varies significantly across the different IPCEIs and within the same IPCEI at project level. While most milestones of the analysed IPCEI-related measures (reforms) are fulfilled, the implementation of most IPCEI investments (targets) is facing potential delays.** This is due partly to differences in the official approval timelines of each Member State involved<sup>26</sup>, but also the result of the lengthy notification process. Even though companies were allowed to start with their project activities shortly after the pre-notification phase, most of them decided to wait for the formal notification, which confirms they comply with State aid rules. Disbursement of funds, which in the case of most IPCEIs still come from national budgets, is linked to the authorisation. Thus, companies commencing project activities prior to receiving official authorisation face the uncertainty of receiving national funding.

Due to their structure, IPCEIs generally start with an R&D phase, followed by an industrial deployment phase, which necessitates the largest portion of investments. Thus, the most significant share of investments is expected towards the end of the funding period which will result in a lower percentage of funds distributed to projects by Q3 2026. Nevertheless, the four analysed countries do not anticipate significant delays and some progress on measures can be reported.

In IPCEI microelectronics, two Austrian companies reported having nearly completed the construction of the manufacturing factory which will be followed by the setting up of the machine by the end of 2023, while another company reported having started a successful simulation for a new furnace which is used for crystal growth. On the other hand, hydrogen-related investments, especially in Germany, foresee the building or renovation of infrastructure, which will lead to concrete results in the longer term. These investments are the most visible ones in terms of benefits and results, but also the ones taking more time to materialise. Progress registered so far regards the reduction of CO<sub>2</sub> emissions and development of certain technologies but mainly analysed at the project level. In Austria, half of the approved projects have started reporting some progress, including completing the material and new infrastructure testing and the approval of the plan to build an electrolyser in the country.

<sup>26</sup> That is, approval of projects within an IPCEI. In some Member States, contracts are signed directly between the contracting authority and company leading the specific project. Any delays in signature of the contract turns into delay in project implementation.

The first IPCEIs on Microelectronics and Batteries (which have been finalised) can to a large extent speak towards key lessons learned that should be taken up in future design and implementation of cross-border projects to enhance their effectiveness<sup>27</sup>. In addition to a clear political steer and clear strategic objectives, the involvement of the European Commission in designing the IPCEI(s) is seen as good practice. Furthermore, the selection of participating companies via open calls, intense cooperation between Member States, and accurate screening by Member States of all individual projects (to prevent difficult issues during the assessment by DG COMP) are key factors that can facilitate the impact of cross-border projects.

### Effectiveness – contribution of the RRF to IPCEIs

Eisl ([2022, a](#)) argues that European financing through the RRF helped to enlarge the circle of Member States able to take part in IPCEIs, especially towards Central and Eastern Europe. As for the countries analysed for this study, stakeholders reported that when the RRF regulation was drafted in 2021, most of the IPCEIs had already been designed and the Member States had already committed to allocating funds to these projects. Thus, **the possibility of using the RRF as a funding source did not influence the decision whether to take part in the IPCEIs but rather had an impact on the scale of funding, which might have been lower in the absence of the RRF**. By overcoming national budgetary limitations, the RRF represented a good source of funding or co-funding for the Member States and an opportunity to integrate IPCEIs into the national programmes. The use of RRF to support one or more IPCEIs was a political decision taken by each Member State, driven by the appealing prospect of accessing EU-level funds that aligned thematically with these projects. Following negotiations with the Commission, the RRF was deemed a suitable instrument for financing IPCEIs, particularly in light of their cross-border aspect. However, Member States may not have fully anticipated the associated limitations, i.e., the fulfilment of milestones and targets within strict timelines, which added a layer of complexity to the implementation process.

At the same time, the setting up of cross-border or **multi-country projects requires intense articulation between the Member States** involved, which might not be compatible with the short time frame of deploying RRF funds (Dias et al, 2021) but also with the timeline for drafting the plans. The Commission guidance clearly defines how cross-border projects should be incorporated in the NRRPs, including aspects such as a minimal number of Member States involved, clear attribution of costs, reporting of milestones and targets, and disbursements in a way to avoid overlaps and delays in assessment and implementation. While the successful completion of plans should be independent of other countries ([European Commission, 2021a](#)), the need for coordination might have discouraged more Member States from pursuing this approach and, therefore, using RRF money to support IPCEIs. However, given that the number of Member States (and companies) that participate in IPCEIs keeps growing steadily over the years, this does not seem to be the deciding factor in cross-border project participation.

The European Court of Auditors Special Report on the Recovery and Resilience Plans [21/2022](#) noted that a harmonised approach in the definition of milestones and targets would have been beneficial for cross-border projects. This comment overlooks the differences in financial and sectoral capacities (in this case in the hydrogen industry) across countries. More importantly, it does not take into account the fact that IPCEIs are comprised of a mix of individual projects, with different project batches concerning distinct streams of the value chain. This impedes the complete harmonisation of milestones and targets across participating Member States. Also, the different milestones and targets are not always clearly linked to the IPCEIs, rather they can be attributed to other measures in the same field which can be complementary to IPCEIs [e.g., in the case of Spain under the measure *Renewable hydrogen: a country project*, one of the targets is not linked to the IPCEI. The same applies to France, where milestones and targets under the measure *Develop decarbonised hydrogen* only partially are related to IPCEIs (2 out of the 5) to some extent]. A call for harmonisation was made by participants at the Roundtable, who called for more harmonisation on KPIs that

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<sup>27</sup> DG COMP presentation on Lessons learned from the Batteries IPCEI, available at [https://www.ipcei-batteries.eu/fileadmin/Files/downloads/Lessons\\_learned\\_IPCEI\\_Batteris\\_EU.pdf](https://www.ipcei-batteries.eu/fileadmin/Files/downloads/Lessons_learned_IPCEI_Batteris_EU.pdf)

need to be reported for individual IPCEI projects. As the reporting on KPIs is done towards more than one DG, alignment in these would help in reducing administrative burden for companies.

According to the information collected during the interviews, the main limitation of the RRF in supporting IPCEIs is linked to the deadline in 2026, also in light of the reporting system for the achievement of milestones and targets, and related payments. In addition, this short timeframe was reduced by the delays in the State aid notification process. In the hydrogen industry especially, projects are related to the building or modernising of infrastructure, pipelines, and plants which necessitate a long time before they can get into operation. However, most of these projects have not yet started. Considering that the lifespan of such projects is 5-6 years, there is a risk that **these might not be completed with a relative budget spent by 2026**. Whether some exceptions or extensions are going to be granted is unclear, but it is an issue that some Member States anticipate.

The short timeframe might have negatively influenced decisions regarding additional IPCEIs and the possibility of being developed under the REPowerEU chapter. Anecdotal evidence suggests that there have been informal brainstorming meetings regarding an IPCEI focused on solar, but the constrained RRF timeline deterred further pursuit due to the associated risks.

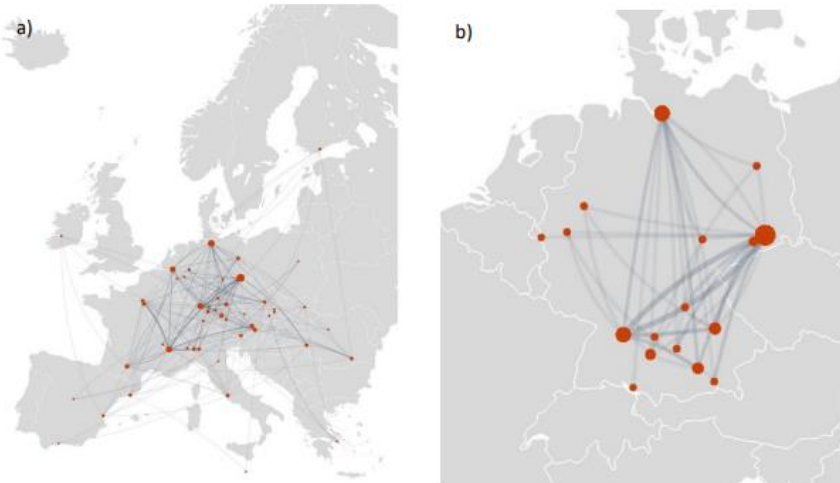
### Effectiveness – cooperation among companies

Enabling cooperation among companies is one of the main objectives of an IPCEI. When project portfolios are submitted to be assessed by DG COMP, they are thoroughly scrutinized for the **degree of cross-border collaboration**. If the cooperation primarily takes place within national boundaries, suggestions are made to emphasize the cross-border element or refrain from IPCEI participation.

To comply with the requirement, cross-border cooperation is defined based on Article 16 of the RRF legal basis, which explicitly lays out a definition of cross-border cooperation as well as the elements to consider such as shared risks, shared Intellectual property rights, collaboration topics, and added value.

Interviews with stakeholders indicate **that IPCEIs typically present challenges in fostering cooperation beyond the conventional value stream with supply partners or customer partners**. This difficulty is the result of **antitrust rules** that restrict the sharing of processes and developments with competitors. On the opposite, cooperation often occurs at the horizontal level related to issues such as the measurement of a certain technology or the implementation of recycling and circular economy practices within the production process. This type of information does not fall under confidentiality and can thus be shared horizontally. This underscores that, **despite the undisclosed aspects, cooperation is still possible across various other dimensions**.

*Figure 10: Cooperation between direct participants IPCEI ME/CT*



Source: Federal Ministry for Economic Affairs and Climate Action, [2023](#)

However, it is not sufficient to state that cooperation is happening at national and cross-border levels, but companies are asked to **provide evidence of collaboration**, whether in the form of a Memorandum of Understanding (MoU), Non-Disclosure Agreements (NDA), or ideally, cooperation contracts. This information is then incorporated into the portfolio and subsequently into the Chapeau Document. This part constitutes a significant portion of the application process and often represents a burden for companies, particularly in cases that require legal involvement. While **there is not a strict minimum number**, larger enterprises usually have a higher threshold for cross-border collaborations (at least 5), while for SMEs the number is reduced due to the potential challenges they face in collaborating with numerous other entities. It is worth mentioning that in R&D projects, collaboration is more straightforward.

In the context of production, however, collaboration tends to be more **indirect** and **vertical**, involving **collaborations with customers along the value chain** through component exchange. For instance, if a project entails the building of some type of infrastructure project, i.e., pipelines, the Commission often requires open access to ensure that both producers and off-takers can reap the benefits of the new infrastructure. In the case of developing new technologies, instead, results can be distributed and used in other projects, but actual joint technological development is restricted due to antitrust rules. To navigate antitrust limitations, some companies establish shared production facilities. For instance, they might build a new manufacturing facility (Fab) that covers multiple stages of semiconductor production, involving joint procurement of machinery. Partners involved benefit from the collectively developed components, ultimately enhancing their products. On the other hand, **horizontal collaboration is more prevalent in terms of spillovers and dissemination activities**. Companies and projects are assessed based on their engagement in these activities, which can be quite demanding for companies responsible for the organization of conferences and events for universities and students. Further to the organizational challenges, the sharing of knowledge gained in the framework of the project may not always be feasible due to antitrust rules.

To conclude, companies do collaborate and derive mutual advantages from each other's contributions. However, this type of collaboration **differs from the conventional idea of cooperation**. Rather than a change in IPCEI regulations or State aid policies, stakeholders would welcome more flexibility and a wider array of approaches accepted by DG COMP to comply with the spillover requirement.

## Effectiveness – identified bottlenecks

### Notification process

The lengthy notification process remains the main challenge of the implementation of IPCEIs. With an average time of 1,5 years for receiving authorisation, the timeline for IPCEIs remains uncertain. While efforts put into the revision of the Communication on IPCEIs were welcomed by all, some unclarities remain and concerns are expressed by various stakeholders. **A year's delay can cause substantial problems for businesses, especially for such industries that live on innovation and speed.** Some companies decided to start their project after the pre-notification, but in case of a negative outcome from the notification, the costs would have to be borne by the company itself which is not entitled to receive national funding. Moreover, external factors are more likely to have an impact and the plans to change along the way.

The **General Block Exemption Regulation (GBER)** provides State aid cover for categories of aid that are **exempt from the European Commission's formal notification process**. Amendments to the regulation were made to further simplify and speed up support for the EU's green and digital transitions in 2023. In the IPCEI framework, companies seeking limited aid amounts can obtain public support under GBER, which therefore does not need to be notified to the Commission for approval. This amendment also led to the establishment of a new partner status, called the associated partner, which can receive up to EUR 50 million without undergoing the notification. This in turn reduces the number of companies that have to be subjected to notification, which might contribute to **reducing the time taken for the assessment**. In addition, with IPCEI ME/CT Public support to projects handled by research organisation do not require the Commission's approval, as it does not qualify as aid.

While stakeholders are aware that DG COMP was (and continues to be) faced with an overwhelming number of projects to be checked for State aid, they call for further measures that would allow a smoother notification process. For hydrogen, the authorisation of the third and fourth waves of projects is still in progress even two years after the initial preselection. A recommendation is to **enhance the Commission's capacity**, which has been addressed to some extent internally, although further improvement is necessary.

At the same time, some delays were already registered at Member States level during the IPCEI preparation phase. As noted in the section describing measures and uptake per country, each Member State follows its own approach to the selection of projects and companies that will be included in the IPCEI. While some countries carry out a pre-selection of projects, others have laxer selection criteria which might result in a great number of projects being pre-notified to DG COMP, many of which do not fulfill the requirements to be eligible for State aid (see the case of the IPCEI ME/CT, with more than 110 projects pre-notified and only 68 positively assessed<sup>28</sup>). Such practice results in an increased workload for DG COMP, slowing down the assessment processes. As highlighted by both the European Commission and Member States, a more thorough selection of projects by Member States would likely benefit the process. Additionally, for Member States new to IPCEIs, this process is not straightforward, thus help and support from more experienced ones would be beneficial in identifying good practices. Otherwise, **the time taken for all Member States to align on the objectives and rationale of the IPCEI, particularly for those inexperienced in the industry, will have higher chances of resulting in additional delays**. This is particularly true in IPCEIs with a large number of projects, where any project progressing slowly inevitably slows down the entire wave.

Additional delays for the project's start were, and still are, experienced even after the notification process when Member States have to issue the first investment decisions. This is partially due to the national process regarding investment decisions with the project owner to finalize the agreement. In addition, it is worth mentioning that Member

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<sup>28</sup> Information not publicly available, provided by Commission officials.

States themselves have been hit by the war in Ukraine and its consequences, thus, funding possibilities were limited both at the national level and also at the company level (particularly the demand side).

### Lack of clarity

The majority of stakeholders mentioned that the whole process is complex and not clearly defined in terms of processes, timeline, and responsibilities, but also requirement criteria for project selection, the definition of additional benefits or spillovers, and the issue of the off-taker (Hydrogen). Poitiers and Weil (2022) concur, claiming a lack of public record of the process through which IPCEIs are started.

IPCEIs, being a relatively new mechanism, have no real well-established precedent to learn from or to use as a model, so both the Commission and MSs are learning while implementing, and dealing with obstacles or bottlenecks as they arise. Some aspects were to some extent clarified with the Communication in 2021, but stakeholders reckon that there were no major changes. On the opposite, it is still considered too lax and broadly designed, building largely on the previous communication from 2014. This works fine if already involved in an IPCEI but still represents a challenge for newcomers, both at the MS level and especially at the company level. In the case of hydrogen IPCEI, Communication changed the process, especially for the industry projects – 10 projects that were supposed to be part of the industry wave were not considered suitable for it anymore. DG COMP advised they proceed as stand-alone projects under the CEEAG – guidelines on State aid for climate, environmental protection, and energy. This change required further internal adjustments in order to re-balance internal cooperation and the scope of the IPCEI. While this further shows the uncertain institutional framework within which IPCEIs operate, it also points towards flexibility.

### Communication

**Communication amongst participating Member States appears to be challenging at times.** The coordinating Member State is in charge of steering conversations and proposing a specific plan for the IPCEI, yet all participating Member States are expected to contribute in an equal manner. Semi-structured interviews pointed towards challenges in these regards, with different stakeholders reporting a different degree of communication among Member States. Overall, the **lack of an institutionalised gateway to communicate with all participating MSs poses a challenge to seamless interaction.** Moreover, IPCEIs' responsible Ministries differ in each country, ranging from one to several, depending on the thematic focus.

Countries taking on the role of coordinators are undoubtedly more active and maintain communication with a greater number of Member States while other countries mainly engage in bilateral communications. Notably, communication with Germany holds particular intensity due to their experience with IPCEIs. In addition to country differences, the degree of communication varies across different phases of the project but is **particularly intense during the project's design process.** Although the coordinating Member State assumes a leading role during the drafting of the Chapeau document, contributions from other Member States remain essential. However, **not all Member States engage to the same extent.** Some, (for instance Spain, Italy, the Netherlands, and Belgium) are more active participants, while others show greater reluctance. This could be attributed to resource limitations or the country's size, for which limited capacity could hinder a more active involvement. The coordinating Member State often needs to proactively follow up with less engaged states, requesting their input on documents and contributions related to their respective companies. This has been the case with some companies dropping out of the project, which is now requiring the coordinating Member States, but also the MS the company is from extra efforts to keep the other companies engaged and active in their ambition for the projects, as well as technical adjustments to compensate for changes in participation to ensure projects feasibility.

In addition, **communication with interest groups**, both on a national and EU level holds significant importance because it serves as a means to understand the industry's or area's situation in other Member States. In case one county

intends to propose an IPCEI in a certain area, knowing if the sector or topic holds relevance for other Member States is crucial for the proposal's success.

For this reason, Austria together with the support of several other MSs promoted some type of improvements by asking for a **joint EU forum where multilateral exchanges could take place and improve the communication between MSs and with EC about procedures, strategic objectives, and other important issues**. Within this framework, they would be able to share experiences, expertise, and best practices, discuss challenges faced - particularly by smaller and less experienced Member States – and learn about the internal processes of the different Member States. Furthermore, this initiative could serve as a means to closely monitor implementation by reaching a consensus on common Key Performance Indicators (KPIs) to be incorporated in all implementation reports. This would also encompass determining the type of feedback that Member States require (Member States are obligated to submit annual reports to the Commission). However, feedback on these reports is currently absent, and the nature of each report varies based on the current state of implementation. Lastly, it could provide a platform to brainstorm about potential future IPCEI areas where new IPCEIs could be designed. The proposal has gotten positive feedback from the European Commission, and both DG GROW and COMP have shown interest and endorsed the idea of the Forum, recognizing that IPCEIs represent a new instrument with substantial untapped potential, albeit still in the process of learning and refinement. One potential arrangement could involve co-chairing by DG COMP and DG GROW, aiming to increase Commission engagement and monitoring. Nevertheless, the challenge of resource limitations from the Commission side might hinder this plan. At the same time, it is crucial that MSs commit themselves to active participation in the Forum. Especially, the Forum should aim to involve MSs that have not yet taken part in any IPCEI, so they to familiarise themselves with the instrument and potentially increase their interest in participating. According to the latest developments, the Forum has been confirmed and will take place in autumn 2023.

As for **communication with the Commission**, from the interviews, it emerged that takes place **mainly with DG COMP**, which holds procedural expertise, while for a more strategic perspective on the IPCEIs or more technical background different DGs are involved based on the topic of the IPCEI, such as DG GROW for hydrogen and batteries and DG CNECT for microelectronics. Despite certain **capacity constraints and limitations in terms of timeline**, communication is perceived positively. DG COMP has so far shown support for the subject as a whole and is highly interested in identifying constructive approaches, aiming to facilitate rather than obstruct. For instance, following the projects' presentations, it emerged that some of them did not align with the IPCEI framework. During this phase, the Commission played a constructive role by selecting the most suitable projects and excluding others, always ensuring a collective advancement. Another positive example is that during the process it emerged that one of the Austrian companies would not qualify as a direct partner, but rather as an associated partner. The switch from one category to the other worked well, considering that this partner status was quite new. As for monitoring and reporting of IPCEI-related milestones and targets included in the NRPPs, the communication line is mainly between the Member State's competent authorities and SG RECOVER. Before the integration of IPCEIs into the NRPPs, interactions primarily took place with DG COMP and the relevant sectorial DGs and generally proceeded smoothly thanks to DG's expertise in the subject matter and IPCEI mechanisms. Reporting to SG RECOVER and ECFIN in the RRF framework requires extra effort from both sides, due to the technical complexities of the topics. This was mentioned mainly in relation to the justification of delays in meeting the planned targets or requests for milestones and targets re-negotiations.

On the other hand, **companies seem not to have direct contact with the Commission** services itself, but communication is rather channelled **through Member States**, which often act as intermediaries and translate the Commission requests for the companies. The documentation for DG COMP also follows a similar path through the Member States, and the process seems to be generally smooth. However, some stakeholders often highlighted the Commission's limited grasp of market dynamics. This is evident, for instance, when there is a call for a higher degree of cooperation, which would require breaking antitrust rules or the focus on internal state aid limitations compared to imbalances beyond the Single Market. Additionally, stakeholders mentioned the lack of opportunities to directly



explain critical matters from a company point of view (separation of R&D and implementation following the EU Chips Act).

### Effectiveness – external factors

The **timing** aspect has played a significant role in the unfolding of events. Initial figures for the projects were established in late 2021, setting the foundation for the project. However, these figures were affected by the energy crisis triggered by the Russian invasion of Ukraine. While awaiting formal notification, the landscape shifted dramatically - construction and equipment costs experienced a sharp escalation due to disruptions in energy supplies. These numbers were at odds with the original project plan. This represented **a challenge** not only for larger corporations but also an even **bigger strain on smaller enterprises**.

**Rising material prices have indeed posed challenges** in the implementation of the IPCEI projects. The fluctuations in material costs have led to **delays in the delivery of products**, impacting project timelines. The ever-changing landscape for material prices necessitates constant adjustments to budgets by many companies involved in the IPCEI projects. Such external factors can disrupt the smooth progress of these initiatives, requiring careful management and adaptability to navigate these obstacles effectively.

In response, two primary courses of action emerged. One approach was to absorb the mounting costs, a solution that posed considerable difficulty even for major companies grappling with the energy crisis and material cost fluctuations. This situation led some to contemplate **downsizing the project** or **trimming down its activities**.

At first glance, one might assume that these circumstances presented an opportune moment to expedite the transition to alternative energy sources. However, the surge in costs and energy instability translated into a reduction in revenues for businesses, which, in turn, cast doubt on the feasibility of executing the envisioned investments outlined in the IPCEI project.

It is worth noting that while the global market's instability and material cost fluctuations certainly influenced investment decisions, there have been no cases of companies withdrawing from the project after receiving notification from the Commission. On the contrary, drop outs were registered during the notification phase, often driven by the uncertainties brought about by the energy crisis and its repercussions on the broader economic landscape. This trend was especially pronounced in the case of hydrogen-related initiatives. The intricate network of consortia and partnerships formed around these projects meant that the departure of a single entity could negatively affect the feasibility of the project.

A recurring sentiment among companies is the desire for additional funding allocation due to the surging costs exacerbated by the energy crisis and material cost fluctuations. However, it's important to recognize that such a decision ultimately rests on political considerations at the national level.

## 5 Coherence

As projects of strategic interest that can serve 'green and digital transition' and provide more strategic autonomy, IPCEIs allow Member States to finance the early stages of industrial policy projects that are in line with their national and European priorities. All IPCEIs must be notified to the European Commission (DG COMP), which authorises projects in line with the requirements set in its Communication on IPCEIs<sup>29</sup>. It should be noted that the IPCEI Communication complements other State aid rules such as the [Climate, Energy, and Environment Aid Guidelines](#), the [General Block Exemption Regulation](#), and the [Framework for State aid for research and development and](#)

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<sup>29</sup> C/2021/8481 final

[innovation](#), which allow supporting innovative and green projects whilst ensuring that potential competition distortions are limited.

### Alignment with European objectives

The IPCEI hydrogen is in line with the Commission's efforts to support the development of an innovative and sustainable European hydrogen industry. Hydrogen and more specifically green hydrogen "is a key priority to achieve the European Green Deal and Europe's clean energy transition" as it is seen as a technology that can bridge the gap between electricity production from renewable energy and the goal of decarbonising a large share of the EU's energy consumption by 2050. Hydrogen plays a pivotal role within the **European Green Deal** and the **REPowerEU** plan, as its use will accelerate the decarbonisation of the energy system and provide an alternative to Russian imported fossil fuels. The so-called **Hydrogen Accelerator** concept is included within the REPowerEU plan setting the targets of producing 10 million tonnes of renewable hydrogen by 2030 and importing 10 million tonnes by 2030.

They are complemented by several measures already in place at EU level, such as:

- Within the Hydrogen Accelerator measures, the Commission has proposed to establish a global European hydrogen facility to create investment security and business opportunities for European and global renewable hydrogen production. The [Communication on the European Hydrogen Bank](#) (COM/2023/156), published in March 2023, describes its concept, tasks, and structure. The European Hydrogen Bank is a financing instrument run internally by Commission Services, with the main objective of unlocking private investments in hydrogen value chains, both domestically and in third countries, by connecting renewable energy supply to EU demand and addressing the initial investment challenges. It will establish an initial market for renewable hydrogen, offering new growth opportunities and jobs. In autumn 2023, a [pilot auction](#) (competitive bidding) will be launched under the Innovation Fund, supporting the production of renewable hydrogen for European consumers.
- the [EU Hydrogen Strategy](#), adopted in 2020 with COM/2020/301 suggested policy action points in five areas through 20 key actions to decarbonise hydrogen production and expand its use in sectors where it can replace fossil fuel<sup>30</sup>.
- the **Fit-for-55 package** within the EU Green Deal, proposes targets for the uptake of renewable hydrogen in industry and transport by 2030. This first package of measures encourages the demand and production of low-carbon gases, including hydrogen. More in detail, the Hydrogen and gas markets decarbonisation package entailed the revision of the Gas Directive 2009/73/EC and Gas Regulation (EC) No 715/2009 allowing the removal of barriers to decarbonisation and the setting of the conditions for a more cost-effective transition.
- the [Clean Hydrogen Partnership](#), established in November 2021 building upon the success of its predecessor, the Fuel Cells and Hydrogen Joint Undertaking, to support research and innovation in the hydrogen ecosystem. It is backed by the Commission through Horizon Europe. On March 1<sup>st</sup>, 2023, the Commission and key stakeholders signed a [joint declaration on renewable hydrogen research and innovation](#), committing to step up and accelerate joint action in research, development, demonstration, and deployment of Hydrogen Valleys.
- the **Hydrogen Energy Network**, an informal group of representatives from the energy ministries in EU countries where they can share information on good practices, experiences, and the latest developments in

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<sup>30</sup> "Questions and answers: a Hydrogen Strategy for a climate neutral Europe", European Commission [https://ec.europa.eu/commission/presscorner/detail/en/QANDA\\_20\\_1257](https://ec.europa.eu/commission/presscorner/detail/en/QANDA_20_1257)

hydrogen with the aim to help national competent authorities identify and exploit the opportunities offered by hydrogen.

- the [European Clean Hydrogen Alliance](#), launched in parallel with the Hydrogen Strategy in 2020 as part of the new industrial strategy for the EU. It includes industry, national and local representatives, civil society, and other stakeholders to deploy hydrogen technologies by 2030 by bringing together renewable and low-carbon hydrogen production, demand in industry, transport and other sectors, and transmission and distribution.
- **Hydrogen Public Funding Compass**, an online guide for stakeholders to identify public funding sources for hydrogen projects, including information on all the EU programmes and funds (2021-2027) that are relevant for the sector.

Similarly, as with the IPCEI on hydrogen, The **IPCEI on microelectronics and connectivity** directly contributes to achieving several **EU objectives** of a greener, digital, more secure, resilient, and sovereign economy set out in key EU policy initiatives, such as:

- The **European Green Deal** and more specifically its **Industrial Plan**.
- The **Europe's Digital Decade** programme sets concrete targets and objectives to achieve by 2030, which will guide Europe's digital transformation. This will be achieved through trajectories at the EU and national level which will be monitored through key performance indicators; an annual cooperation cycle to monitor and report on progress; and multi-country projects combining EU, national, and private investments.
- The **Digital Europe Programme (DIGITAL)** focuses on bringing digital technology to businesses, citizens, and public administrations. It supports projects in five key capacity areas: supercomputing, artificial intelligence, cybersecurity, advanced digital skills, and ensuring a wide use of digital technologies across the economy and society, including through Digital Innovation Hubs. The allocation of €7.5 billion aims to accelerate the economic recovery and shape the digital transformation of Europe's society and economy, bringing benefits to everyone, but in particular to small and medium-sized enterprises.
- The **Connecting Europe Facility (CEF Digital)** promoting both public and private investments in digital connectivity infrastructures between 2021 and 2027. In particular, it addresses investments to safe, secure, and sustainable high-performance infrastructure, in particular Gigabit and 5G networks across the EU but especially to Outermost Regions.
- **The European Chips Act** is a funding programme to double the EU global market share in chips by 2030 to 20%, and produce the most sophisticated and energy-efficient semiconductors in Europe.

## Synergies between the RRP cross-border projects and other EU funds

The European regulations are clear — expenditure can never be covered by two different sources of EU funding. While double funding is theoretically possible for any project in the interest of complementarity, in practice it is impossible to balance the equation in this way. For the average project, it could even be counter-productive, given the administrative burden involved (ECA articles, [2022](#)).

Synergies with the InvestEU fund are quite important, not only in terms of policy priority alignment but also considering benefits for beneficiaries, with both programmes offering complementary support possibilities. InvestEU contributes to *the resilience of the Union in areas of strategic importance, upholding and strengthening strategic value chains and maintaining and reinforcing activities of strategic importance to the Union, including Important Projects of Common European Interest (IPCEI), in the areas of critical infrastructure, transformative technologies, game-changing innovations and inputs to businesses and consumers* ([InvestEU guideline](#)). Member States can invest part of their RRF

funds through the Member State Compartment of InvestEU into dedicated financial products offered by one or several of the InvestEU implementing partners<sup>31</sup>. Specifically, for IPCEIs, both InvestEU and RRF aim to stimulate private investment in strategic sectors, supporting sustainable infrastructure projects, innovation, and SMEs. **InvestEU provides financial instruments and incentives to attract private capital, while IPCEIs focus on identifying and promoting projects that have a significant impact on European competitiveness and innovation. These objectives can align well, as IPCEI projects can benefit from InvestEU's financial support.**

Both initiatives are aligned with the broader EU policy framework, including the European Green Deal and the Digital Europe Program InvestEU alignment with the RepowerEU, the EU Green Deal Industrial Plan, the Europe Fit for the Digital Age, the Just Transition, they both ensure that a wide range of sectors are included, especially in the green transition, transport, digitalization, and research and innovation.

## 6 EU added value

By definition, IPCEI must contribute in a concrete, clear, and identifiable manner to one or more Union objectives and must significantly impact the Union's competitiveness, and sustainable growth, addressing societal challenges or value creation across the Union. To be eligible, an IPCEI project must demonstrate that it is designed to overcome important market or systemic failures, preventing the project from being carried out to the same extent or in the same manner in the absence of the aid, or societal challenges, which would not otherwise be adequately addressed or remedied (see C(2021) 8481 final).

Yet, Eisl (2022 b)<sup>32</sup> finds that IPCEIs can create some tensions with EU competition policy, and thus the functioning of the Single Market. The author argues that key challenges for the Single Market's level playing field emerge due to differences in financial, technical, and administrative capabilities between Member States and their enterprises as well as shortcomings in the arrangements governing the creation, implementation, and evaluation of IPCEIs. **Smaller and less advanced economies often lack the fiscal space necessary to finance IPCEI projects or do not have sufficient administrative staff to manage the development, implementation, and evaluation of IPCEIs.** Participants of the roundtable confirmed this notion stating that there are differences across Member States in terms of capacity and organization of IPCEI. Participants claim that having a centralised unit in one Ministry dealing exclusively with the IPCEI could help in this regard and can be considered best practice.

The capacity issues can also exist at the enterprise level, where small and medium-sized enterprises (SMEs) might not possess the capabilities to join IPCEI projects<sup>33</sup>. Thus, IPCEIs might end up subsidising larger companies and thereby create distortions in the Single Market. In addition, they are often more well-connected to public authorities and supplied with more fiscal and administrative resources (Poitiers and Weil, 2022). Indeed, when examining the proportion of smaller economic actors (particularly SMEs and start-ups) partaking in the IPCEIs across time, it is clear that participation of bigger companies dominates. The first and second IPCEI waves on Microelectronics show that the number of emerging players involved is still low, while for the first and second waves approved of the IPCEI on hydrogen, SME participation stands at 19% and 9%, respectively. For IPCEI MECT, 21% (14 out of 67) of direct participants are SMEs. With the introduction of GBER, the share of SMEs has increased. Germany now reports that 14 out of 67 participants are SMEs (with 11 SMEs holding the associated partner status). However, Germany underlines (IPCEI MECT) that SMEs are usually indirect partners, thus not really part of the IPCEI per se, rather of the ecosystem. Nevertheless, more integrated and active participation in the project should be promoted.

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<sup>31</sup> [https://investeu.europa.eu/investeu-programme\\_en](https://investeu.europa.eu/investeu-programme_en)

<sup>32</sup> Eisl, Andreas (2022), Important Projects of Common European Interest (IPCEIs) as a New Form of Differentiation: An Analysis of Their Challenges for the European Single Market, EU Idea, Policy paper No. 18, available at [https://euidea.eu/wp-content/uploads/2022/03/euidea\\_pp\\_18.pdf](https://euidea.eu/wp-content/uploads/2022/03/euidea_pp_18.pdf)

<sup>33</sup> Ibid

Given that State aid to SMEs is less likely to distort competition, the inclusion of smaller players should be encouraged (Poitiers and Weil, [2022](#)). At the same time, taking part in IPCEIs is a crucial opportunity for SMEs to establish partnerships and learn from larger companies. This is particularly relevant, for instance, during matchmaking events, where companies in the sector get together and explore ways to cooperate both horizontally and vertically (along the value chain). **By pooling skills and know-how, during these sessions, companies find ways to compensate for the lack of specific technologies and skills in the wider IPCEI ecosystem, to establish a whole new value chain** like in the case of the IPCEI on batteries. This collaboration enables the development of R&D projects that contribute to the proliferation of innovative solutions and technologies within the industry. Thus, the main added value is **sharing knowledge on underdeveloped subjects**, where SMEs and larger groups come together bringing innovation aspects to the market. If broader SME participation in IPCEI is to be encouraged, simplification and streamlining of processes should be carried out, considering the admin burden that SMEs have to deal with in case they take part in IPCEI. More than often, they do not have the capacity or do not have a unit exclusively dealing with funding thus it is a strain for them also to follow conversations with both MS and the Commission. If one considers that the Single Market should ensure the right to exercise the four freedoms (of movement of goods, capital, services, and people) and provide a level playing field for economic actors, access to cross-border projects should be universal.

Eisl ([2022. b](#)) calls for a more inclusive and coherent governance framework, in which the Commission plays a more central role in ensuring that all interested public and private stakeholders can take part in IPCEIs. The issue of different levels of involvement and participation has emerged also during semi-structured interviews including the need for a more active involvement of all participating Member States, considering the nature of the initiative as a common project, requiring alignment to the extent possible. This is often due to the lack of knowledge and expertise compared to more “expert” Member States that have participated in previous IPCEIs. This could be improved via the [Code of good practices](#), developed on a Franco-German initiative to simplify the process of IPCEI to reduce delays. It includes the five steps of the IPCEI with a description of each phase, what is expected from MSs, what from companies, and the Commission’s expectations for each phase. Special focus is given to the pre-notification phase since it is the most burdensome one and where a lot of simplification could be made. At the same time, it was important to include all the phases, cause each phase entails a lot of work, and not all MSs are able to follow, especially if they do not have previous experience. This more than often discourages MS participation. Another aspect worth mentioning is that this code could serve as a tool to have more harmonised procedures, where ideally frontrunners MS share information or procedures that proved to work well in the past, especially for the provision of funds to project owners. So far, each MS acts differently but identifying the fastest and most suitable procedures that work across the different legislative frameworks of each MS could help.

**The contribution of IPCEIs to the Union’s objectives and their importance in providing a comparative advantage to European companies remain unchallenged** by stakeholders. Semi-structured interviews collected insight from various stakeholders partaking in four IPCEI waves of projects, with both private and public stakeholders emphasising the added value of cross-border projects. This is especially prominent in the **opportunity to give European companies a comparative advantage instead of the global market players and give Europe strategic autonomy**. The case of the IPCEI on Microelectronics highlights how targeted funding of strategic value chains can help keep European companies remain relevant in the market. The European global fabrication capacity of microchips<sup>34</sup> fell from more than 30% in the 1990s to less than 10% in 2020 ([Varas et al., 2020](#))<sup>35</sup>. Given the global 'subsidy race' in the world's

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<sup>34</sup> Microchips are ubiquitous nowadays and crucial for technologies driving the [digital transformation](#), such as artificial intelligence, low power computing, 5G/6G communications, as well as the Internet of Things and edge, cloud and high-performance computing platforms.

<sup>35</sup> Varas, A., Varadarajan, R., Goodrich, J., Yinug, F., Boston Consulting Group (2020), Government Incentives and US Competitiveness in Semiconductor Manufacturing, available at <https://www.semiconductors.org/wp-content/uploads/2020/09/Government-Incentives-and-US-Competitiveness-in-Semiconductor-Manufacturing-Sep-2020.pdf>

main producing regions, which has seen the US and China allocating funds to support their industry production<sup>36</sup> and following the global disruption in production of microchips in 2020, the value of investing European funds to support the semiconductor industry has become more pertinent than ever. Another example is the IPCEI on Batteries, where economic actors managed to develop a value chain that did not exist in the EU before, ranging from mining to repurposing, recycling, and refining, through the development of advanced materials and manufacturing of cells, modules, and systems as well as dedicated software and testing systems and solutions.

## 7 Relevance

IPCEI is designed to support strategically important industries and technologies. In the coming decades, as Europe seeks to maintain its competitiveness on the global stage, the identification and support of key sectors will be essential. IPCEIs represent a useful tool for identifying such sectors as well as creating complex new value chains that have the potential to ensure the EU's increased autonomy, long-term competitiveness, and economic growth. **Especially in light of the green and digital transition, it is vital to explore IPCEIs as a support to such areas to reach hydrogen production goals, phase out fossil fuels, and work towards energy independence.** The outcomes of these projects are not solely focused on the near future; rather, they contribute to the EU's long-term sustainable energy objectives. As such, the IPCEI hydrogen projects will continue to be instrumental in driving advancements in clean energy technology and ensuring a greener and more sustainable future for the European Union. This is further mirrored in the coherence with other several EU strategies that go beyond 2026.

At the same time, if their relevance is clear in the longer term, Eisl ([2022.a](#)) highlights the **lack of a more predictable source of funding** for such projects. In the best-case scenario, new European funding would substitute for the European recovery plan on a more permanent basis, allowing EU co-financing for future IPCEIs. If this is not the case, a lack of national financial capabilities could hamper their feasibility in the longer term.

## 8 Conclusions

**IPCEIs contribute to the Union's objectives and their importance is specifically reflected in providing a comparative advantage to European companies.** By pooling skills and know-how, IPCEIs can help European companies find ways to compensate for the lack of specific technologies and skills in the wider IPCEI ecosystem, providing the possibility of establishing whole new value chains. Due to their cross-border nature, as well as their strategic role in fostering cooperation in strategic industrial sectors and potential contribution to green and digital transition, the Commission promoted their use to strengthen the resilience of industrial ecosystems and deepen the Single Market.

Although the RRF represented an opportunity for countries to allocate funds to IPCEIs, not all of them opted to do so. In general, whenever the **IPCEI aligned with national strategies included in the NRRP**, the RRF seemed to be a suitable funding source for IPCEI. In addition, if the timing of the Facility coincided with the developments of IPCEIs, it encouraged MS to **take advantage of the availability of EU funds** that aligned thematically with the focus of the projects. This also helped offset potential reductions in national funding due to financial constraints faced by MS following the COVID-19 crisis.

The analysis reveals **variation in the progress of IPCEI implementation of reforms and investments** within the NRRPs, both among the different IPCEIs and within the same IPCEI at project level. In general, the fulfilment of milestones which entailed the national selection of projects has been completed. On the other hand, the fulfillment of targets is

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<sup>36</sup> In the US, the Biden administration has identified semiconductors as a critical good and has urged Congress to pass legislation supporting additional domestic investment in the industry. In August 2022, President Biden signed into law a US\$52.7 billion 'CHIPS (Creating Helpful Incentives to Produce Semiconductors) and Science Act'. China's 2015 plan 'Made in China 2025' set the aim of producing 40 % of the country's chip consumption in 2020 and 70 % by 2025; between 2015 and 2025, Chinese government support to its domestic chip industry could reach US\$200 billion. For more information see <https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/733596/EPRS-Briefing-733596-EU-chips-act-V2-FINAL.pdf>

expected to be delayed. Several factors contribute to these delays, including overly ambitious targets set in the Plan, the impact of the energy crisis, and delays in notification processes. In some cases, Member States are seeking to renegotiate targets to ensure they can meet them by the end of the funding period.

While it is true that the RRF represented a source of funding for MS to allocate to IPCEI, at the same time it also added constraints to an already complex situation. Compliance with IPCEI regulation and the associated processes, timeline, and responsibilities already represented a burden for both national authorities and companies potentially participating in the projects. Therefore, the fulfilment of milestones and targets with such a strict timeline **appears challenging for such projects**. In addition, delays in the notification process and the consequent start of projects, as well as external factors that affected both prices of raw materials and national financial capacities, together with the disruption of supply chains further complicated project start and implementation.

IPCEIs typically present challenges in fostering cooperation beyond the conventional value stream with supply partners or customer partners. This difficulty is the result of antitrust rules that restrict the sharing of processes and developments with competitors. Despite the undisclosed aspects, cooperation is still possible across various other dimensions, with examples of sharing concerning the measurement of a certain technology or the implementation of recycling and circular economy practices within the production process. In the case of developing new technologies, instead, results can be distributed and used in other projects, but actual joint technological development is restricted due to antitrust rules. To navigate antitrust limitations, some companies establish shared production facilities.

It is important to note that before the RRF, IPCEIs were initiated, run, and funded by the participating countries. For the MSs included in this case study, the possibility of using the RRF as a funding source **did not influence the decision of whether to take part in the IPCEIs but rather had an impact on the scale of financing**. On the contrary, Member States that had not previously taken part in any IPCEI might have been encouraged to do so thanks to RRF. This raises the question about different financial, technical, and human capacities among newcomer Member States, potentially leading to tensions within the Single Market. In addition, once the RRF spending period is finished, the prospect of a more predictable source of funding could hamper the participation of Member states in the long term.

## 9 Annexes

### 9.1 Annex 1: Interviewees

Table 2: Consulted stakeholder

Stakeholder category	Country	Date of the interview
Company representative	DE	05/07/2023
Representative from the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology	AT	13/07/2023
Representatives from the Federal Ministry for Economic Affairs and Climate Action - Hydrogen	DE	19/07/2023
Representative from the Ministry of Finance – Directorate General for Enterprise - Hydrogen	FR	20/07/2023
Representatives from the Ministry for the Ecological Transition and the Demographic Challenge	ES	20/07/2023
Representatives from the Institute for Diversification and Saving of Energy (IDAE)	ES	20/07/2023
Company representative	DE	25/07/2023
Company representative/ IPCEI Hydrogen (Hy2Tech) spokesperson		25/07/2023
DG GROW		02/08/2023
Ministry of Finance – Directorate General for Enterprise - Microelectronics	FR	No response
Federal Ministry for Economic Affairs and Climate Action - Microelectronics	DE	Written input
DG ENER		Declined
DG CNECT		No response
DG COMP		No response

Table 3: Participants of the roundtable

Country	Role
Austria	Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology, Directorate General III – Innovation and Technology
Germany	VDI/VDE-IT
Germany	Federal Ministry for Economic Affairs and Climate Action – Division IVA2
Germany	Federal Ministry for Economic Affairs and Climate Action – Division IVE3
Germany	Federal Ministry for Economic Affairs and Climate Action – Division IVE3
France	Ministry of the Economy, Finance and Industrial and Digital Sovereignty – Directorate General for Enterprise



Country	Role
Jacques Delors Institute	Academic
EC	DG COMP, Unit H.3 – IPCEI, Environment & Innovation II
EC	DG GROW, Unit I1 – Energy Intensive Industries, Raw materials, Hydrogen
EC	SG RECOVER Policy Officer involved in the mid-term evaluation of the RRF
EC	SG RECOVER Policy Officer involved in the mid-term evaluation of the RRF

## 9.2 Annex 2: Literature reviewed

- RRF Scoreboard Database
- National RRFs
- Other literature sources:

Dias, C, Grigaitė, K., Cunha, I., Directorate-General for Internal Policies of the European Parliament (2021), In-Depth analysis: Recovery and Resilience Plans – Thematic overview on cross-border projects, see [https://www.europarl.europa.eu/RegData/etudes/IDAN/2021/689472/IPOL\\_IDA\(2021\)689472\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/IDAN/2021/689472/IPOL_IDA(2021)689472_EN.pdf)

Eisl, A. (2022) “EU Industrial Policy in the Making - From ad hoc exercises to key instrument: how to make IPCEIs fit for the long run”, Policy Paper, No. 286, Jacques Delors Institute, Paris.

Eisl, A. (2022) Important Projects of Common European Interest (IPCEIs) as a New Form of Differentiation: an analysis of their challenges for the European Single Market.

European Commission (2014) Communication from the Commission — Criteria for the analysis of the compatibility with the internal market of State aid to promote the execution of important projects of common European interest

European Commission (2021) COMMUNICATION FROM THE COMMISSION Criteria for the analysis of the compatibility with the internal market of State aid to promote the execution of important projects of common European interest C/2021/8481 final

European Commission (2021), SWD(2021) 12 final, Commission Staff Working Document Guidance to Member States

European Commission (2023), Code of good practices for a transparent, inclusive, faster design and assessment of IPCEIs

Federal Ministry of Economic Affairs and Climate Action (2023), IPCEI in the field of microelectronics and European Chips Act

Pilati, M. (2021) *National Recovery and Resilience Plans: Empowering the green and digital transitions? EPC Discussion Paper* April 2021.

Poitiers, N. and P. Weil (2022) ‘Opaque and ill-defined: the problems with Europe’s IPCEI subsidy framework’, Bruegel Blog, 26 January

## 9.3 Annex 3: RRF Scoreboard tables

*Table 4: Summary of IPCEI Hydrogen measures included in Austrian RRF*

Milestone/Target	Milestone/Target Name	Timeline	Current Status
Milestone	National selection of projects to support the development of hydrogen production, storage and applications	Q3 - 2021	Fulfilled
Target	At least 66 % of approved projects started	Q2 - 2024	Not completed
Target	EUR 125 000 000 allocated and at least 80% of the aid disbursed for approved projects	Q3 - 2026	Not completed

Source: RRF Scoreboard database

Table 5: Summary of IPCEI Microelectronics and Connectivity measures included in Austrian RRP

Milestone/Target	Milestone/Target Name	Timeline	Current Status
Milestone	Climate-related eligibility criteria established in call documents	Q4 - 2021	Fulfilled
Milestone	National selection of projects to support the development of innovative microelectronics and connectivity technologies	Q4 - 2021	Fulfilled
Target	At least 66 % of approved projects started	Q2 - 2024	Not completed
Target	EUR 125 000 000 allocated and at least 80% of the aid disbursed for approved projects	Q3- 2026	Not completed

Source: RRF Scoreboard database

Table 6: Summary of Quantum Austria IPCEI measures included in Austrian RRP

Milestone/Target	Milestone/Target Name	Timeline	Current Status
Milestone	Call for expressions of interest (BMBWF); Identification of an executing agency	Q4 - 2021	Fulfilled
Milestone	Interim report	Q4 - 2024	Not completed
Milestone	Closure of projects with transfer to university operations	Q1 - 2026	Not completed

Source: RRF Scoreboard database

Table 7: Summary of IPCEI Hydrogen measures included in French RRP

Milestone/Target	Milestone/Target Name	Timeline	Current Status
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Milestone	Signature of decision to attribute financial support to private promoters under the IPCEI on hydrogen	Q3 2022	Completed (not assessed)
Target	Electrolyser production capacity	Q4 2025	Not completed

Source: RRF Scoreboard database

Table 8: Summary of IPCEI Hydrogen measures included in German RRP

Milestone/Target	Milestone/Target Name	Timeline	Current Status
Milestone	Completion of expression of interest procedure	Q2 - 2021	Completed (not assessed)
Milestone	Issuance of first grant decisions	Q1 - 2022	Completed (not assessed)
Target	Commitment of at least EUR 500 000 000	Q2 - 2024	On track
Milestone	Evaluation of the support programme	Q4 - 2025	Not completed
Target	Commitment of EUR 1 500 000 000	Q3 - 2026	Not completed
Target	Creation of at least 300 MW of electrolysis capacity	Q3 - 2026	Not completed

Source: RRF Scoreboard database

Table 9: Summary of IPCEI Microelectronics measures included in German RRP

Milestone/Target	Milestone/Target Name	Timeline	Current Status
Target	Launch of first projects	Q4 - 2022	Not completed
Target	Budget execution – disbursement of at least EUR 1 275 000 000 to the supported projects	Q3 - 2026	Not completed

Source: RRF Scoreboard database

Table 10: Summary of IPCEI Hydrogen measures included in Spanish RRP

Milestone/Target	Milestone/Target Name	Timeline	Current Status
Target	Financing of SMEs to reinforce the value chain of hydrogen	Q2 - 2023	On track
Target	Technological developments in the renewable hydrogen value chain	Q4 -2023	On track
Target	Renewable hydrogen clusters (or valleys)	Q4 - 2023	On track
Target	Test facilities or new manufacturing lines	Q4 - 2023	On track
Target	Authorised electrolyser capacity	Q2 - 2026	Not completed

Source: RRF Scoreboard database