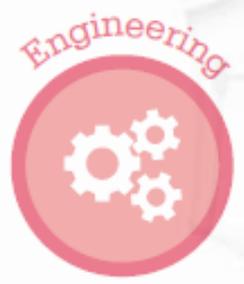


# TRENDS REPORT 2020



Sustainable Process Industry through  
Resource and Energy Efficiency



A.SPIRE

Produced in 2020  
Based on data from 2014-2019 projects



**Document Edited by the A.SPIRE Team**

**© A.SPIRE aisbl**

## TABLE OF CONTENTS

INTRODUCTION .....	3
CHAPTER 1 – PROGRESS OF PARTICIPATION .....	4
CHAPTER 2 – PROCESSES <sub>4</sub> PLANET BUILDING ON SPIRE RESULTS .....	10
OUTCOMES AND INSIGHTS .....	10
SUCCESS STORIES PORTFOLIO .....	11
INDUSTRIAL-URBAN SYMBIOSIS.....	11
CO <sub>2</sub> CARBON CAPTURE AND USE.....	12
DIGITAL.....	14
CONCLUSIONS.....	16



## INTRODUCTION

This SPIRE projects Trends Report offers a snapshot of the progress of the SPIRE contractual Public-Private Partnership (cPPP) projects from 2014 up to 2019 in a new format. This overview offers a vision of the cPPP advancements in relation to its objectives under the European Union (EU) Horizon 2020 **research and innovation** (R&I) programme and in terms of the **systemic benefits** that it provides. From 2013 SPIRE has supported R&I in the field of **Sustainable Process Industries in Europe through Resource and Energy Efficiency** with the EU economy, environment, and society as beneficiaries. With its activity among eight sectors (cement, ceramics, chemicals, engineering, minerals and ores, non-ferrous metals, steel, and water) A.SPIRE has brought together companies, world-leading universities and research organisations as well as other stakeholders. **A.SPIRE** is the European Association that manages SPIRE in its activity in collaboration with the European Commission, member organisations and the industry associations that represent the SPIRE sectors. As a cPPP, SPIRE provides an enhanced framework for EU-funded R&I, implementing the SPIRE 2030 strategic roadmap to deliver key economic and societal goals.

This year's publication differs from the traditional Progress Monitoring Report<sup>1</sup>. It is in fact an **overview**: a brief and concise **analysis of progress and trends** SPIRE has registered in its projects in the 2014-2019 timeframe.

This report offers a systemic vision on the major trends related to a portfolio of **125 projects** supported by SPIRE from 2014 to 2019 and aligned with the 2030 SPIRE Roadmap, alongside an analysis of the evolution of the involvement of member **organisations**. Within this pool of projects, outstanding **performances have been tracked** from different portfolio clusters. **Industrial-Urban Symbiosis, CO<sub>2</sub> carbon capture and use and Digital clusters** represent **success stories** in themselves and have delivered game-changing results in the Roadmap 2030.

All eight SPIRE sectors (increasing to ten in 2020) are active in projects and collaborating on cross-sectorial innovations. The overall success rate for proposals in response to SPIRE Calls is 23%. A total of **1775 organisations have participated<sup>2</sup> in granted projects: 275 are Higher or Secondary Education Establishments, 1010 private for-profit entities, 33 are Public Bodies and 363 research organisations (+33 others). 29 % of participants are SMEs.**

---

<sup>1</sup> The Trends Report is not based on the survey A.SPIRE usually sends to the SPIRE projects coordinator. It is based on data from the results of the calls.

<sup>2</sup> Some of them in multiple projects for a total of 1972 participations.

## CHAPTER 1 – PROGRESS OF PARTICIPATION

This chapter provides an overview of the trends in the **participation in SPIRE calls** during the 2014-2019 period. Indicators such as progress in success rate and the evolution in the number of companies and organisations involved will also be considered.

### PARTICIPATION

The first data to be discussed is the evolution in the number of **eligible proposals** submitted. A total of 1126 proposals have been submitted to SPIRE calls and in other calls supported by the Partnership.

The total number of the qualified proposals sent in response to **SPIRE calls** is **342**. Table 1 shows how this number has evolved in comparison to the **Grant Agreements** in the same calls: a total of **79** during 2014-2019. Along with the proposals, an analysis can be made of the progress in the **number of organisations** - represented by the **red line** - involved in the 342 eligible proposals.

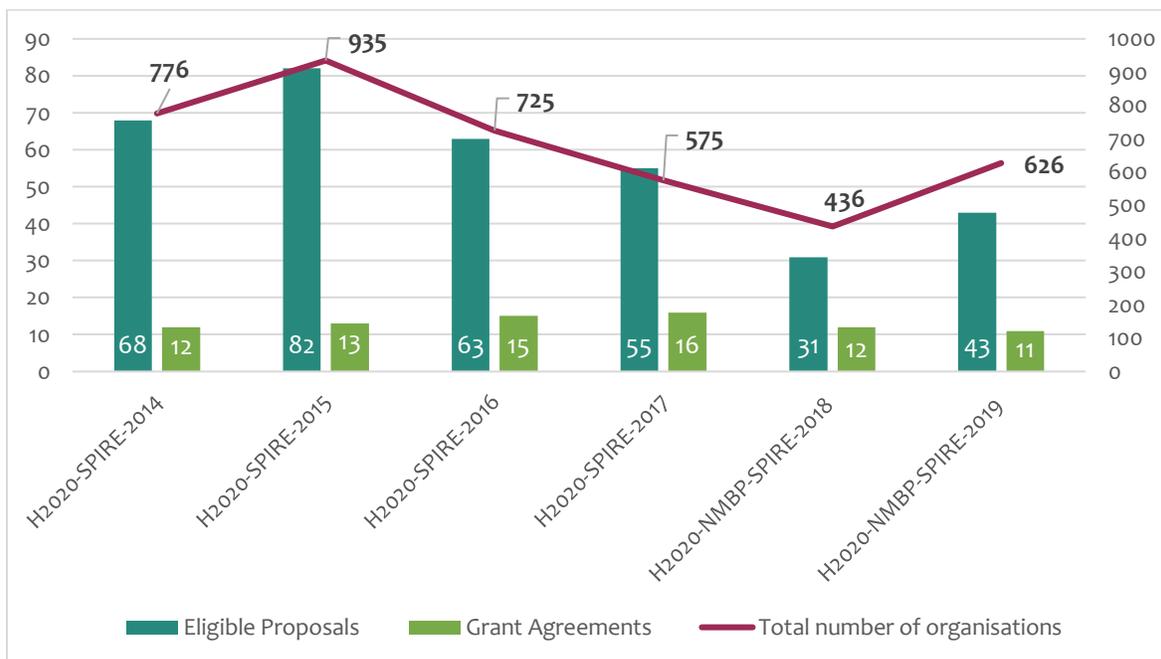


Table 1: 2014-2019 SPIRE calls participation

The total number of qualified proposals sent in response to other SPIRE related calls<sup>3</sup> is **784**. In Table 2 the number of eligible proposals between 2014 and 2019 is compared to the total number of Grant Agreements (GAs) concluded in the same calls (77) and the number of **SPIRE GAs for these calls (46)**.

<sup>3</sup> Calls included in SPIRE related calls are not labelled as SPIRE but address SPIRE 2030 Roadmap objectives and are supported by the Partnership.

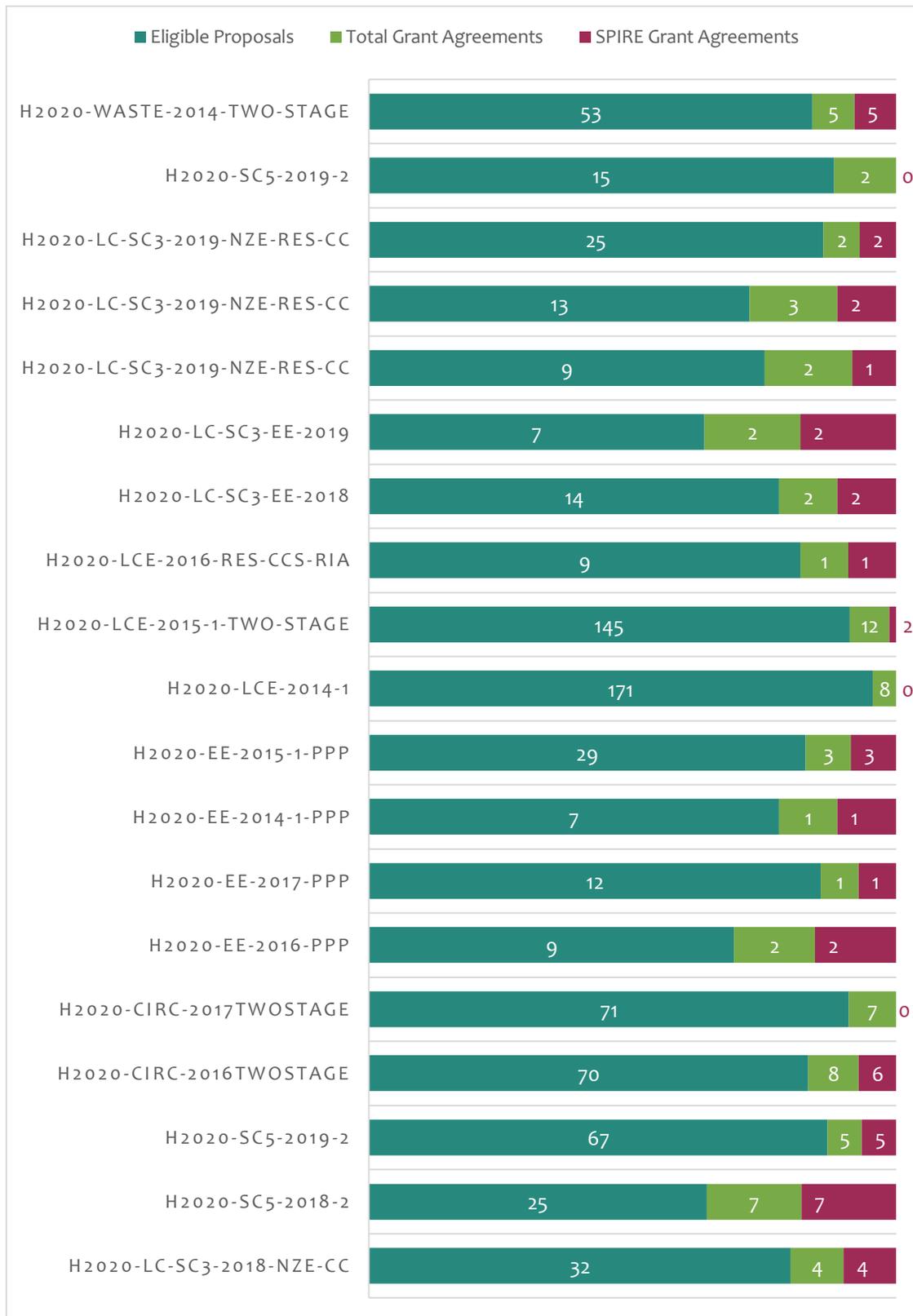


Table 2: 2014-2019 SPIRE related calls participation

## SUCCESS RATE

A significant factor to monitor in all the **calls supported by SPIRE cPPP** and launched between 2014 to 2019 is the **success rate**: the **percentage of the eligible proposals that resulted in grant agreements**.

For the SPIRE calls from a total of 342 proposals, 104 successfully passed the quality threshold (30.4%) and, of those, 79 concluded a grant agreement. This gives an aggregate success rate for SPIRE labelled calls of **23%**.

This parameter shows in Table 3 a general **positive trend** from 2015 onwards, with a peak for success rate in 2018. It is worth noticing that for SPIRE calls, 2018 was both the year with highest success rate and the year with the lowest number of eligible proposals participating and that 2015 was both the year with the lowest success rate and the year with the highest number of eligible proposals. It is worth mentioning that **70% of the 79 projects from SPIRE calls are coordinated by A.SPIRE members**.

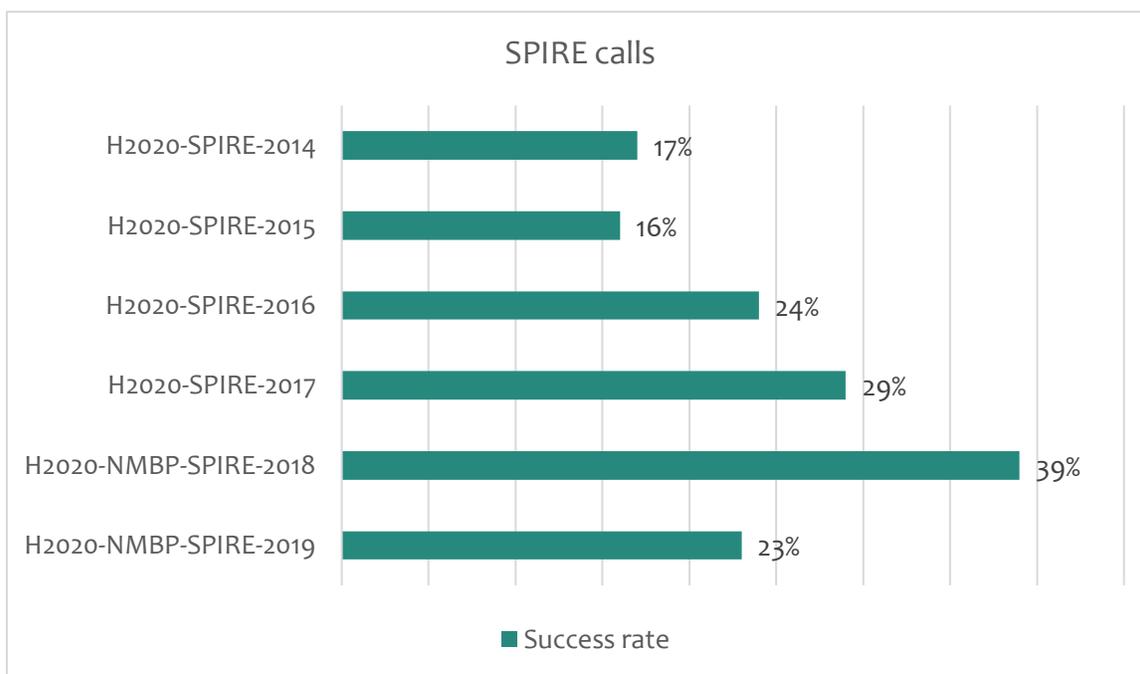


Table 3: 2014-2019 evolution of SPIRE calls success rate

A different approach is used to calculate the success rate for the SPIRE related calls. In fact, these SC3, SC5, CIRC, WASTE, EE, and LCE calls addressed **SPIRE 2030 Roadmap** goals, but only some, and sometimes none, of the received proposals were fully or directly aligned to SPIRE roadmap objectives. The calculation of the success rate therefore considers the ratio between the total number the GAs achieved and the number of the SPIRE-relevant GAs.

In calculating the data for Table 4, the SPIRE related calls with zero GAs for SPIRE projects have been excluded as we do not know if any of the proposals were fully or partially addressing SPIRE objectives or were directly SPIRE related. For the same reason it is not consistent to make an average success rate, since we cannot assess how many SPIRE related proposals were actually submitted.

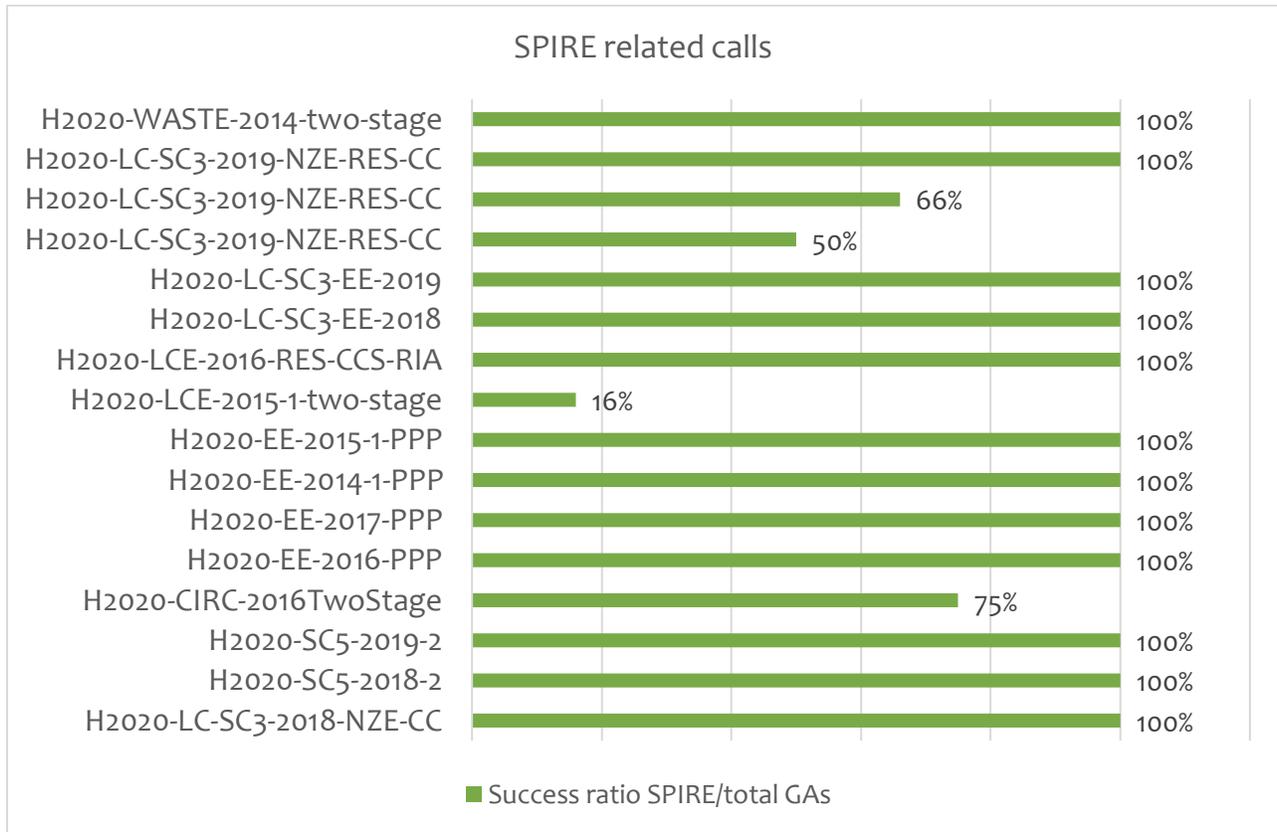
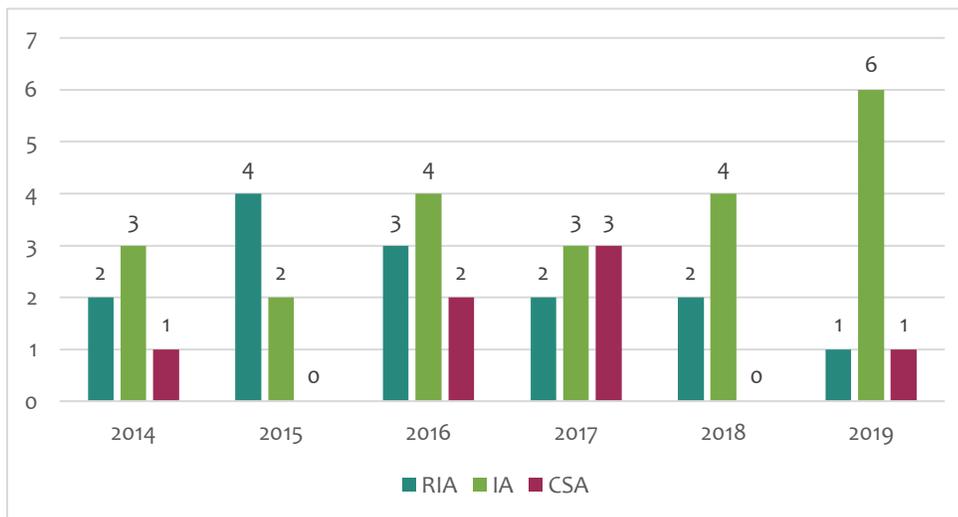


Table 4: 2014-2019 relative success ratio for SPIRE related calls GAs

**TYPE OF ACTION AND ORGANISATIONS**

In the same 2014-2019 timeframe, projects were submitted to all the calls above supported by the SPIRE cPPP. The pool of different calls offered can be differentiated by the **type of action: Research and Innovation Actions (RIA), Innovation Actions (IA) or Coordination and Support Action (CSA)**. Table 5



shows an overview of the evolution in calls offered based on types of action is given.

As a further step in identifying trends in the projects granted from **SPIRE calls**, it is relevant to assess and calculate how the **composition of partners groups** has changed over time.

Table 5: all SPIRE calls per types of action

The analysis, presented in Table 6, is based on the following classification of participating organisations in SPIRE projects:

- **Higher education establishments (HES)**
- **Private companies (PRC)**
- **Research organisations (REC)**
- **Public sector (PUB)**
- **Other (OTH)**

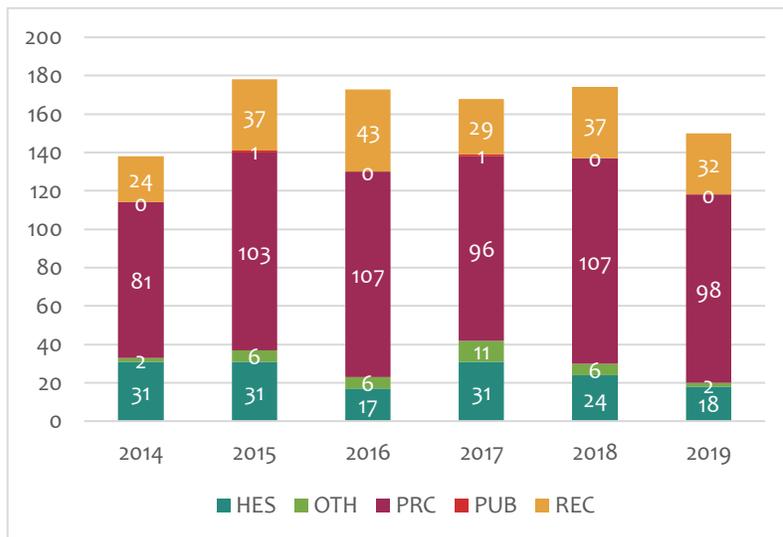


Table 6: composition of organisations on projects from SPIRE calls

This paragraph shows the aggregated number of participating organisations in 2014-2019 (**981 in total**) SPIRE calls granted projects, with **152 Higher education establishments, 592 Private companies, 170 Research organisations, 2 Public sector and 33 Other.**

Considering the complete scenario of SPIRE and SPIRE related calls granted projects, a total of 1775 organisations are involved. 1010 of them were private entities and at least<sup>4</sup> 513 - **a share of 29%** - presented themselves as **SMEs** distributed among the HES, OTH, PRC and REC categories. The analysis considers the data for private companies to assess participation by company size (SMEs %, others %) in all 125 projects. The European Commission contribution granted to **SME participants totals EUR 205 million (EUR 205 937 203)**. The private companies involved, with a share always greater than 50%, represented the most prominent stakeholders among the participant organisations

## COUNTRIES

To date, **32 countries** have participated in the **79 projects funded by SPIRE calls** with the participation rate (expressed in numbers of beneficiaries) shown in Table 7. Out of the EU-28, 24 countries are represented, including **5 Eastern Europe countries** (Czechia, Hungary, Poland, Romania, Slovakia) and with the additional external participation from 8 non-EU countries: **Switzerland, Israel, Iceland, United Kingdom, Norway, Serbia, Turkey and South Africa.**

<sup>4</sup> 22% of participants – 396 in total - did not provide information about SME status: some of these will also be SMEs.

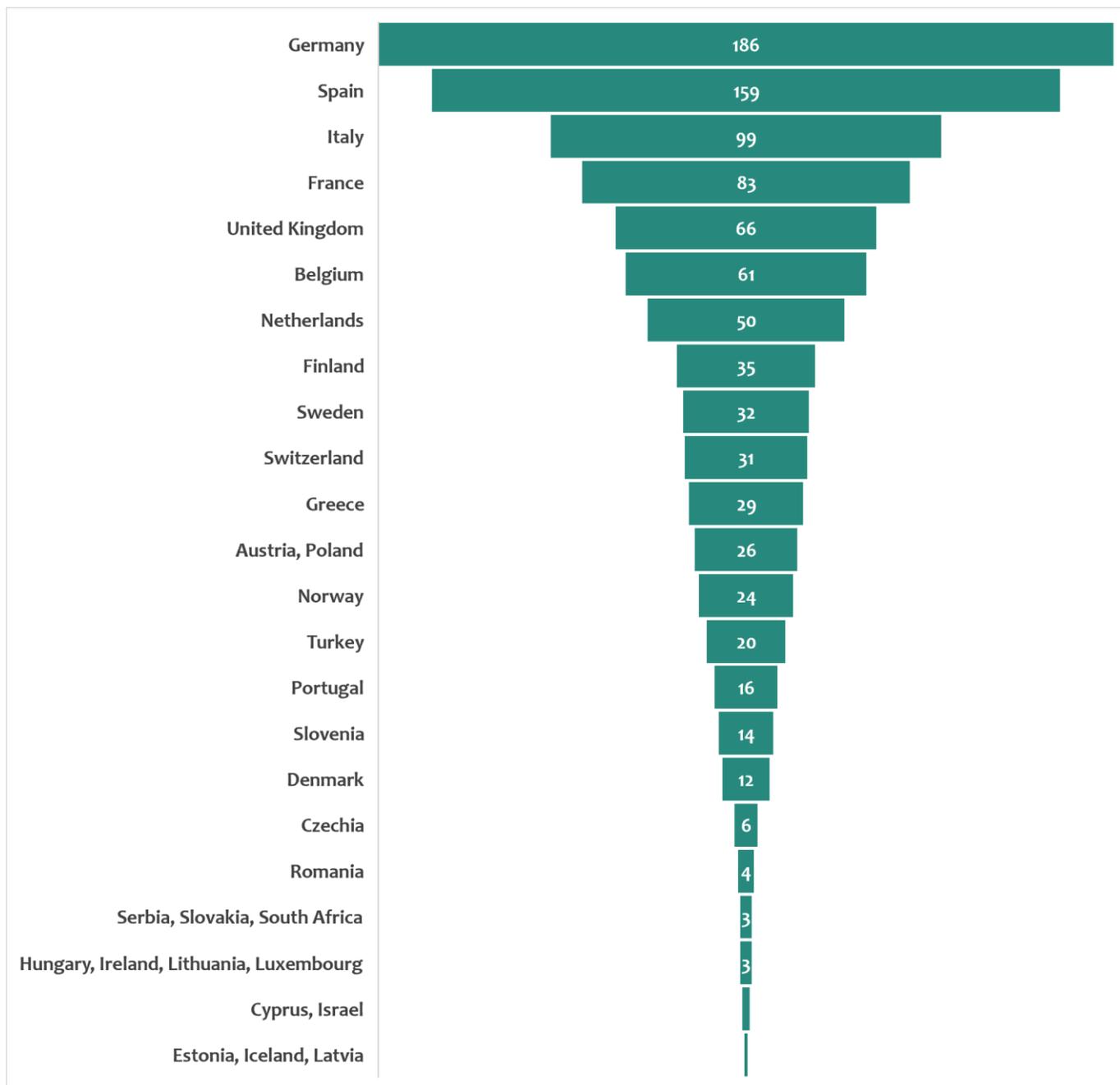


Table 7: participants countries in SPIRE calls GAs

## BUDGET

Considering the overall 2014-2019 SPIRE activity, a total of EUR 817 million (EUR 817.744.312,24)<sup>5</sup> was provided through Grant Agreements for the 125 projects.

<sup>5</sup> Calculated on the maximum EU contribution per project.

## CHAPTER 2 – PROCESSES4PLANET BUILDING ON SPIRE RESULTS

### OUTCOMES AND INSIGHTS

The Processes4Planet partnership was born to support European aims to become the **first climate neutral continent** in the world and to reach a circular economy **by 2050**. This target implies a systemic transformation in the next three decades for **process industries**, that are already pivotal in many value chains. SPIRE sectors - cement, ceramics, chemicals, engineering, minerals and ores, non-ferrous metals, steel, and water with the newer recruits - refining and pulp and paper sectors - are crucial for closing loops along and across their value chains and enabling climate neutral solutions. This shift requires a **holistic approach** and united efforts in a socio-economic framework. At this interface, **Processes4Planet (P4Planet)** has been launched as one of the new Horizon Europe partnerships promoted by the European Commission. P4Planet supports process industry sectors in rethinking how materials are produced and how they flow along their lifecycle.

In this perspective, developing innovation through **cross-sectorial collaboration** has great potential to provide an added value while enabling this scenario of carbon neutrality and economy circularity to happen. A.SPIRE envisions the Processes4Planet partnership as the most effective tool to make the P4Planet 2050 Roadmap a reality. In 2014-2019 the SPIRE cPPP has developed a pipeline of projects with high positive impact involving industries, society, international organisations and other stakeholders. With reference to the SPIRE **2030** Roadmap, for most of its innovation programmes excellent **outcomes** have been achieved in terms of lower **GHG emissions, waste reduction and competitiveness**.

Through cross-sectorial technological and non-technological innovation efforts, SPIRE has opened the way and Processes4Planet will build on its results and learning while enriching a portfolio of projects that progresses towards three general objectives:

- Developing and deploying climate-neutral solutions,
- Closing the energy and feedstock loops,
- Achieving a global leadership in climate-neutral and circular solutions, accelerating innovation and unlocking public and private investment (competitiveness).

Processes4Planet will work on emerging technologies and on the scaling up of technologies already developed at higher TRLs to deliver expected CO<sub>2</sub> emission reductions by 2030 and to achieve its full impact by 2050. Processes4Planet will implement its cross-sectorial R&I roadmap through four transformation levers:

- Process innovation, with four core drivers: energy mix (including H<sub>2</sub>), energy and resources flexibility/efficiency, electrification of industrial processes and Carbon Capture and Use (CO<sub>2</sub>),
- Industrial-urban symbiosis,
- Digitalisation,
- Non-technological innovation.

## SUCCESS STORIES PORTFOLIO

With the end of the SPIRE partnership programme in sight, SPIRE projects are feeding into the strategic agenda of P4Planet. This first edition of the **Trends Report** features outstanding thematic project clusters as SPIRE success stories. Industrial-Urban Symbiosis, CO<sub>2</sub> Carbon Capture and Use and Digitalisation achievements highlight how SPIRE's work in 2014-2019 has boosted the development of many highly promising innovations for process industries that can enable them to be more sustainable and resource and energy efficient.

## INDUSTRIAL-URBAN SYMBIOSIS

Eight of the projects that SPIRE has funded and supported in the field of **Industrial Symbiosis (IS)** can be viewed as a coherent and high impact network. They are first line in promoting sharing of physical resources such as energy, water, residues and recycled materials both between different industrial processes and at a site level. For example **EMB<sub>3</sub>RS**, with its heat and cold matching tool, has the potential to **reduce 30% of CO<sub>2</sub> emission for a cement plant** by recovery of excess heat. While the **EPOS project** acts **on-site** and brought together five process industries - steel, cement, chemicals, minerals, and engineering - in one cross-sectorial IS system that offers a wide range of technological and organisational options for making businesses and operations more efficient, more cost-effective, more competitive and more sustainable.

This cluster of projects has already demonstrated the potential to increase business opportunities, create new jobs and the power to drastically reduce environmental impact in different sectors sectors. **FISSAC** developed an innovative IS model for a **zero-waste approach in resource intensive industries**. Besides guidelines and training, the project also has led to novel blended cement and eco tiles at TRL6 leading to 35-40% GHG reductions and 25-30% waste reduction.

A.SPIRE has promoted a further shifting, building on the results of this cluster of projects, from a purely industrial perspective to a holistic vision and the concept of **Industrial-Urban Symbiosis (I-US)** that has led to the proposal of the **Hubs4Circularity<sup>6</sup> within the Processes4Planet 2050 roadmap**.

---

<sup>6</sup> A SPIRE 'HUB FOR CIRCULARITY' is defined as a focal point of interconnected industrial (large companies as well as SMEs) and/or public facilities, within a given geographical area, that collectively achieve a demonstrable level of circularity and carbon neutrality in their use of resources (including feedstock as well as energy and water) whilst boosting global competitiveness of the EU Process Industry and sustainable growth.

The **INCUBIS** project has contributed to this success applying the I-US paradigm to **entire industrial parks or districts** with the potential for 22 kton CO<sub>2</sub>eq per year saved at the initial stage of the project and 55 kton CO<sub>2</sub>eq per year in three years.

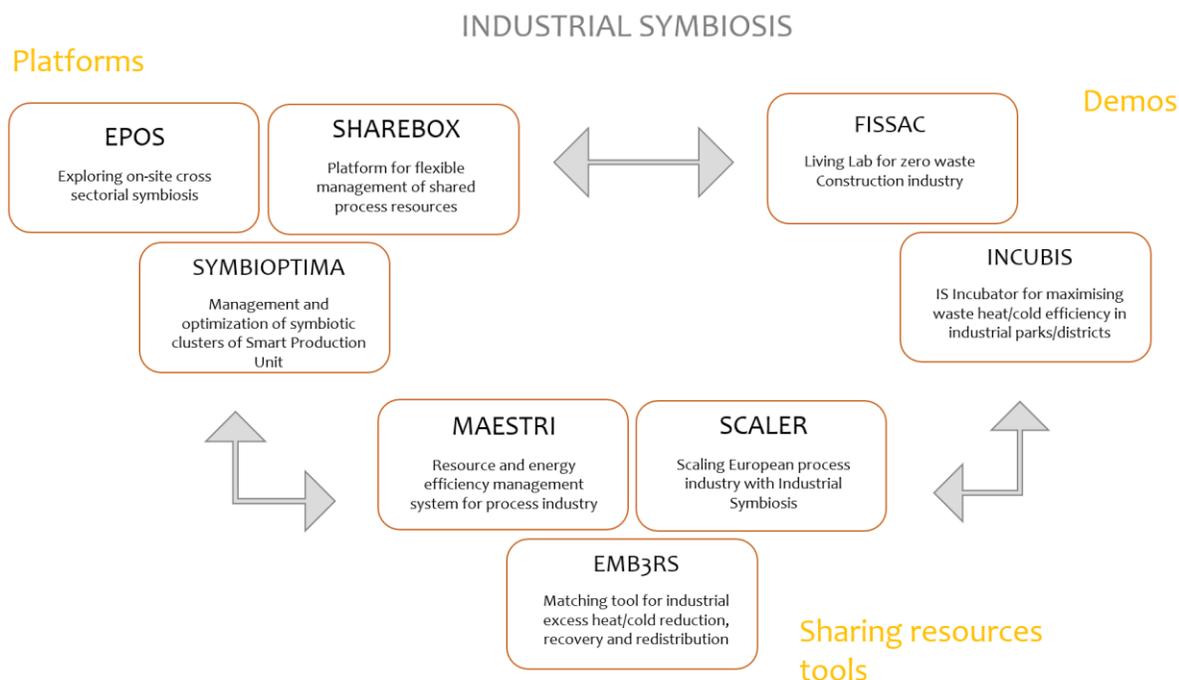


Figure 1: *INDUSTRIAL SYMBIOSIS* success story portfolio

Figure 1 shows how the projects in this cluster have targeted the goals of IS and IUS for A.SPIRE and how they are related in their scope. This has been crucial for the SPIRE 2030 Roadmap and will be even more so for the [P4Planet 2050 Vision Roadmap](#). The figure highlights the correlations between some of the projects (platforms, sharing resources tools, demos) and their coherency in reaching the final goals of the Industrial Symbiosis cluster.

Based on these learnings and outcomes, the P4Planet 2050 Roadmap includes one completely dedicated Innovation Programme that will help scale up I-US concepts.

### CO<sub>2</sub> CARBON CAPTURE AND USE

Among the projects that SPIRE supported under the driver of **Carbon Capture and Use** in 2014-2019, this Report points to an outstanding cluster of **12 projects**. Becoming the first climate neutral continent is one of the EU’s main goals under the Green Deal and the SPIRE partnership has created an eco-system of projects aligned with this objective through this cluster. Projects have the potential to tackle CCU goals at different levels. With **FRESME** a cost reduction of 80% is foreseen and up to 66 Mtons of GHG emissions

can be avoided. Great performances are also guaranteed from **MEFCO<sub>2</sub>**, that provides a **CO<sub>2</sub> reduction potential of 68%**.

Some process-related emissions in the industry will be difficult to reduce to zero. This is why technologies like **RECO<sub>2</sub>DE**, **ICO<sub>2</sub>CHEM** and **Carbon4pur** are disruptive to enable and take advantage of carbon capture and utilisation to make specific industries become greenhouse gas emission free.

The first solution has developed a 20% reduction of CO<sub>2</sub> emission in the cement industry by CO<sub>2</sub> capture, purification and conversion. The second has already an upscaled reactor to convert CO<sub>2</sub> into waxes (via an innovative Fischer-Tropsch) and the subsequent conversion into non-fossil-based coatings. Lastly, Carbon4pur technology allows a reduction of the CO<sub>2</sub> footprint of polyurethane production by 20-60% and a substitution of at least 15% of oil-based reactants by waste gas-based carbon.

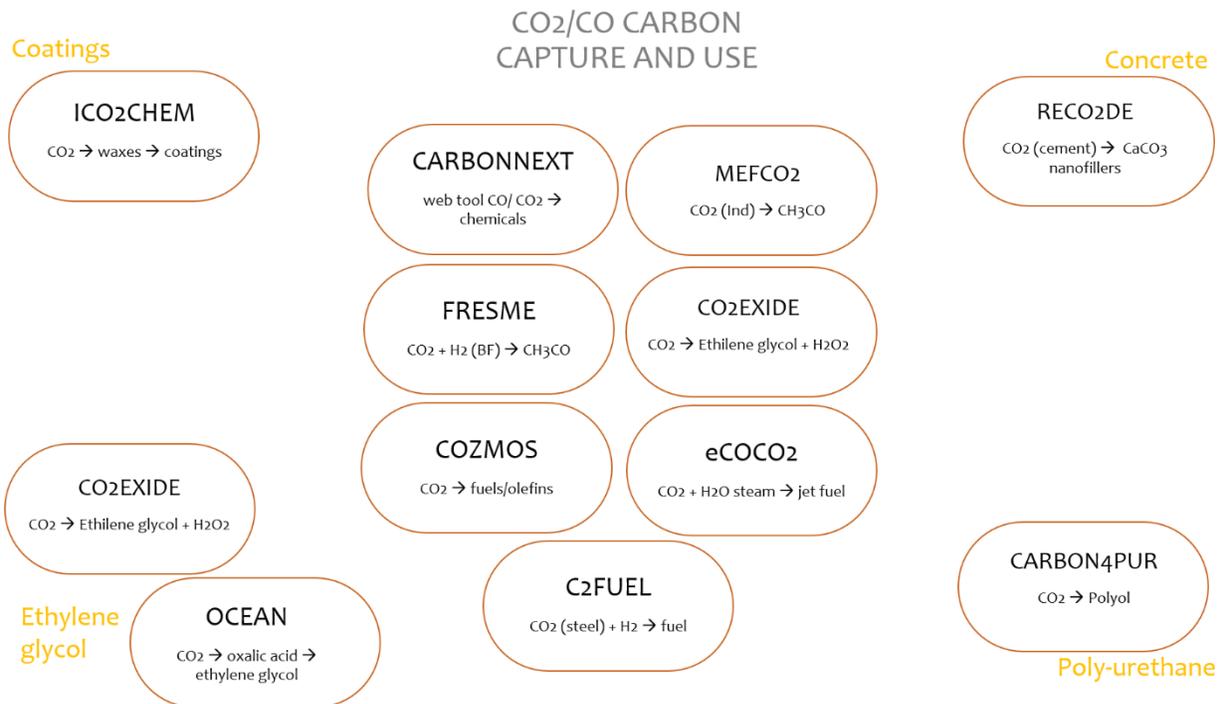


Figure 2: CO<sub>2</sub>/CO CARBON CAPTURE AND USE success story portfolio

Figure 2 highlights how these different projects are addressing significant modernisation or replacement of existing installations – in particular in the coatings, concrete, polyurethane and ethylene glycol industries. It also showcases the overall CO<sub>2</sub> carbon capture and storage thematic cluster that SPIRE has built.

Building on results and learnings from these projects, the P4Planet 2050 Roadmap includes seven Innovation Programmes that can escalate **Carbon Capture and Use**.

## DIGITAL

SPIRE has promoted digitalisation in the process industries with many projects and eight of them can be clustered in a success story network. These projects have demonstrated the power to **connect and enable value chains** by, for example, driving new business models like **CoPRo**. This technology provides decision support to operators and managers and allows progress to automated closed-loop solutions to achieve an optimal energy and resource efficient production. CoPRo, applied in petrochemical sites, consumer products, food canning, and viscose fibres supply-chains, leads to GHG emissions reduction by 10% thanks to improved energy and resource efficiency.

The projects in the digital cluster also allow optimisation of production demand. With a potential to reduce waste **in the plastic sector by 12-15%**, **MONSOON** technology provides economic and environmental improvements in the use and re-use of raw resources and energy.

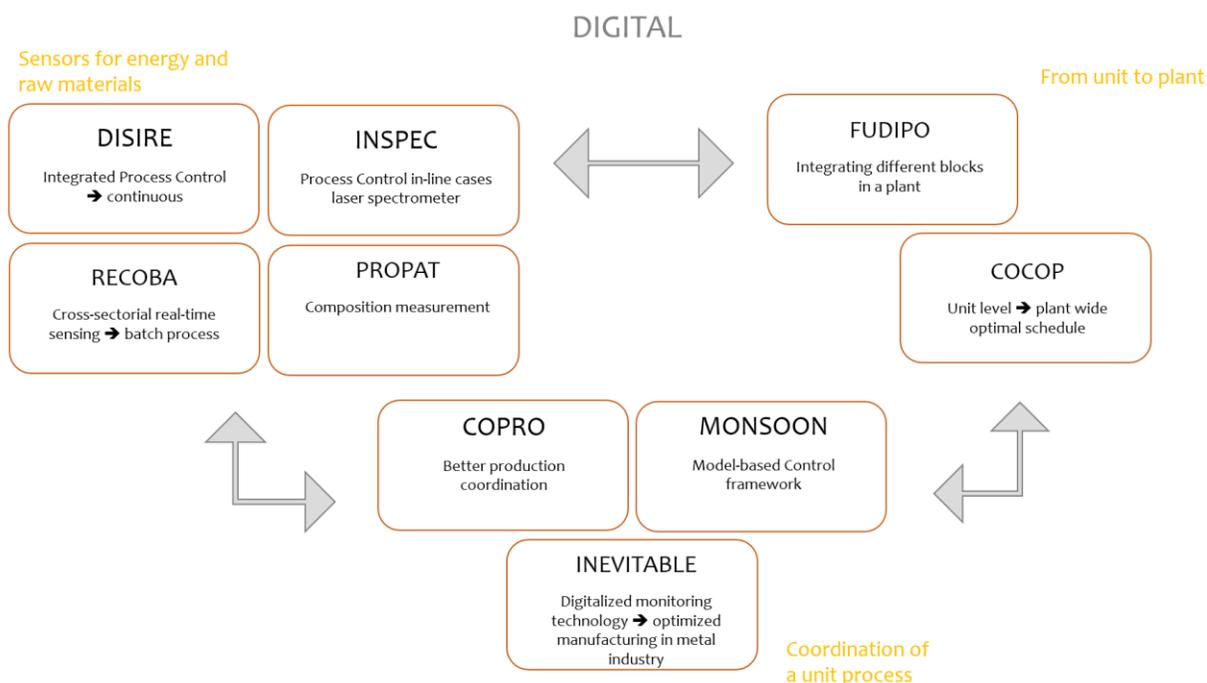


Figure 3: DIGITAL success story portfolio

The projects shown in Figure 3 have the power to untap the potential of digital technologies in all innovation areas for the process industry and escalate resource efficiency and productivity in a cross-sectorial way. The potential anticipated raises **process control and operations performance**. For this purpose **RECOBA** has developed a real-time temperature sensing technology that enables a new paradigm for the design and implementation of batch processes, with efficient predictive maintenance and real-time production scheduling. This solution applied to a number of metal sectors reduces GHG emissions by 600 kton per year, together with reduced energy and raw materials requirements.

This cluster of SPIRE projects on digital solutions is deeply related to **Process Industry 4.0.** concepts (artificial intelligence, big data, cybersecurity etc.). Project **DISIRE**, thanks to a reconfiguration of process models based on 'big data' analytics, can provide a 20-30% production capacity increase and savings of up to 20% in chemical, steel and non-ferrous industries.

With the P4Planet 2050 Roadmap A.SPIRE will build on these results including six Innovation Programmes to heighten the potential of digital solutions for process industries.

## CONCLUSIONS

A.SPIRE has defined an ambitious **mid-century R&I strategy** to promote the solutions for a climate changing world that the process industry can provide. The three success stories portfolio highlighted in this Trends Report show the extent to which the next generation of EU Process Industries will be the backbone of European competitiveness and sustainability. P4Planet's 2050 roadmap will be a keystone to develop these solutions.

To deliver **integrated digital European process industries that support a well-below 2°C and real circular future** for our planet and society, Processes4Planet 2050 roadmap includes 36 Innovation Programmes, many of them building on the learnings and outcomes of SPIRE projects. The following **innovation programmes** build directly on the success of the three portfolios signaled in this report:

### INDUSTRIAL SYMBIOSIS

- Process technologies for Industrial- Urban Symbiosis
- Business models & demonstration of Industrial- Urban Symbiosis

### CCU/CO<sub>2</sub>

- Capture & purification of CO<sub>2</sub>
- CO<sub>2</sub> to minerals
- CO<sub>2</sub> valorisation to chemicals, polymers & fuels

### DIGITAL

- Digitalisation of connected processes and supply chains
- Digitalisation of plants
- Digitalisation of process/product R&D

The SPIRE portfolio has seen a continuing increase in IA projects under its 2018–2020 Work Programme, in order to take innovations to higher TRLs, nearer to commercialisation and deployment. Beyond this, A.SPIRE sectors, with two new sectors - Refining and Pulp and Paper – joining the community in August 2020, are now working on an **'implementation plan'** (the Processes4Planet 2050 Roadmap) to build on the results of the SPIRE cPPP within **the forthcoming Horizon Europe Partnership: Processes4Planet**.



**A.SPIRE aisbl**  
**[www.spire2030.eu](http://www.spire2030.eu)**  
**Email: [info@spire2030.eu](mailto:info@spire2030.eu)**