SPIRE 2050

Cities of the Future 2019 Brokerage Event

Workshop 3: Circulare Economy, Raw materials & SPIRE

Brussels, 8 November 2019

SPIRE ADDED VALUE

+150
Members teaming up

SPIRE
Sustainable Process Industry through Resource and Energy Efficiency

€900
Million budget (2014-2020)

8
Sectors

20
Countries

95%
Of investments in EU

Challenges
- Resources & energy
- Competitiveness
- High-risks/long-term investments

Strengths
- 6.3 million direct jobs
- 19 million indirect jobs
- 450,000 enterprises
- €1,8 trillion/y turnover
- 4.7% OF EU28 GDP

SPIRE 2050 ambitions

Sustainable Process Industry through Resource and Energy Efficiency

HUBS FOR CIRCULARITY (H4C)

One of our tools to broaden and accelerate the three ambitions

Territorial connection: regions, cities, communities

Closing the climate technological gap

Development of the required solutions to fully contribute to the EU Climate Neutrality scenarios

2015
-37% in $CO_{2éq}$ emissions versus 1990

2030
key technologies of SPIRE Vision 2050 ready for deployment (TRL9)

2050
-80% in $CO_{2éq}$ emissions versus 1990

Circular Resources for zero-landfilling

Spread the Hubs for Circularity across Europe to develop the required solutions to **move towards zero-waste-to-landfill**.

2030
key technologies of SPIRE Vision 2050 ready for deployment (TRL9)

2050
ZERO landfilling of recyclable / recoverable waste in the EU

Global competitiveness

Development of technologies which create new investment opportunities for globally competitive EU Process Industries

Average growth in Gross Value Added of SPIRE sectors over the period 2021-2050 above average GDP growth in the European Union

2021
Kick-off Horizon Europe

2030
key technologies of SPIRE Vision 2050 ready for deployment (TRL9)

2050

HUBS FOR CIRCULARITY (H4C)

THE CONCEPT

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 H4C will become the new business centres of the future:

- Act as a competence and resource hub developing RDI initiatives
- Set up a voluntary industrial and social culture of emissions and waste reduction
- Driven by Process Industry and connecting their solutions to territorial demands
- Set up a Business to Territory (B2T) Plan
- Connected to other sectors and regions

ELEMENTS OF H4C

SPIRE
Sustainable Process Industry through Resource and Energy Efficiency

Regional demands

- Societal needs
- Customer needs
- Stakeholder demands

Hub for Circularity

Regional Community

- Process industry
- SMEs
- Other sectors
- RTOs
- Civil society
- Financial institutions

Sustainable model

- B2T plan
- Co-investments model

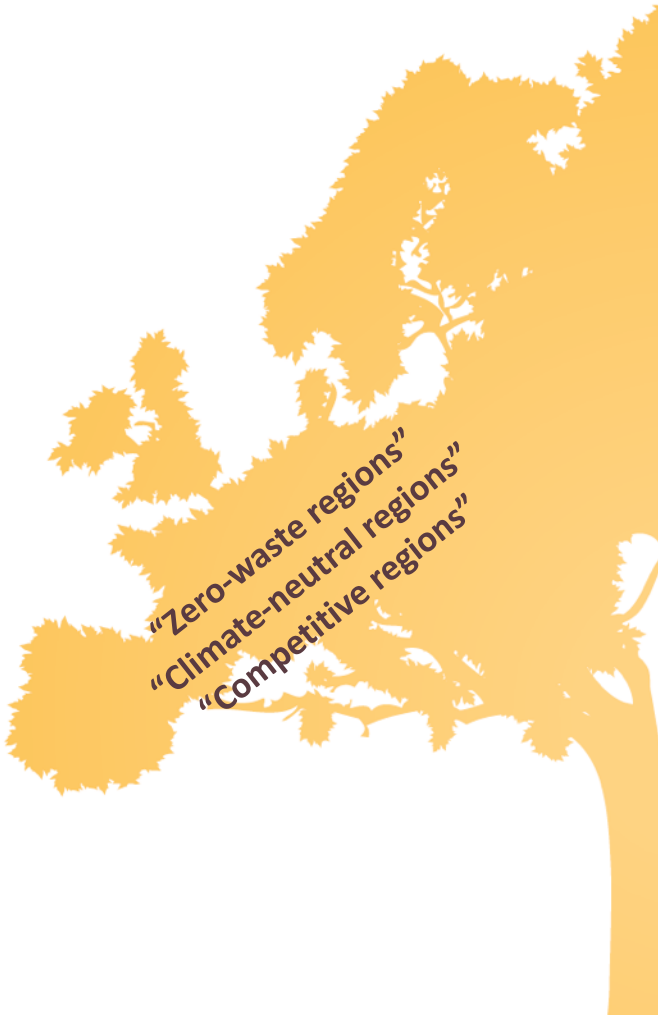
Disruptive innovation

- Technology
- Processes
- Business models
- Social innovation

Export to other hubs/regions

Regional benefits

- Knowledge sharing
- Competences sharing
- Joint business development
- Job development
- Identifying demands together



SPIRE Topics in 2020 (5/02/2020)

SPIRE
Sustainable Process Industry through Resource and Energy Efficiency

- CE-**SPIRE**-01-2020: Tapping into the potential of **Industrial Symbiosis** (IA, 70%)
- CE-**SPIRE**-07-2020: Preserving fresh water: **recycling industrial w**aters industry (IA, 70%)
- LC-**SPIRE**-08-2020: Novel **high performance materials and components** (RIA)
- CE-**SPIRE**-09-2020: **Alternative Mineral resources** for high volume production (IA, 70%)

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- DT-**SPIRE**-11-2020: **Artificial Intelligence** and Big Data Technologies for Process Industries (CSA)

CE-**SPIRE**-01-2020: Tapping into the potential of **Industrial Symbiosis** (1)

Specific Challenge:

- Major improvements in resource and energy efficiency for all energy intensive industries.
- Accelerate the transition to a circular economy and to renewable energy systems, reduce waste heat energy and lead to significant reduction of GHG emissions.

Challenge:

- Need to tackle technological and non-technological barriers to harness its full potential.
- Energy grids and adjacent infrastructures as well as the local and regional dimension are all critical factor which must be taken into account

CE-SPIRE-01-2020: Tapping into the potential of Industrial Symbiosis (2)

Demonstrate novel symbiotic value chain involving multiple industrial sectors in real industrial settings.

Proposals are expected to address:

- Broader symbiosis with infrastructures communities and energy grids.
- Management of side/waste streams specifically for the use as resource for other plants and companies across sectors and/or across value chains;
- Process (re-)design and implementation to integrate and adapt existing processes to enhance industrial symbiosis.
- Integration of information technology (e.g. AI) for multi-criteria decision making, the design and management of IS in a dynamic production environment. Considering data sharing and preservation of data confidentiality.

CE-SPIRE-01-2020: Tapping into the potential of Industrial Symbiosis (3)

Scope:

- Assessment methodologies and KPIs to measure the performance of symbiosis, including environmental, economic and social impacts and existing best practices;
- Consider Non-technological aspects (e.g. regulatory issues, standards, and new business models) covering ownership, management and fair sharing of benefits.
- Clustering and cooperation with other selected projects under this cross-cutting call and other relevant projects is strongly encouraged.

CE-SPIRE-01-2020: Tapping into the potential of Industrial Symbiosis (4)

Sustainable Process Industry through Resource and Energy Efficiency

Expected Impact:

- Step change towards closing circular loops;
- Improvement of at least 15% in energy efficiency;
- Reduction of at least 30% in total energy intensity;
- Overall reductions in CO2 emissions of 40%;
- Reduction in primary raw material intensity of up to 20%;
- Reduction of waste generation by at least 25%;
- Better understanding of relevant barriers (e.g. end of waste criteria);
- The environmental gains in absolute figures, and weighted against EU and global environmental footprints, should be demonstrated;
- The replication potential should also be assessed.

- *EUR (12-20 millions)*

CE-**SPIRE**-07-2020: Preserving fresh water: **recycling industrial w**aters industry (1)

Specific Challenge:

- Energy-intensive industries are major users of fresh water, for e.g. processing, washing, diluting, heating, cooling, and transporting products.
- Since fresh water is a scare resource, breakthrough innovations are needed in energy-intensive industries to recycle water and create closed loops in industrial processes and reduce the use of fresh water.
- Industrial symbiosis offers the potential for energy, water and other resource efficiency at a scale beyond energy intensive industries.

CE-SPIRE-07-2020: Preserving fresh water: recycling industrial waters industry (2)

Scope:

- Proposals should aim at near-zero discharge using closed-loop systems in combination with recovery of energy and/or substances (resources) through the development of integrated water-smart strategies for industrial processes.

Strategies should take into account:

- Better characterization of water usage and production in the industrial processes.
- Defining recycling options with a combined water, waste and energy approach in an integrative system design method considering investment and optimal operations.
- Reduce water demand through design, control options, and technologies integration that reduce water consumption, recycle water, and reduce the use of fresh water (e.g. cascading use of different kinds of water in industrial settlements or for compatible re-use in urban and rural areas).

CE-SPIRE-07-2020: Preserving fresh water: recycling industrial waters industry (3)

Scope: Proposals should develop new technologies and approaches at a large scale, considering:

- Real time smart monitoring and management systems with innovative digital solutions for sensors and actuators.
- Recovery technologies such as highly selective separation and extraction processes;
- Integrated Water Management should consider different qualities and sources of water
- Scale-up testing to robust industrial processes will be required.
- Clustering and cooperation with other selected projects under this cross-cutting call, and with other relevant projects, SC5-04-2019 "Building a water-smart economy and society", is strongly encouraged.

CE-SPIRE-07-2020: Preserving fresh water: recycling industrial waters industry (4)

Expected Impact:

- Significant reduction of the current use of fresh water resources.
- Significant steps towards near-zero discharge using closed-loop systems in industrial processes.
- Significant increase of the recovery of water, energy and/or substances and materials.
- Increase of resource and water efficiency by 30% compared to the state-of-the-art.
- The environmental gains in absolute figures, and weighted against EU and global environmental footprints, should be demonstrated.
- In addition, the replication potential should also be assessed.
- Relevant indicators and metrics, with baseline values, should be stated clearly in the proposal.

(8 – 12 million)

LC-**SPIRE**-08-2020: Novel **high performance materials and components** (1)

- Proposals should develop and test high performance materials and combined components to withstand extreme and varying conditions that are expected in future processes. The proposals need to consider the following aspects:
- Design, including through modelling and artificial intelligence, development, processing and testing of highly innovative materials with improved properties for specific industrial application;
- Components embedded with sensors to minimise industrial processing conditions constraints;
- Significant increase in lifetime of equipment;
- Reduction of environmental impacts in terms of waste management and energy and resource consumption.

LC-**SPIRE**-08-2020: Novel **high performance materials and components** (2)

- The proposed solutions across value chains should demonstrate at least two out of following three impacts:
- Energy efficiency improvement of the target production and/or operation processes of at least 30%;
- Reduction of CO2 emissions and resource utilisation by 20%;
- Increased lifetime of the equipment by at least 20%.

- Relevant indicators and metrics, with baseline values, should be clearly stated in the proposal.

LC-**SPIRE**-08-2020: Novel **high performance materials and components** (3)

- Proposals submitted under this topic should include a business case and exploitation strategy.

- Activities should start at TRL 3 and achieve TRL 5 at the end of the project.

(4 – 6 Million €)

CE-**SPIRE**-09-2020: **Alternative Mineral resources** for high volume production (1)

Specific Challenge:

- Energy intensive industries in Europe depend on the one hand on very large volumes of minerals and other raw materials. On the other hand, they heavily rely on imports from third countries. The environmental footprint of high-volume products is also too high.
- The challenge is to develop technologies for the uptake of secondary raw materials based on industrial symbiosis, waste collection, or water treatment systems, and leading to new value chains or even value loops.
- Such new technologies should enable overcoming barriers such as low costs of primary raw materials or differences in taxes across countries and regions.

CE-**SPIRE**-09-2020: **Alternative Mineral resources** for high volume production (2)

Scope:

- Regulatory aspects such as transport and use of secondary material in new products put on the market.
- Information guides should be provided and facilitate decision making.
- Proof of concept should be delivered at pilot or demo scale to demonstrate convincingly scalability towards industrial applications.
- Clustering and cooperation with other selected projects under this cross-cutting call and other relevant projects is strongly encouraged.

CE-**SPIRE**-09-2020: **Alternative Mineral resources** for high volume production (3)

Scope:

- Proposals should address the development of new high volume value loops and integrated supply chains through industrial processes enabling the cross-sectorial, symbiotic, use of mineral waste, by-products and end-of-life materials from other industry sectors;
- The secondary materials can be used either as raw material for the production process or can be introduced in a subsequent process step to an intermediate product where they become a constituent of the final product;
- Composition variability of wastes or by-products can be addressed either by purification processes prior to production, or within the production process.

The following aspects should also be considered:

- Product specifications compliance;
- Economic viability of the proposed processes together with potential new business concepts.

DT-**SPIRE**-11-2020: **Artificial Intelligence** and Big Data Technologies for Process Industries (1)

Specific Challenge:

- Process Industries are becoming increasingly digitised. The development of devices, sensors and actuators, connected through the internet of things, allows machines to acquire capabilities such as identifying and optimising solutions, or making complex decisions.

DT-**SPIRE**-11-2020: **Artificial Intelligence** and Big Data Technologies for Process Industries (3)

Expected Impact:

- The impacts of the CSA are, through a roadmap identifying and developing strategies:
- Better exploitation of AI potential for all the different sectors in the process industries, and strategies for developing AI applications, including the generation of data;
- Identification of existing and future data requirements for the development of data driven technologies;
- Seamless collaboration of human operators with process control systems and plants;
- Implementation and further elaboration of the strategic research and innovation agenda announced in the EC Communication on Artificial Intelligence.

SPIRE related topics in 2020

- **LC-SC3-CC-9-2020 Industrial (Waste) Heat to Power conversion (01/09/2020)**

LC-SC3-CC-9-2020 Industrial (Waste) Heat to Power conversion

Scope:

- Integrate industrial waste heat-to-power conversion system using one type of fluid (supercritical CO2 or organic)
- Demonstrate the system operation in industrial environment at an output power level >= 2 MW.
- Bring the technologies to TRL 6 or 7
- EU Contribution: EUR 12 to 14 million (but can be different)

LC-SC3-CC-9-2020 Industrial (Waste) Heat to Power conversion (2)

Scope:

- Optimisation of thermal cycles for different temperature and constrained industrial environment, vs. efficiency and economics
- Development/improvement of tools, materials, components
- Integration, demonstration in industrial environment
- Technical and economic life cycle assessment of systems adapted for at least 4 industrial sectors, to demonstrate economic viability and exploitation strategy
- Dissemination Assess potential technology transfer to Energy Generation sector

LC-SC3-CC-9-2020 Industrial (Waste) Heat to Power conversion (3)

Expected impact:

- Improved cycles to achieve scalability to higher power levels, higher cost effectiveness, wider input temperature ranges, significantly reduced system size, allowing wider take up of heat recovery from more industrial processes
- Primary energy savings (GWh/year) in industry, potential primary energy savings in the power generation sector.

Sustainable Process Industry through Resource and Energy Efficiency

Connected across borders and to citizens

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