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H2020 Theme Oriented Training NMBP

Vladimir CID-BOURIE

A.SPIRE Programme Manager

Outline

- SPIRE cPPP in H2020
- NMBP – 2018-2020 calls
  - SPIRE topics
  - Catalysing the Circular Economy topics

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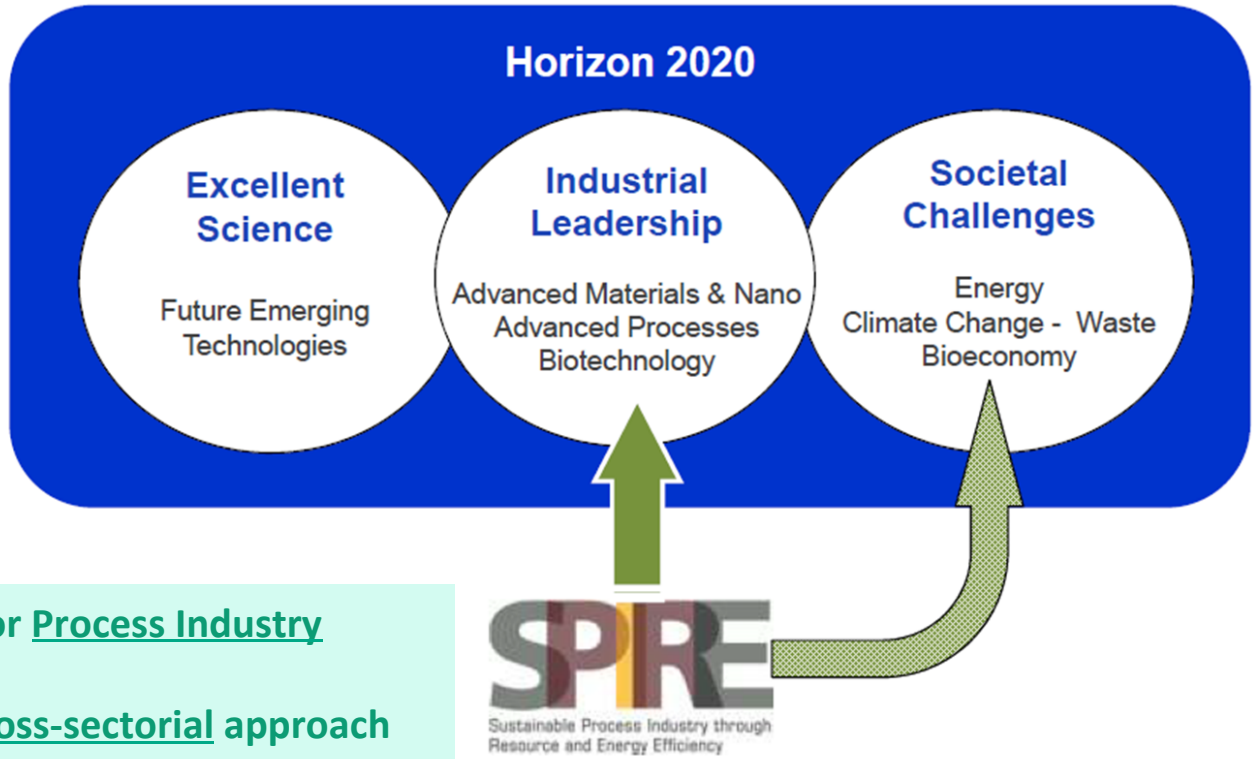
Horizon 2020 & SPIRE cPPP



1st cPPP for Process Industry

Unique cross-sectorial approach

cPPPs characteristics

A public procurement arrangement (business relationship) between the public sector and business where risks, rewards and responsibilities are shared.

The contractual arrangement specifies an indicative 7 years EU funding

- Budget is only committed on an annual basis through H2020 calls in Work Programmes
- Work Programmes are prepared on the basis of an industry-developed multi-annual roadmap
- Calls are open to all and come with high leverage factors (not legally binding)

- Industry has a leading role in defining research & innovation priorities in this roadmap (allowing long-term investment plans)
- More emphasis on relevance of industry and impact towards sustainability
- Focused on enabling industrial technologies – European competitiveness

SPIRE framework

Contractual Public-Private Partnership between European Commission & A.SPIRE supporting R&I for Process industries

"Public" SPIRE Budget: € 850M (DG RTD) + 50 (DG ENER) = **€ 900M**

Horizon 2020 rules for participation

- Openness: supporting all partners of projects, welcoming new stakeholders and new sectors across the whole Europe
- Collaborative: with the European Commission, Member States, Regions and all R&I stakeholders (members and non-members)
- Innovation foresight: moving towards the next generation of sustainable process industries

Horizon 2020 rules

- Single set of simpler and more coherent participation rules
- New balance between trust and control
- Moving from several funding rates or different beneficiaries and activities to just two
  - RIA (Research & Innovation Action): EU contribution up to 100% of the total eligible costs
  - IA (Innovation Action): EU contribution up to 70% of the total eligible costs (exception: non-profit legal entities who get 100%)
- Replacing the four methods to calculate overhead or «indirect costs» with a single flat rate (25%)
- Successful applicants to get working more quickly: time-to-grant of 8 months; exceptions for the ERC and in duly justified cases
- No negotiation of the grant agreement in future, what is submitted will be evaluated.

Sustainable Process Industries through Resource and Energy Efficiency (SPIRE cPPP)

Process industries key to Europe's manufacturing base: 20% of European industry in terms of both employment and turnover.

EU process industry highly dependent on raw materials and energy → efficiency key driver for both competitiveness and sustainability.

Central objectives: optimise industrial processing, reduce energy and resource consumption and minimise waste through cross sectorial approaches → Significant contributions to the Circular Economy and to fighting climate change.

SPIRE cPPP:

- EC responsible for drafting and managing WP under H2020 rules
- Roadmap based strategy developed by SPIRE community
- Topics in LEIT-NMBP, SC3 Secure, clean and efficient energy and SC5 Climate action, environment, resource efficiency and raw materials

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NMBP – SPIRE & CE calls for 2018-2020

- Provide major momentum to Research & Innovation across the process industry sectors with **+250 M€ in calls only from NMBP**
- Build on the positive results achieved so far, aiming at **large scale demos to enable prompt industrial deployment**
- Target breakthrough gains in **resource and energy efficiency** across the process industry, through **Industrial Symbiosis** and **cross-sectorial integration**, **recycling and recovery technologies**
- Support the development of **smart retrofitting** concepts to improve performance of existing large scale installations
- Enable the shift to **renewable electricity** (e.g. electrification)
- **International cooperation** may be particularly appropriate in some areas of the Sustainable Process Industry, in particular with Eastern Partnership countries (Ukraine, Moldova, Georgia, Armenia, Azerbaijan and Belarus)

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SPIRE topics

- CE-SPIRE-02-2018: Processing of material feedstock using non-conventional energy sources (IA)
- CE-SPIRE-03-2018: Energy and resource flexibility in highly energy intensive industries (IA 50%)
- CE-SPIRE-10-2018: Efficient recycling processes for plastic containing materials (IA)
- CE-SPIRE-04-2019: Efficient integrated downstream processes (IA)
- CE-SPIRE-05-2019: Adaptation to variable feedstock through retrofitting (IA 50%)
- DT-SPIRE-06-2019: Digital technologies for improved performance in cognitive production plants (IA)

SPIRE topics

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CE-SPIRE-02-2018: Processing of material feedstock using non-conventional energy sources (IA)

Specific Challenge:

- Non-conventional energy sources, such as microwave, plasma, ultrasound and laser, as well as electrochemical and photochemical processes, have already been applied in process intensification, mainly at lab scale, showing significant improvements in process performance (e.g. improved selectivity, crystal nucleation, reaction speed easing raw material demand) for the benefit of energy efficiency.
- The processes powered by non-conventional energy sources are suitable for connection to the electricity grid.
- They allow variable throughputs to better follow market demand and enable leaner production paradigms (e.g. decreased stock, production on demand).
- Such technologies are suitable for downscaling and continuous processing, where they can also be coupled with real time monitoring allowing a finer control of the transformations.

TRL 4 to 6

CE-SPIRE-02-2018: Processing of material feedstock using non-conventional energy sources (IA)

Scope:

Proposals are expected to develop technologies applying non-conventional energy sources to processes of high industrial interest. The concepts proposed should:

- Show potential for integration in a renewable electricity grid, and consider the relevant limitations (fluctuating nature of the electricity stream);
- Provide significant advantages in terms of resource and energy efficiency, compared to the current state of the art processes (or similar ones, as relevant);
- Provide improved flexibility, working at variable throughputs without major losses in the overall process performance;
- Be applicable to continuous processes and/or show potential enabling the replacement of current batch ones;
- Consider, where relevant, the possibility for containerised and/or mobile (e.g. biomass in situ processing) technologies;
- Consider Life Cycle Assessment proving a reduced environmental footprint;
- Consider replicability and scalability of the proposed concepts.

CE-SPIRE-02-2018: Processing of material feedstock using non-conventional energy sources (IA)

Expected impact:

- Allowing for a -30% to +30% energy input within RES fluctuations timeframes, without significant losses in specific energy efficiency;
- Improvement in energy efficiency of 30%;
- Improvement in resource efficiency of 30%;
- Decrease in CO2 emissions by 40% (without considering the electricity generation and at steady state);
- Decreased OPEX and CAPEX by 15%;
- Effective dissemination of major innovation outcomes to the current and the next generation of employees of the SPIRE sectors, through the development of learning resources with flexible usability. These should be ready to be easily integrated in existing curricula and modules for undergraduate level and lifelong learning programs.

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

EUR from 6 – 10 million

SPIRE topics

- CE-SPIRE-02-2018: Processing of material feedstock using non-conventional energy sources (IA)
- CE-SPIRE-03-2018: Energy and resource flexibility in highly energy intensive industries (IA 50%)
- CE-SPIRE-10-2018: Efficient recycling processes for plastic containing materials (IA)
- CE-SPIRE-04-2019: Efficient integrated downstream processes (IA)
- CE-SPIRE-05-2019: Adaptation to variable feedstock through retrofitting (IA 50%)
- DT-SPIRE-06-2019: Digital technologies for improved performance in cognitive production plants (IA)

CE-SPIRE-03-2018: Energy and resource flexibility in highly energy intensive industries (IA 50%)

Specific Challenge:

- Energy intensive industries should adapt their production processes and unit operations to increasingly sustainable, but highly fluctuating energy supply.
- To this end, energy and resource flexibility in the European process industry can be improved through the development of novel processes utilising more efficiently energy streams, heat recovery and raw materials flows with variable properties (including new or modified materials as well as secondary raw materials and by-products).
- The challenge is to establish synergistic integration at a regional level among different production sectors leading to optimisation of production system as a whole and logistics, especially in terms of the supply of energy and raw materials. This should reduce emissions and environmental impact, while maintaining competitiveness and job security.

TRL 5 to 7

CE-SPIRE-03-2018: Energy and resource flexibility in highly energy intensive industries (IA 50%)

Scope (1/2):

Solutions are needed for value chain optimisation through energy efficiency considerations in the design phase of manufacturing equipment and processes, collective demand side strategies, and potential integration of the nearby renewable energy sources.

In particular, proposals are expected to develop:

- Innovative production technologies allowing flexibility in terms of raw material, including new, modified or secondary raw materials, and intermediate or final products are expected to be developed. They have, at the same time, to consider quality of the main products and by-products in view of their valorisation through re-use and recycle;
- Novel advanced energy systems, could include new combustion and gasification techniques applied to the highly resource and energy intensive industries have to be developed;
- New developments should clearly indicate how the use of sustainable electrical energy sources, or heat recovery, could enhance energy efficiency and cope with a fluctuating energy input. These actions have to bring a significant impact on the sustainability profile of the process and/or the final products.

CE-SPIRE-03-2018: Energy and resource flexibility in highly energy intensive industries (IA 50%)

Scope (2/2):

Proposals need to consider the following elements:

- Treatment technologies and process integration solutions allowing a significant reduction as well as the valorisation, re-use and recycling of by-products and waste streams (solid, liquids and gaseous);
- System, process modelling and integration (up and down-stream) within the plant operation terms or symbiosis concepts, improving energy and raw materials efficiency and flexibility, and minimising the impact on the environment of the whole value chain. Taking also into consideration optimisation at a plant/system level. The activities have to be supported by a quantitative Life Cycle Assessment.

Proposals should include multiple demonstrators, including retrofitting of industrial installations, in a highly energy and resource intensive industry-relevant environment. The whole value chain should be considered, as well as relevant regulations which support the recycling of waste materials in Europe. Exploitation of structural and regional funds in connection with smart specialisation strategies is strongly encouraged.

CE-SPIRE-03-2018: Energy and resource flexibility in highly energy intensive industries (IA 50%)

Expected impact:

- Cost reduction of the process of at least 10% through the implementation of a flexible scheme in raw materials, including secondary raw materials, process and product quality specifications;
- Improved process efficiency through re-utilisation of energy and/or material process streams by at least 15%;
- CO2 emissions reduction by at least 5% and reduction of the environmental impact in terms of the main key performance indicators by at least 15%;
- Effective dissemination of major innovation outcomes to the current and next generation of employees, through the development, by education/ training experts, of learning resources with flexible usability. These should be ready to be easily integrated in existing curricula and modules for undergraduate level and lifelong learning programmes.

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

EUR from 8 – 12 million

SPIRE topics

- CE-SPIRE-02-2018: Processing of material feedstock using non-conventional energy sources (IA)
- CE-SPIRE-03-2018: Energy and resource flexibility in highly energy intensive industries (IA 50%)
- **CE-SPIRE-10-2018: Efficient recycling processes for plastic containing materials (IA)**
- CE-SPIRE-04-2019: Efficient integrated downstream processes (IA)
- CE-SPIRE-05-2019: Adaptation to variable feedstock through retrofitting (IA 50%)
- DT-SPIRE-06-2019: Digital technologies for improved performance in cognitive production plants (IA)

CE-SPIRE-10-2018: Efficient recycling processes for plastic containing materials (IA)

Specific Challenge:

- Plastics materials are produced mainly from raw materials of fossil origin (e.g. PE, PP, and PET). A variety of bio-based plastic materials are increasingly available. Plastic materials are used in a wide range of applications because of their properties, versatility, lightweight and price, for example for making lightweight polymer composites to substitute metals and in more traditional applications, such as packaging. The wide use of these materials results in a huge amount of plastic waste.
- Recycling and redesign of plastics are essential in reusing plastic waste material and avoiding landfill. This also allows utilising plastics as carbon sinks in an optimal way, before using them for energy recovery at the end of life.
- A major challenge lies in the development of process technologies, utilising plastic waste as starting material (at least in part). A better use of underexploited resource (plastic waste) for the production of added value products (not restricted to plastics but excluding fuels) and process streams would support the circular economy.

TRL 5 to 7

CE-SPIRE-10-2018: Efficient recycling processes for plastic containing materials (IA)

Scope (1/2):

Proposals submitted under this topic are expected to cover processes for the production of recyclable materials containing plastics. Aspects to be considered are:

- Improved energy and resource efficiency. The processes proposed are expected to have a lower environmental footprint compared to the current state of the art for the production of added value products; this should be proved by Life Cycle Assessment as well as Life Cycle Cost to prove the economic viability of the proposed technology;
- Integration with the relevant value chains, ensuring the secure supply of the raw material streams. In this respect, a clear strategy to involve the relevant actors along the value chain is expected;
- Process flexibility and ability to utilise waste heterogeneous plastic materials, including plastic composites, as input to allow the recycling and the re-processing of this widely available resource into added value products (excluding fuels). Sustainable raw materials, such as bio-based raw materials and organic waste could also be considered;

CE-SPIRE-10-2018: Efficient recycling processes for plastic containing materials (IA)

Scope (2/2):

- Key issues related to the quality of the raw (including secondary) material streams should be covered, and in particular the heterogeneity of the waste plastic material, as well as the wide variety of substances contained in plastic materials (e.g. plasticisers, anti-oxidants, etc.). The valorisation of fillers or fibres from composites should also be covered;
- Quality/specifications of the yielded streams ensuring their usability by downstream industries;
- Non-technological hurdles, such as regulations and standards, to enable the prompt deployment in industry of the developed concepts and economic indicators (e.g. CAPEX and OPEX).

Demonstration activities, prototypes and pilot implementations in real industrial settings for the concepts proposed are expected.

Proposals submitted under this topic should include actions designed to facilitate cooperation with other projects; to enhance user involvement; and to ensure the accessibility and reusability of data produced in the course of the project.

CE-SPIRE-10-2018: Efficient recycling processes for plastic containing materials (IA)

Expected impact:

- More efficient and sustainable chemical process and processing technologies utilising plastic waste as starting material for the production of added value products such as recyclable plastic materials (e.g. composites) and chemicals but excluding fuels);
- The technologies proposed should provide a decreased utilisation of primary fossil resources in the process industry of at least 30%;
- The concepts proposed should provide a decrease in CO2 emissions of at least 20%;
- The concept should utilise at least 70% of waste material including at least 40% of plastic waste;
- Effective dissemination of major innovation outcomes to the current next generation of employees of the SPIRE sectors, through the development, by education/training experts, of learning resources with flexible usability. These should be ready to be easily integrated in existing curricula and modules for undergraduate level and lifelong learning programmes.

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

EUR from 6 – 8 million

SPIRE topics

- CE-SPIRE-02-2018: Processing of material feedstock using non-conventional energy sources (IA)
- CE-SPIRE-03-2018: Energy and resource flexibility in highly energy intensive industries (IA 50%)
- CE-SPIRE-10-2018: Efficient recycling processes for plastic containing materials (IA)
- **CE-SPIRE-04-2019: Efficient integrated downstream processes (IA)**
- CE-SPIRE-05-2019: Adaptation to variable feedstock through retrofitting (IA 50%)
- DT-SPIRE-06-2019: Digital technologies for improved performance in cognitive production plants (IA)

CE-SPIRE-04-2019: Efficient integrated downstream processes (IA)

Specific Challenge:

- Today, process industry operations for downstream processing represent on average 50-60% of the total capital (CAPEX) and operating costs (OPEX) and they account for up to 45% of the process energy in industrial operations.
- These high costs for downstream processing are often linked to the inefficiencies in the upstream process, due to low conversion and formation of co-products, by-products and/or impurities.
- Hybrid processing technologies (including chemical and biochemical steps) can provide major advantages in terms of primary process selectivity and sustainability. However, they have not been widely deployed in industry so far.
- The development of novel technologies for upstream and downstream unit operations, as well as their better integration, could provide significant resource and energy efficiency gains.

TRL 5 to 7

CE-SPIRE-04-2019: Efficient integrated downstream processes (IA)

Scope:

Proposals submitted under this topic are expected to provide novel solutions for a deeper integration of upstream and downstream processing operations. Proposals should consider:

- Intensified process technologies presenting multistep upstream processes, potentially exploiting hybrid chemo and bio catalytic technologies as well as process analytical techniques (PAT), in order to maximise production efficiency, selectivity and mitigation of downstream processing;
- Complex downstream operations, integrating different separation techniques and purification steps;
- Modularity and flexibility of the solutions, as well as, potential for transition from batch to continuous operations;
- The technologies proposed should enable increased productivity, purity and quality of products, while lowering the process environmental footprint and increasing resource and energy efficiency;
- The potential for integration in the current industrial scenario, and the replicability of the concept in different sectors of the process industry;
- Increased safety of the work environment.

Proposals should provide proof of economic and industrial feasibility of the technologies involved; and should consider the potential integration in existing installations, as well as their retrofitting. Reduction of production costs and time to market is also expected.

CE-SPIRE-04-2019: Efficient integrated downstream processes (IA)

Expected impact:

- 20% decrease in greenhouse gas emission;
- Increased in resource and energy efficiency by at least 20%;
- Novel modular and scalable integrated (upstream-downstream) pilot line technologies with 10% decrease in CAPEX and OPEX;
- Effective dissemination of major innovation outcomes to the current and next generation of employees, through the development of learning resources with flexible usability. These should be ready to be easily integrated in existing curricula and modules for undergraduate level and lifelong learning programmes.

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

EUR from 10 – 14 million

SPIRE topics

- CE-SPIRE-02-2018: Processing of material feedstock using non-conventional energy sources (IA)
- CE-SPIRE-03-2018: Energy and resource flexibility in highly energy intensive industries (IA 50%)
- CE-SPIRE-10-2018: Efficient recycling processes for plastic containing materials (IA)
- CE-SPIRE-04-2019: Efficient integrated downstream processes (IA)
- CE-SPIRE-05-2019: Adaptation to variable feedstock through retrofitting (IA 50%)
- DT-SPIRE-06-2019: Digital technologies for improved performance in cognitive production plants (IA)

CE-SPIRE-05-2019: Adaptation to variable feedstock through retrofitting (IA 50%)

Specific Challenge:

- Process industry plants have to be operated for a long time to make their operations viable. They include equipment such as furnaces, reactors, raw materials handling and storage systems which sometimes have a lifetime beyond 30 years.
- Keeping these facilities up to date from a technological and from regulatory point of view (for instance related to zero waste regulations and to the circular economy) is a major challenge. Even industrial plants which are less than 10 years old, are often not equipped for new or renewable (e.g. biomass) materials and alternative or renewable energy input streams.
- More generally, this increased variety of inputs along with the need for energy efficiency improvements poses a real challenge and requires technological breakthroughs in the process industry.

TRL 5 to 7

CE-SPIRE-05-2019: Adaptation to variable feedstock through retrofitting (IA 50%)

Scope:

Proposals need to cover the following:

- Implement simulation models and decision support tools for the production chain in an energy intensive sector, including the detection of inefficiencies, in order to allow flexibility with respect to feedstock of variable composition, while offering energy efficiency and product quality;
- The development of tools and methodologies to streamline and support retrofitting;
- Find the most efficient operational input conditions to optimise the performances;
- Develop indicators to modify input variables and its potential of replication across the industry;
- Facilitate and adapt the equipment towards a larger number and more diverse feedstock in order to be ready for a transition in which variability in quality, quantity and price of feedstock are key to make the production competitive and sustainable;
- Solutions should demonstrate the feasibility and suitability of the concepts of retrofitting at industrial scale.

Demonstration of the technology in different process industries should be undertaken, covering both the technology (new 'plug-ins'), as well as the process control (higher variability of the process requires new Monitoring & Control Systems).

Proposals submitted under this topic should include actions designed to facilitate cooperation with other projects; to enhance user involvement; and to ensure the accessibility and reusability of data produced in the course of the project.

CE-SPIRE-05-2019: Adaptation to variable feedstock through retrofitting (IA 50%)

Expected impact:

- Increasing the resource and energy efficiency of the targeted processes by 20%;
- Decrease GHG emissions through retrofitting by at least 30%;
- Decreased utilisation of fossil resources in the process industry of at least 20%;
- Reduced OPEX by 30% and increased productivity by 20%;
- Effective dissemination of major innovation outcomes to the current next generation of employees of the SPIRE sectors, through the development, by education/training experts, of learning resources with flexible usability. These should be ready to be easily integrated in existing curricula and modules for undergraduate level and lifelong learning programs.
- Relevant indicators and metrics, with baseline values, should be clearly stated in the proposal.

EUR from 8 – 12 million

SPIRE topics

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- CE-SPIRE-03-2018: Energy and resource flexibility in highly energy intensive industries (IA 50%)
- CE-SPIRE-10-2018: Efficient recycling processes for plastic containing materials (IA)
- CE-SPIRE-04-2019: Efficient integrated downstream processes (IA)
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- DT-SPIRE-06-2019: Digital technologies for improved performance in cognitive production plants (IA)

CE-SPIRE-06-2019: Digital technologies for improved performance in cognitive production plants (IA)

Specific Challenge:

- Shortage in raw materials, increased energy prices and environmental constraints require the European process industry to improve its performance and flexibility and there are unexploited opportunities for digitising a large range of enterprises of very different size in the process industry.
- Digitisation endows the production system with capabilities for analysis. This should enable the autonomous operation of the system based on embedded cognitive reasoning, while relying on high-level supervisory control.
- As a consequence, changes in the production process need to be detected and the system needs to be able to respond to these dynamic fluctuations, by adapting the production to stay within the target ranges of production costs and rate, as well as those of and sustainability parameters.
- A fully up-to-date interactive and self-learning process control integrated with management tools is essential to obtain an optimal efficiency, while maintaining adequate flexibility of the system in regard to changing feedstock, energy sources and product demand.

TRL 5 to 7

CE-SPIRE-06-2019: Digital technologies for improved performance in cognitive production plants (IA)

Scope:

- Improvement of online monitoring and innovative control technologies in terms of process performance and flexibility, maintenance needs and product quality;
- Digital retrofitting of existing assets, integration towards and holistic optimisation of operations, data-analytics, real-time capability, use role-specific representation of information, feedback control & detect deviations and adjust operations immediately decision support (e.g. advanced process control, reactive scheduling);
- Several among the following concepts: apply low-cost sensors for on-line assessment of product quality and integration into process control; robust optimisation methods to distributed targeted process monitoring; simulation methods for the analysis, characterisation and study of systems for enhanced operations and decision-making combination of various forms of data with cognitive insight to optimise and enhance resources;
- Replicability and scalability of the concepts should be considered appropriately.

CE-SPIRE-06-2019: Digital technologies for improved performance in cognitive production plants (IA)

Expected impact:

- Improved capabilities for valid, reliable and real-time control logics of the properties, efficiency and quality of process streams and final products for existing and for more flexible process operation concepts:
- Show potential for improved performance in cognitive production plants;
- Increased production performance, energy and resource consumption, or waste or by-products production will be significantly improved by more than 20%. The targets should be quantified in the proposal and validated during the execution of the demonstration;
- Project outcomes should demonstrate a positive environmental impact, by reducing CO2 emissions compared to the state of the art and in the scale relevant for the different applications;
- Effective dissemination of major innovation outcomes to the current next generation of employees of the SPIRE sectors, through the development, by education/training experts, of learning resources with flexible usability. These should be ready to be easily integrated in existing curricula and modules for undergraduate level and lifelong learning programmes.
- Relevant indicators and metrics, with baseline values, should be clearly stated in the proposal.

EUR from 6 – 8 million

Indicative Budgets & Deadlines 2018-2019

Topics (Type of Action)	Budget 2018 (M€)	Budget 2019 (M€)	Deadlines
CE-SPIRE-02-2018 (IA) CE-SPIRE-03-2018 (IA) CE-SPIRE-10-2018 (IA)	Total: 97.5		31 Oct.17 - 22 Feb.18
CE-SPIRE-04-2019 (IA) CE-SPIRE-05-2019 (IA)		Total: 65.8	16 Oct.18 - 21 Feb.19
DT-SPIRE-06-2019 (IA)		32.9	16 Oct.18 - 21 Feb.19

SPIRE topics in 2020, still to be written…

- CE-SPIRE-01-2020: Industrial symbiosis (IA)
- CE-SPIRE-07-2020: Recovery of industrial water, thermal energy and substances contained therein (IA)
- CE-SPIRE-08-2020: Improved Industrial Processing using novel high-temperature resistant materials (RIA)
- CE-SPIRE-09-2020: Making the most of mineral waste, by-products and recycled material as feed for high volume production (IA)

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Catalysing the Circular Economy

Policy Context

- Global challenges towards a cleaner world
  - United Nations COP21, COP22 & COP23
- EU priorities in Energy and Climate
  - Energy Union, EU climate goals 2030 and 2050
  - EU Climate and Energy targets by 2030:
    - ✓ GHG reduction by 40%
    - ✓ renewables share 27%
    - ✓ energy efficiency 30%

Catalysing the Circular Economy

Ambition:

- Europe becomes the world-leader in developing sustainable chemistry, smart materials and intelligent recycling.
- In this context catalysis is a key technology in chemical industry and for a sustainable economy.
- The substitution of fossil fuels at all steps along the industrial value-chain plays a crucial role to decarbonise industrial processes.
- CO2 or C1 building blocks are alternative feedstocks for chemicals, materials and fuels.
- Future disruptive technologies could play a very significant role in lowering the carbon footprint of industry and the entire economy.

Catalysing the Circular Economy topics

- CE-NMBP-24-2018: Catalytic transformation of hydrocarbons (RIA)
- CE-NMBP-26-2018: Smart plastic materials with intrinsic recycling properties by design (RIA)
- CE-NMBP-25-2019: Photocatalytic synthesis (RIA)

Catalysing the Circular Economy topics

- CE-NMBP-24-2018: Catalytic transformation of hydrocarbons (RIA)
- CE-NMBP-26-2018: Smart plastic materials with intrinsic recycling properties by design (RIA)
- CE-NMBP-25-2019: Photocatalytic synthesis (RIA)

CE-NMBP-24-2018: Catalytic transformation of hydrocarbons (RIA)

Specific Challenge:

- Advanced chemical energy conversion, storage and transportation will play a key role in enabling the EU to develop a low-carbon economy and provide more flexibility. As such, increasing the exploitation of natural gas, stranded resources and biogas is creating new opportunities for the utilisation of low cost light alkanes.
- High value can be added through improved catalytic transformations to C2-C4 olefins, C-C coupling and/or C1 chemistry together with significant impact towards the climate action targets agreed in COP21. The integration of catalysts and process design will be instrumental in creating process improvements and flexibility as well as tackle the global climate challenges.

TRL from 3 to 5

CE-NMBP-24-2018: Catalytic transformation of hydrocarbons (RIA)

Scope:

Development of novel catalytic materials and routes for the valorisation of currently unexploited light hydrocarbons resources, bio- or stranded gas for chemical and energy production.

Proposals should cover at least one of the following:

- Selective direct conversion of light hydrocarbon resources (C1-C4 alkanes) to mono-olefins and/or butadiene, with improved performance (on energy/carbon bases) and competitive costs compared to existing industrial processes;
- Conversion of non-transportable gas resources to liquid hydrocarbons (not passing through CO/H2 formation);
- Novel energy-efficient and cost-competitive routes for the direct utilisation of light alkanes in the production of high-value chemicals;
- Assessment of environmental and safety issues and should involve industries in a leadership role as well as validate the feasibility of the proposed route in industrial relevant environments.

In line with the strategy for EU international cooperation in research and innovation (COM(2012)497), international cooperation is particularly encouraged in particular with countries from the Broader EU Neighbourhood (e.g. European Neighbourhood Policy countries, Iran and Iraq) among others

CE-NMBP-24-2018: Catalytic transformation of hydrocarbons (RIA)

Expected impact:

Novel catalysts and routes for the valorisation of currently unexploited light hydrocarbons resources will:

- Reduce the dependence from the current fossil fuel resources (>30% reduction of current use of fossil fuels for the equivalent production);
- Improve industrial competiveness by novel processes with improved energy efficiency (OPEX). Reduction of greenhouse gases emissions and investment costs (CAPEX) by >20% with respect to current production route;
- Novel and scalable catalysts and catalytic processes which can handle feedstock variability.

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

EUR from 4 – 6 million

Catalysing the Circular Economy topics

- CE-NMBP-24-2018: Catalytic transformation of hydrocarbons (RIA)
- CE-NMBP-26-2018: Smart plastic materials with intrinsic recycling properties by design (RIA)
- CE-NMBP-25-2019: Photocatalytic synthesis (RIA)

CE-NMBP-26-2018: Smart plastic materials with intrinsic recycling properties by design (RIA)

Specific Challenge:

Developing of multifunctional materials based products with smart intrinsic recycling and/or sorting abilities that harmonise with circular economy principles will create a real paradigm shift in the market and a clear benefit for society.

It will also help industry to better match the EU environmental targets at the same time as improving their competitiveness.

TRL from 3 to 5

CE-NMBP-26-2018: Smart plastic materials with intrinsic recycling properties by design (RIA)

Scope:

Proposals should cover one or more of the following types of materials design:

- Design of polymer material structures with intrinsic sorting/recycling abilities such as: Composite and reinforced composite materials, multilayers, mix of plastics, sequence controlled polymers, reinforced polymers, but also the design of polymer formulations with smart additives, which allow adequate sorting, separation and recycling;
- Design of smart polymer materials for recycling/re-processing: The development of resins of thermoplastic nature, but also the development of new smart polymers (e.g. sequence controlled polymers, vitrimers, nano-structured block co-polymers, self-sorting polymers, click chemistry based materials) and others;
- Further developments of separation and recycling technologies: New separation technologies like the removal of organics, contaminants, but also further developments or novel chemical recycling and/or controlled bio-degradation technologies, which are today not cost effective enough or still need to be validated.

Proposals should demonstrate the actual circular use of such materials through re-processing of recycled products and the evaluation of properties of such re-processed products (industrial environment).

Proposals should include the full Life Cycle Assessment (LCA) of the material production & life-cycle.

TRL from 3 to 5

CE-NMBP-26-2018: Smart plastic materials with intrinsic recycling properties by design (RIA)

Expected impact:

The development of novel plastic materials would aid in:

- Meeting the EU's circular economy and environmental targets while demonstrating a clear benefit, i.e. more efficient or economic than the state of the art in order to enable market uptake in the short to medium term;
- Create new technologies and business opportunities for the recycling industry across Europe, especially in the area of composites and plastics where the challenge is high;
- Demonstrate a potential reduction in landfill waste volume by > 50 %;
- Reduction of the carbon footprint of the corresponding products by > 30 % (based on a full Life Cycle Assessment).

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

EUR from 4 – 6 million

Catalysing the Circular Economy topics

- CE-NMBP-24-2018: Catalytic transformation of hydrocarbons (RIA)
- CE-NMBP-26-2018: Smart plastic materials with intrinsic recycling properties by design (RIA)
- CE-NMBP-25-2019: Photocatalytic synthesis (RIA)

CE-NMBP-25-2019: Photocatalytic synthesis (RIA)

Specific Challenge:

The efficient storage and utilisation of solar energy in the form of chemicals or chemical energy will play a key role to transform the European industry into a low-carbon economy.

In the long term, there will be a need for highly integrated solutions enabling the carbon-neutral production of high-value chemicals or energy, which is crucial to reduce CO2 emissions.

The development of integrated processes will require a systems-catalysis approach that includes engineering aspects as small-scale and intermittent operation.

TRL from 3 to 5

CE-NMBP-25-2019: Photocatalytic synthesis (RIA)

Scope (1/2):

Development of cheap materials and integrated processes/devices for the direct photocatalytic conversion of CO2 (from anthropogenic CO2 sources and/or from air) and H2O to fuels and/or chemicals, with an overall solar-to-hydrogen efficiency of >20%, with the following goals:

- Improve selectivity and efficiency by rational engineering of the bandgap and electronic structures;
- Realise a new design of multi-heterojunction materials with scalable preparation for Z-scheme mimicking;
- Design multifunctional photocatalysts for simultaneous CO2 reduction and H2O oxidation;
- Optimise solar photoreactors (light harvesting, mass transfer, reactivity);
- Couple photo-assisted and non-photo-assisted catalytic processes for C-C bond formation.

CE-NMBP-25-2019: Photocatalytic synthesis (RIA)

Scope (2/2):

Proposals should:

- assess the efficiency, reduction of the steps and costs with respect to the overall process, as well as
- the advantages of the proposed technology in terms of social/environment impact with respect to conventional production of the same chemicals and/or fuels.
- The scalability and exploitability of the devices should be analysed.
- The validation of the technology should be carried out by a demonstration of a photo- or photo-electrochemical reactor/integrated device of the size of the existing photovoltaic cells.

CE-NMBP-25-2019: Photocatalytic synthesis (RIA)

Expected impact:

- Development of cost-efficient systems based on multifunctional photo catalytic system which should enable upscaling and process intensification, with:
- Increased efficiency of the system with sunlight to chemical energy conversion efficiency (to chemicals other than H2) higher than 5%;
- Improved stability/robustness of the system under extended operational conditions, with loss of performances <5% in 1000h;
- Cost reduction/effectiveness of the system, including recycling if relevant and continuous product recovery, with cost of production of chemicals comparable to actual route from fossil fuels, and <50% CO2 emissions (based on Life Cycle Assessment).

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

In line with the strategy for EU international cooperation in research and innovation (COM(2012)497), international cooperation is particularly encouraged.

EUR from 5 – 7 million

Indicative Budgets & Deadlines 2018-2019

Topics (Type of Action)	Budget 2018 (M€)	Budget 2019 (M€)	Deadlines
CE-NMBP-24-2018 (RIA) CE-NMBP-26-2018 (RIA)	Total: 38		31 Oct.17 – 23 Jan.18 (First Stage) 28 Jun.18 (Second Stage)
CE-NMBP-25-2019 (RIA)		18.46	16 Oct.18 – 22 Jan.19 (First Stage) 03 Sep.19 (Second Stage)

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Teşekkür ederim

Questions?

Contact details

Vladimir CID-BOURIÉ

A.SPIRE Programme Manager

A.SPIRE aisbl

Av. E. van Nieuwenhuyse, 4

B-1160 Brussels

Tel: +32.(0)2.676.7398

Email: vcb@spire2030.eu

www.spire2030.eu