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## **Horizon 2020**

### **Work Programme 2016 - 2017**

#### *5.ii. Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing*

**Important notice on the second Horizon 2020 Work Programme**

**This Work Programme covers 2016 and 2017. The parts of the Work Programme that relate to 2017 are provided at this stage on an indicative basis. Such Work Programme parts will be decided during 2016.**

*(European Commission Decision C (2015)6776 of 13 October 2015)*



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## **Introduction**

In this part of the Work Programme, LEIT-NMBP stands for 'Leadership in enabling and industrial technologies – Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing'.

**Open research data:** A novelty in Horizon 2020 is the Pilot on Open Research Data which aims to improve and maximise access to and re-use of research data generated by projects. Projects funded under topics NMBP-23 to NMBP-29 inclusive, on modelling and nanotechnology safety, will by default participate in the Pilot on Open Research Data in Horizon 2020.

Projects have the possibility to opt out of the Pilot, provided a justification is given for doing so. Participation in the Pilot is not taken into account during the evaluation procedure. Proposals will not be evaluated favourably because they are part of the Pilot and will not be penalised for opting out of the Pilot.

A further new element in Horizon 2020 is the use of Data Management Plans (DMPs), detailing what data the project will generate, whether and how it will be exploited or made accessible for verification and re-use, and how it will be curated and preserved. The use of a DMP is required for projects participating in the Open Research Data Pilot. Other projects are invited to submit a DMP if relevant for their planned research. Only funded projects are required to submit a DMP. Further guidance on the Pilot on [Open Research Data](#) and [Data Management](#) is available on the Participant Portal.

Projects funded under the other calls of this Work Programme may participate in the Open Research Data Pilot in Horizon 2020 on a voluntary basis.

A novelty in Horizon 2020 is the Pilot on Open Research Data which aims to improve and maximise access to and re-use of research data generated by projects. While certain Work Programme parts and calls have been explicitly identified to participate in the Pilot on Open Research Data, individual projects funded under the other Work Programme parts and calls can choose to participate in the Pilot on a voluntary basis.

Participating projects will be required to develop a Data Management Plan (DMP), in which they will specify what data the project will generate, whether and how it will be exploited or made accessible for verification and re-use, and how it will be curated and preserved. Further guidance on the Pilot on Open Research Data and Data Management is made available on the Participant Portal.

Proposers should consider participation in open data pilot (mandatory for modelling topics) and the European modelling market place initiatives (reference to the 2017 topic).

**Gender aspects:** Where relevant, research and innovation activities should explore, analyse, and address possible sex and gender differences<sup>1</sup> and take into account biological characteristics as well as the evolving social and cultural features of women and men, and other relevant factors of diversity (e.g. age, weight, user/consumer preferences and needs) in a given context. Addressing the gender dimension in technology development and use can lead to better designs and improve the marketability of products. Proposals should also pay due attention to the gender dimension of research and innovation in the proposed actions.

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<sup>1</sup> For guidance on methods of sex / gender analysis, please refer to: [http://ec.europa.eu/research/science-society/gendered-innovations/index\\_en.cfm](http://ec.europa.eu/research/science-society/gendered-innovations/index_en.cfm)

## **Call - CALL FOR ENERGY-EFFICIENT BUILDINGS**

**H2020-EEB-2016-2017**

The buildings industrial sector (residential and non-residential) is the first economic sector in the construction market, as construction and refurbishment activities account for 85% of the total construction sector output. It represents about 7 % of the EU28 non-financial business economy and provides **11.5 million direct jobs** (about 8.8% of total employment in the non-financial business economy)<sup>2</sup>. Furthermore the built environment affects the life and work of all EU-citizens: The construction sector also has a crucial impact on the EU environment and energy policies as buildings use **40 % of total EU energy consumption** and **responsible for 36% of Green-House Gases** in Europe while the replacement rate of the existing stock is very small (1-2% per year).

The buildings sector is on the critical path to decarbonise the European economy by 2050. In order to achieve this objective it must enable reducing its CO<sub>2</sub> emissions by 90% and its energy consumption by as much as 50%. This is a unique opportunity for sustainable business growth provided that products and related services for both new and refurbished buildings are affordable and of durable quality, in line with several current or future European Directives. Yet, together with the 2050 deadlines, such Directives are putting more constraints on a sector which is directly impacted by the on-going financial and economic crisis, taking into account that, although Europe has major companies, **this sector is highly fragmented with over 95% of SMEs**.

The objective of the *Energy-efficient Buildings* Public-Private Partnership (PPP) Initiative is to drive the creation of a high-tech building industry which turns energy efficiency into a sustainable business, fostering EU competitiveness in the construction sector on a global level.

This call will complement the call on Energy Efficiency of the Energy societal challenge, by helping deliver, implement and optimise building and district concepts that have the technical, economic and societal potential to drastically reduce energy consumption and decrease CO<sub>2</sub> emissions, both in relation to new buildings and to the renovation of existing buildings. This new initiative should have a large payoff, as it will increase the market for energy-efficient, clean and affordable buildings. Priority will be given to delivering new building technologies, materials and components for energy saving and energy generation, thermal energy storage systems, advanced insulation systems, thermal distribution systems, lighting, windows and glazing, energy generation systems based on renewable sources. Priorities also include reliable simulation and prediction tools, including assessment methods that integrate economic, social and environmental issues, including comfort and safety. To date, the

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<sup>2</sup> Based on EUROSTAT statistical business survey [sbs\_na\_sca\_r2] and as also reflected in table 1.1. (page 17) and table 1.3 (page 21) in the JRC study available at: [http://iet.jrc.ec.europa.eu/energyefficiency/system/tdf/eur26888\\_buildingreport\\_online.pdf?file=1&type=node&id=9069](http://iet.jrc.ec.europa.eu/energyefficiency/system/tdf/eur26888_buildingreport_online.pdf?file=1&type=node&id=9069)



construction industry has difficulty to effectively integrate key technologies into its operations in order to achieve sustainable, long-term competitiveness and such integration should also be promoted.

Activities supported under the EeB PPP are expected to contribute to EU industrial leadership and the grand societal challenges.

The participation of public authorities may be an asset for some projects, as public authorities own a large part of the building stock at European level.

The EeB cPPP will support a high-tech building industry which turns the need for energy efficiency into an opportunity for sustainable business, fostering EU competitiveness in the construction sector at the global level.

Proposals are invited against the following topic(s):

**EEB-01-2016: Highly efficient insulation materials with improved properties**

Specific Challenge: The role of insulation is essential to achieve energy efficiency in renovated buildings and in nearly zero energy buildings following the requirements of the recast of the Energy Performance of Building Directive (2010/31/EU). An improved insulation in buildings will have a large impact on the reduction of energy consumption and CO<sub>2</sub> emissions at European level. It can also bring significant environmental, economic and social benefits both for the Member States and for the citizens.

Although currently many materials are available on the market, there is a strong need to develop affordable advanced insulation materials which exceed the performance of presently used materials, and also respect strict sustainability principles.

Scope: Proposals should address the development and characterisation of new insulation materials and solutions based on nanotechnologies and/or advanced sustainable materials and offering enhanced insulation properties and environmental performance. Proposals could also consider highly effective insulation materials that respond dynamically to environmental stimuli (temperature, light, humidity, air and biological pollution, etc..)

The proposed solutions should go well beyond the state of the art and take into account the final performance properties of the new materials and of the respective building components.

The following factors should also be considered: enhanced durability for increased use duration, reduced maintenance and reduced costs; respect of sustainability principles (the sustainability of each developed solution should be evaluated via life cycle assessment studies carried out according to the International Reference Life Cycle Data System - ILCD Handbook); reduced embodied energy and minimised environmental impacts; applicability to both new build and renovation; lightweight construction and ease of installation; realistic solutions at a competitive price; limited impact on living space; improvement of indoor air quality; increased comfort and noise reduction; fully compatible with a wide set of material combinations which reflect the wide variety of building typologies across the EU; fit for

deconstruction; reuse/recycling of materials at end of life. Resistance to damaging agents such as fire, moisture, rodents etc. should also be considered when relevant for the application. Standardisation aspects should be included particularly in relation with the work carried out in CEN/TC 350. Additional properties such as multi-functionality, load bearing capacity (and other mechanical properties), and use of wastes may also be considered.

Proof of concept in terms of one (or more) component(s) containing the new materials developed should be delivered within the project, excluding commercially usable prototypes (2006/C323/01), but convincingly demonstrating scalability towards industrial needs duly justifying availability of the proposed materials for potential further massive use and wide replication across Europe. Information guides for applications, installation and training on the new solutions should be provided before the end of the project.

In addition to the industrial, academic and construction stakeholders, the participation of public authorities would also be an asset for the proposals, as public authorities own a large part of the building stock at European level.

**Activities are expected to focus on Technology Readiness Levels 5 to 7 and to be centred around TRL 6.**

*This topic is particularly suitable for SMEs.*

The Commission considers that proposal requesting a contribution from the EU between EUR 3 and 6 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: Compared to state of the art materials and components, the newly developed materials should bring:

- Improvement by at least 25% of the insulation properties at component level;
- Reduction by at least 20% of the total costs compared to existing solutions;
- Improvement by at least 20 % of durability at component level;
- Respect of sustainability principles;
- Improvement in indoor air quality;
- Proof of high replication potential both in new built and renovation in Europe;
- Easier implementation;
- At least a 15% reduction of the energy spent during the whole life cycle of a building;
- Contribution to standardisation and certification activities.

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

To maximise their impact, the funded projects are expected to cluster with each other in order to facilitate research cohesion, integration, and advancement of the EeB-PPP agenda.

Type of Action: Innovation action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

**EEB-02-2016: Performance indicators and monitoring techniques for energy-efficiency and environmental quality at building and district level**

Specific Challenge: The construction sector is a key player in the efforts to decarbonise the European economy with the goal to drastically reduce energy consumption and decrease CO<sub>2</sub> emissions. Key Performance Indicators, along with appropriate methodologies and tools are crucial in order to quantify and benchmark the energy-efficiency and the environmental quality at building and district level. Adequate monitoring and management techniques are also needed, mixing results and practices from the building sector together with other relevant sectors like energy grid to ensure an effective performance improvement both at building and district level.

Scope: Proposals should focus on solutions beyond the state of the art, which will improve and provide a feedback on the experiences on energy efficiency and environmental quality from the latest generation of new and renovated buildings and their interactions in districts.

Proposals should focus on the following main objectives:

- To establish a consolidated structured and geo-clustered analysis and compilation of the latest generation buildings and their interaction with district resources in order to develop the return of experience associated with them,
- To identify and analyse relevant sectorial indicators, development of models providing insight in data and that will enable and support decision making for energy efficiency and environmental quality, from design to operational phases,
- To elaborate and develop operational and harmonised protocols supporting tools and systems to characterize the performances in real operational conditions,
- To develop benchmarks on the impact of the non-qualities on the overall energy performance, which protect privacy while allowing deep analysis,
- To understand the specific causes of non-performance or sub-optimal performance throughout the entire life cycle (from design to construction and operation) and promoting best practices to the industry.

The Commission considers that proposals requesting a contribution from the EU between EUR 500000 and 750000 would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

**No more than one action will be funded.**

Expected Impact:

- Setting up more accurate guidance for all types of building that can be used by design teams, in particular for the public procurement of innovative solutions. This accurate guidance should match actual building operation more closely;
- Collecting Europe-wide data and knowledge on the effective performance of new and renovated buildings of the latest generation;
- Developing scientific and technical databases which should be robust and shared to objectify and characterize performance in situ. This database should also allow the comparison between forecasts and reality, and detail the need to change practices;
- Statistical and knowledge analyses enabling to reach consensus on how to bridge the gap between performances expected at the design level and performances really obtained.

Type of Action: Coordination and support action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

**EEB-03-2016: Integration of advanced technologies for heating and cooling at building and district level**

Specific Challenge:

- The energy consumed in the use phase for space heating, cooling and hot water generation represents most of the overall energy consumption in buildings (70-90% of total energy). In order to reduce this consumption, state-of-the-art or new technologies need to be deployed, developed and integrated with high efficiency equipment, both for residential buildings and districts. The share of renewable energies in the energy supply for heating, cooling and hot water generation needs to be increased.
- Cost effective, practical and affordable solutions need to be demonstrated and validated to ensure the success of the retrofitting business. The current potential of energy saving in the EU through renovation activities is very high. In Europe there are two main categories and segments to cover: residential buildings and district networks connecting.
- Regarding the existing residential buildings which represent the largest part of the energy consumption, there is an urgent need to develop integrated solutions that would fit with the current natural gas boilers dominance in the EU market.

- For the district networks connecting buildings, systems should be improved with the support of high efficient control systems that manage better the demand/supply for heating and cooling, and that could fit with a better exploitation of the waste heat available from various industrial or commercial sources.

Scope: Buildings retrofitting potential in the EU is huge and existing heating/cooling technologies do not sufficiently enable the integration of new advanced efficient systems. Proposals should embrace two types of buildings: residential buildings and district heating/cooling connected buildings. For both types, the integration of new reliable systems should be based on new or existing reliable design tools which would facilitate taking the decision on the installation of the best solutions. The research activities should at least address the following areas:

- Integration of advanced heating and cooling technologies such as hybrid systems combining fossil based equipment with renewables systems (cost competitive heat pump kits, solar thermal or biomass systems are attractive combinations).
- Energy waste heat/cool sources that may be exploited in the system.
- Easy installation and integration of such equipment with concern to minimise the maintenance needed and to simplify the logistic.
- Control and monitoring of the entire system, to ensure an efficient match between the supply and demand of energy, including ICT and algorithms embedded in the equipment.

Concerning the district systems, advanced District Heat and Cooling (DHC) systems, i.e. systems operating at low temperatures, must be able to deal with both centralised and de-centralised hybrid sources (e.g. solar thermal, biomass, geothermal, heat pumps, waste heat, excess renewable electricity storage).

Proposals should provide detailed information on the energy data of the buildings (current energy use and proposed reduction with new equipment, the gross floor area of the building together with the targeted annual energy use per m<sup>2</sup>, broken down by space heating, cooling, domestic hot water production, and lighting). The energy use should achieve at least the national limit values for new buildings according to the applicable legislation based on the Energy Performance of Buildings Directive.

**Activities are expected to focus on Technology Readiness Levels 5 to 7 and to be centred around TRL 6.**

*A significant participation of SMEs with R&D capacities is encouraged.*

The Commission considers that proposal requesting a contribution from the EU between EUR 5 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Demonstrate a high potential of replication across Europe contributing to large scale market deployment before 2025 with in particular the support of dedicated tool kits, which would be easy to install and would require a limited workforce.
- Cost-effective highly energy-efficient equipment with target reduction of energy consumption of 20 -30 % (including renewables).
- Payback period of below 10 years.
- Best practice examples for the construction sector based on innovation and competitiveness, with benefits for the citizens and the environment.

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Innovation action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

**EEB-04-2016: New technologies and strategies for the development of pre-fabricated elements through the reuse and recycling of construction materials and structures**

Specific Challenge: As a consequence of economic development, construction and demolition waste (CDW) has become a serious problem, creating serious environmental pollution in certain areas of the world. In the EU, CDW accounts for approximately 25% - 30% of all waste generated and consists of numerous materials, many of which can be recycled.

Advanced research actions and technical solutions are required for large-scale reuse and recycling of construction materials in building refurbishment, contributing to overall CO<sub>2</sub> and energy reduction. At the same time pre-fabricated components are now commonly used in the construction sector not just to reduce costs but also to facilitate installation/dismantling and re-use of components.

The development of pre-fabricated elements containing a high share of recycled materials and of energy-efficient building concepts considering a high fraction of material replacement is needed. The main focus would be on the recovery/ recycling of materials that have the highest technical and economic interest and which are associated to refurbishment or demolition processes.

At the same time, the possibility to reuse different materials in energy-efficient buildings should be further investigated through a proper characterisation of their properties. Also the development of processes for easy disassembly needs to be considered as well as the need to address strict regulations and standards (eg. anti-seismic) in several European regions.

The EC Waste Directive mentions under Art 11- 2b that: "by 2020, the preparing for re-use, recycling and other material recovery, including backfilling operations using waste to substitute other materials, of non-hazardous construction and demolition waste excluding naturally occurring material defined in category 17 05 04 in the list of waste shall be increased to a minimum of 70 % by weight."

Scope: Energy-efficient building concepts using new or adapted prefabricated components need to be developed, in order to implement construction processes allowing the reuse and recycling of different materials and structures while reducing energy use and minimising environmental impacts.

In the case of building retrofitting with traditional construction methods poor results are frequently obtained. Recent developments show that even with new constructions the use of recycled materials is still a challenge when prefabrication is concerned. There is a need to address material flows (on-site and off-site processes) and harmonize the way to acquire and use all the information related to the building and its stakeholders (procurers, builders, owners, users, operators, etc.) in order to radically modify the construction processes (e.g. lean construction and higher degree of industrial building prefabrication), and the off-site production of components (e.g. prefabricated components).

Proposals should cover the following areas:

- Optimisation of recyclability properties of the materials and development of solutions to recycle and reuse construction materials and existing building structures in particular through the uptake by the manufacturing chain.
- Innovative pre-fabricated elements solutions integrating the latest developments in recycling and reuse of CDW as well as in construction and installation processes which show clear evidence of technical and economic viability for structural and non-structural components with a life-cycle perspective.

The project should also address the demonstration of the recycling technologies in the construction or refurbishment of energy-efficient buildings representative of at least two different climatic zones across Europe, allowing for a high replication potential.

**Activities are expected to focus on Technology Readiness Levels 4 to 6.**

*This topic is particularly suitable for SMEs.*

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- CO2 savings (by min. 30 %), energy savings (by min 20%), and higher resource efficiency (minimum share of recycled materials in final product of at least 10-15 %) will ultimately contribute to a resource-efficient and climate change resilient economy.
- Creation of new value chains by expanding the size and attractiveness of CDW recycling and reuse for energy-efficient buildings construction and refurbishment, properly tackling non-technological barriers.
- High replication potential of the solutions obtained, with the possibility to export EU technology worldwide.
- Contribution to achieving the objectives of the European Innovation Partnership on Raw Materials, in particular to the relevant impacts shown in Action I.5 "Recycling of raw materials from products, buildings and infrastructure" of the Strategic Implementation Plan<sup>3</sup>.

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Research and Innovation action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

### **EeB-05-2017: Development of near zero energy building renovation**

Specific Challenge: Buildings and more specifically the housing sector represent about 40% of EU energy consumption. Ambitious renovation of the ageing building stock offers huge potential to reduce that energy consumption. Lowering the energy costs for households while increasing in-house comfort will not only help to achieve EU environmental objectives, but will also benefit EU economy and contribute to social well-being.

A large-scale deep rehabilitation of the residential building stock to match the net-zero energy standards at affordable price must be achieved. Breakthrough solutions are required to reduce energy consumption in building (e.g. in space heating/cooling and domestic hot water production, maximising the envelope performances, heat recovery and local use of renewables) with the support of advanced BEM (Building Energy Management) systems. Proposals should go beyond the state of the art and previous project results of the EeB PPP.

Scope: Research should address in-depth analysis and subsequent improvement of the renovation process, including innovative technical elements/products/processes aiming to improve the decision-making, and should be based on a collaborative multi-value multi-stakeholder exercise. Methodology, guidelines and effective operational tools are needed to ease the selection between renovation scenarios. The analysis should take into account life

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<sup>3</sup> <https://ec.europa.eu/eip/raw-materials/en/content/strategic-implementation-plan-part-ii#I.5%20Recycling>



cycle assessment, life cycle costing, indoor environment quality, as well as user behaviour and acceptance. Research should lead to innovative concepts for a systemic approach to retrofitting which integrates the most promising cost-effective technologies and materials, in order to reduce heat losses through the building envelope and also the energy consumption by ventilation and other energy distribution systems, while increasing the share of renewable energy in buildings.

The new tools will help revalorisation of existing buildings in the long term, including the energy performance of the building as a factor of the total property value. This should be reflected in the definition of innovative business models where all relevant actors are involved, including public authorities and investors.

Proposals should aim at maximizing the capacity of replication of the developed concepts and methods for integrated sustainable renovation. Large-scale market uptake should be addressed, for example by targeting buildings with similar use conditions and/or comparable blocks of buildings or districts in need for renovation.

Proposals should show clear evidence of technical and financial viability of the solution through their application on real case demonstrations.

**Activities are expected to focus on Technology Readiness Levels 5 to 7 and to be centred around TRL 6.** This topic addresses cross-KET activities.

*A significant participation of SMEs with R&D capacities is encouraged.*

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Reduction of at least 60% in energy consumption in order to reach the target of near zero energy compared to the values before renovation, while enhancing indoor environmental quality.
- Decrease of installation time by at least 30% compared to typical renovation process for the building type.
- Demonstration of a high replicability potential and of large market uptake capacity.
- Affordability considering all costs involved, with a payback period below 15 years.
- New generation of skilled workers and SME contractors in the construction sector capable of applying a systemic approach to renovation.

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Innovation action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

**EEB-06-2017: Highly efficient hybrid storage solutions for power and heat in residential buildings and district areas, balancing the supply and demand conditions**

Specific Challenge:

- The storage of thermal or electric energy needs optimised operational technical solutions in order to better manage and synchronise the overall supply and demand (at residential, district and urban level). Good management of the peak loads, especially stemming from an increase of renewable energy production, would reduce the overall energy consumption and the cost of operation of the installations.
- Hybrid solutions are needed, inherently addressing the seamless conversion and integration of renewable electricity and heat, as to anticipate the future energy grid that will fully allow an exchange of different energy carriers. Such hybrid solutions form a next step in the electrification of the heat supply market.
- To go beyond current state of the art on thermal storage (i.e. compact systems) for residential buildings, it is necessary to bring research activities in this field closer to pre-commercial stage, to demonstrate their technical and economic viability, and to optimise the operation of such hybrid solutions in view of combining them with the surplus of renewable electricity with low temperature heat and cooling demand.
- In the EU, there are nowadays just a few examples of operationally integrated solutions for the optimal interaction in district networks, combining both electricity and heat/cooling energy supply and storage.
- Efficient use of renewable energy in hybrid systems for the storage and generation of energy needs to be achieved.

Scope: Proposals should develop advanced innovative high-density hybrid energy storage devices, targeting the efficient use and further increase of renewable energy in the built environment, and demonstrating its value in terms of flexibility in the energy systems. They should address both electrical and thermal applications and able to reach a rapid release.

Such hybrid approaches encompass different aspects, which may be addressed separately or coherently:

- high efficiency conversion and storage of surplus renewable electricity into heat;
- multifunctional use in both heating and cooling applications at different temperature grades;

- different time scales, e.g. in seasonal storage of high temperature solar heat and peak-shaving in lower temperature heat-pump applications.

Research and innovation activities should address:

- electricity applications, where the technologies covered may include batteries, flywheels and capacitors suitable for applications in the power range of several tens of KW to 1 MW as well as other technologies related to storage of large-scale power needed for district areas.
- thermal applications, where these hybrid solutions should develop the high efficiency conversion and storage of surplus renewable electricity into heat. The hybrid system should take into account the optimal integration of various potential heat storage media. Therefore, preference will be given to systems that exploit chemisorption or physisorption technologies (solid/ liquid) and/or latent heat (PCM). The innovation part of the project should include the possibility that energy systems may be connected, and of merging energy from different sources, e.g. renewable electricity combined preferably with electric storage and heat, industrial waste heat, heat grids, ground systems.

Proposals are expected to cover the various aspects of the overall system, such as design, storage materials, interfaces with various components and auxiliaries (heat exchangers, reactor etc) and include monitoring and control of the overall technologies/ components (BEMS).

Proposals should preferably include demonstration pilots for both residential and district connected buildings in at least two different climatic regions. They also need to integrate strategies for optimal interaction with the energy grid, and assess the value of this integration in view of flexibility in the energy system.

**Activities are expected to focus on Technology Readiness Levels 4 to 6.**

*A significant participation of SMEs with R&D capacities is encouraged.*

The Commission considers that proposals requesting a contribution from the EU between EUR 4 and 6 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requiring other amounts.

Expected Impact: For residential buildings which are not connected to District Heating and Cooling

- Demonstration of the economic viability of the overall storage systems when operating in real conditions in residential buildings with a return of investment period of 9-10 years and proof of the potential for market penetration.
- Technologies which are reliable and ensure a minimum of 20 years life time

- Solutions compatible with existing building configurations – with compact systems using limited spaces in existing building (volume of storage limited to 3 m<sup>3</sup>).
- Demonstration of an overall net energy reduction by 20 %.
- Validated contribution to energy system flexibility

For residential buildings connected to District Heating and Cooling

- Demonstration of the economic viability of the overall storage systems with return of investment of less than 20 years and proof of the potential for market penetration.
- Technologies which are reliable and operating for a minimum of 30 years.
- Provide compact systems (volume of storage limited to 1 m<sup>3</sup>).
- Overall net energy gain of minimum 30%.

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Research and Innovation action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

### **EEB-07-2017: Integration of energy harvesting at building and district level**

Specific Challenge: Integration of energy harvesting approaches is a major challenge, in particular the development and integration of different renewable energy sources at building and district scale.

The envelope should be considered as an active and/or adaptive skin that interacts with the external environment and strongly influences the building energy performance and indoor comfort. Indeed, in view of a large-scale deployment of nearly-zero energy solutions in existing buildings, besides reducing energy demand through highly insulating materials and reduction measures, the possibility to harvest energy in the building envelope is of great importance.

The district dimension should be taken into account, both because of a higher potential for integration and optimisation of renewable energy sources, and because of the potential of additional energy harvesting approaches.

Scope: Proposals should aim at maximising the harvesting of renewable energy (for heating, cooling, electricity, domestic hot water, etc.) at building and district scale (e.g. exploiting large renewable energy source installations and heating and cooling networks). Research results should contribute to drastic energy saving and CO<sub>2</sub> emission reduction while enabling

massive replication in low zero energy buildings and energy self-sufficient districts. the focus is on a cost-effective and easy installation in a wide variety of buildings and surroundings.

Buildings are connected with various entities like suppliers and distribution system operators through different networks (internet, smart meter linked to the grid, energy storage systems, electric vehicles, etc.). Therefore, proposals should take into account an appropriate integration of monitoring and control systems for the developed solutions, combining, where relevant, additional functionalities such as safety and security.

Proposals should be flexible enough to cope with different designs and architectural concepts, with components being especially shaped and integrating different material combinations (such as glass, pre-casted elements, membranes).

The modular dimension is important to allow a cost-effective and easy installation in a wide variety of buildings and processing practices.

Proposals should enable a reduction of maintenance and operation costs, in particular when many sensors and actuators are cost-effectively distributed throughout the envelope.

Applicability in different geographical areas is important.

Clear evidence of technical and economic viability should be provided by validating and demonstrating the proposed adaptable envelope in real case retrofitting projects.

**Activities are expected to focus on Technology Readiness Levels 5 to 7 and to be centred around TRL 6.**

*A significant participation of SMEs with R&D capacities is encouraged.*

The Commission considers that proposals requesting a contribution from the EU between 4 and 6 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requiring other amounts.

Expected Impact:

- The cost related to new technologies should not exceed conventional standard building costs by more than 20%.
- Demonstration of the replicability potential in a real case-study.
- Solutions with a payback period of below 10 years.
- The integrated harvesting systems will cover at least 30-40 % of the overall energy demand for new buildings and 20% for renovated buildings.

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Innovation action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

**EEB-08-2017: New business models for energy-efficient buildings through adaptable refurbishment solutions**

Specific Challenge: The most important benefit associated with the refurbishment of an existing building comes from improving the energy performance, which gives an essential contribution to reach the EU 2020 consumption goals, taking into account that buildings represent 40% of the energy use in the EU. A key challenge for its large-scale implementation is the necessity to manage a broader involvement of stakeholders representing different interests and different responsibilities influencing the potential solutions and actions. This regards not only the choice of technologies, but also the design and renovation methods, as well as a number of socio-economic issues.

Nowadays, decentralised energy generation technologies have been demonstrated in a number of building applications in Europe and beyond but large scale uptake and business deployment of these technologies is still in its early stage. Currently, the renovation level is about 1.2% of the building stock in Europe per year and it should increase, according to the European Performance Building Directive (EPBD), to 2 - 3 % per year until 2030. Innovative business models which allow consumers and the market to invest with confidence in long term operation, maintenance, reliability and service levels need to be developed.

Scope: Activities should focus on the benchmark and the assessment of innovative business models, evaluating different refurbishment packages enabling the selection of the most attractive and efficient ones for different building types (residential/District Heating Cooling connected) and climatic conditions, taking the maximum advantage of user behaviour and geo-clustering.

Adequate assessment tools and the methodological challenges facing analyses addressing the issue of comprehensive analytical approaches in order to inform business decisions in this respect need to be discussed. Life cycle models as input to the decision making process in the feasibility phase of the renovation project also need to be considered.

Proposals need to assess different highly resource-efficient business models for refurbishing buildings including the assessment of the possibilities provided by public procurement of innovative solutions, appropriate combinations of public and private funding, or only private funding. These concepts need to be developed taking into account the building owners, the socio-economic impacts, and the current EU crisis.

Proposals should also develop effective methods for steering and governance especially paying attention to the local scale, including the variety of actions by cities and municipalities that can define obligations or encourage voluntary actions. In particular the business models developed should support the preparation of innovation-related public building procurements by local/regional/national authorities or at European level, taking into account the needs of the public sector with regard to high-performance buildings (new or retrofitted ones).

The business models should cover the complete cycle as from the design phase of the building: decentralised energy generation technologies, integration, installation, commissioning, operation, servicing and maintenance, etc. In this framework, activities should cover business model design and optimisation, market and customer segmentation approaches for decentralised energy generation, consumer behaviour and decision driver research for optimising business model structures, supply chain and concept delivery optimisation, new earning models and financing mechanisms. In addition, proposers should also seek solutions to increase participation of stakeholders, considering methods to engage end users living in the buildings/neighbourhood and methods to increase the interest and commitment of building owners and market partners.

Socio-economic impacts of refurbishment should be taken into account considering the possibly drastic effects of high renovation costs on house owners and tenants, and seeking possible solutions to reduce costs, as well as addressing the needed commitment by users to energy efficiency after renovation.

Clear evidence of technical, environmental and economic viability should be provided. The possibility to engage municipalities planning to integrate renewable energy sources in the built environment could be an added value.

*This topic is particularly suitable for SMEs.*

The Commission considers that proposals requesting a contribution from the EU between EUR 500000 and 1 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Cost-effectiveness of the renovation compared to current costs.
- Adaptive renovation packages with high energy efficiency and low environmental impact.
- Increased awareness of and commitment to improved energy-efficiency of the building stock.
- Increased capacity of municipalities to effect the renovation of building stocks, in particular through the use of public procurement tools.
- Better quality standards and performance guarantees while improving indoor environment and remaining cost-effective.
- More involvement of customers/users in the integrated–innovative business model solutions.

Type of Action: Coordination and support action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***



## Conditions for the Call - CALL FOR ENERGY-EFFICIENT BUILDINGS

Opening date(s), deadline(s), indicative budget(s):<sup>4</sup>

Topics (Type of Action)	Budgets (EUR million)		Deadlines
	2016	2017	
Opening: 15 Oct 2015			
EEB-01-2016 (IA)	49.00		21 Jan 2016
EEB-02-2016 (CSA)			
EEB-03-2016 (IA)			
EEB-04-2016 (RIA)			
Opening: 20 Sep 2016			
EEB-05-2017 (IA)		54.00	19 Jan 2017
EEB-06-2017 (RIA)			
EEB-07-2017 (IA)			
EEB-08-2017 (CSA)			
Overall indicative budget	49.00	54.00	

Indicative timetable for evaluation and grant agreement signature:

For single stage procedure:

- Information on the outcome of the evaluation: Maximum 5 months from the final date for submission; and

<sup>4</sup> The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.

All deadlines are at 17.00.00 Brussels local time.

The Director-General responsible may delay the deadline(s) by up to two months.

The deadline(s) in 2017 are indicative and subject to a separate financing decision for 2017.

The budget amounts for the 2016 budget are subject to the availability of the appropriations provided for in the draft budget for 2016 after the adoption of the budget 2016 by the budgetary authority or, if the budget is not adopted, as provided for in the system of provisional twelfths.

The budget amounts for the 2017 budget are indicative and will be subject to a separate financing decision to cover the amounts to be allocated for 2017.

- Indicative date for the signing of grant agreements: Maximum 8 months from the final date for submission.

Eligibility and admissibility conditions: The conditions are described in parts B and C of the General Annexes to the work programme.

Evaluation criteria, scoring and threshold: The criteria, scoring and threshold are described in part H of the General Annexes to the work programme. The following exceptions apply:

	<p><b>For single-stage and second-stage evaluations,</b> the threshold for the criteria Excellence and Impact will be 4. The overall threshold, applying to the sum of the three individual scores, will be 12.</p> <p>In case of equal overall scores in the ranked list, the priority order of proposals will be established in accordance with part H of the General Annexes, except that proposals will be ranked on the basis of individual scores for the Impact criterion before the Excellence criterion.</p> <p>In case of equal overall scores in the ranked list, the priority order of proposals will be established in accordance with part H of the General Annexes, except, when comparing <i>ex aequo</i> proposals of different topics, the proposals will be ranked first according to the position in the topic ranked lists</p>
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Evaluation Procedure: The procedure for setting a priority order for proposals with the same score is given in part H of the General Annexes.

The full evaluation procedure is described in the relevant [guide](#) published on the Participant Portal.

Consortium agreement: Members of consortium are required to conclude a consortium agreement, in principle prior to the signature of the grant agreement.

## **Call - CALL FOR NANOTECHNOLOGIES, ADVANCED MATERIALS, BIOTECHNOLOGY AND PRODUCTION**

***H2020-NMBP-2016-2017***

### **ADVANCED MATERIALS AND NANOTECHNOLOGIES FOR HIGH ADDED VALUE PRODUCTS AND PROCESS INDUSTRIES**

This part meets the challenge of enabling inventive combinations of materials, process industries, business models, and links to public-private partnerships in delivering innovative products to markets and customers that demand them. Research and innovation activities (including pilot lines) will focus on high precision processing and fabrication of smart materials structures and systems; nanotechnologies and advanced materials converging systems as a basis for next generation of high added value products in a wide range of application fields, such as transport (in particular also related to 'Green Vehicles'), civil engineering, mechatronics, catalysis, bio-medical and health, textiles and packaging.

Processing is a key to deliver value in new markets with new (nano)material enabled products and materials. Meeting the challenge of scaling up and achieving ever increasing material and energy efficiencies would dictate volume, cost-competiveness and sustainability criteria. Activities will focus on process technologies and management of resources based on high performance nanotechnologies and advanced materials science with the aim of making processes "smarter", "cleaner" and "intelligent", contributing to the Circular Economy. Research will cover "from atoms to components and systems"; new material functionalities induced by intelligent processing technologies; multi-material systems process engineering; and advanced engineering of nanotechnologies and advanced materials systems for process industries, including AM.

Proposals are invited against the following topic(s):

#### **NMBP-01-2016: Novel hybrid materials for heterogeneous catalysis**

Specific Challenge: In many currently explored applications of organic-inorganic hybrid materials, the achievement of superior properties is often hampered by the weak chemical (i.e. van der Waals, hydrogen bonding) interactions existing between the inorganic building blocks, leading, *inter alia*, to leaching of the inorganic components, agglomeration, phase separation, low mechanical stability. This is particularly critical for heterogeneous catalysis applications, where a robust linkage between the components would afford better performances in terms of recovery and re-use of the catalyst. A further factor affecting the actual effectiveness of heterogeneous catalysts is the accessibility of the active component, being facilitated by either i) a porous microstructure or by ii) a loosely cross-linked structure enabling swelling of the hybrid catalyst in the reaction medium, where the substrate is dispersed. In the latter case, an important role is played by the polarity of the medium in which the catalysis is carried out.

Scope: Explore novel concepts in hybrid materials design for heterogeneous catalysis, e.g. based on templating-effects, hierarchical architectures, tailored heterostructures or surface functionalisation and based on one-step synthesis, accomplishing i) the formation of a robust structure based on covalent bonds between organic and inorganic components and ii) accessibility of the catalysis-active moiety by tailoring the morphology and the polarity of the resulting materials, according to the targeted conditions and application such as condensations and asymmetric reactions.

A further aspect to be taken into account is the possibility to tune the cross-linking degree of the obtained hybrid materials by changing the synthetic parameters and synthesis route, to achieve different nano- and microstructures. The novel routes should be based on easy synthetic step(s) being scalable and adjustable for industrial scale, where toxic properties and LCA are taken into consideration.

**The implementation of this topic is intended to start at TRL 3 and target TRL 5.**

The European Commission considers that proposals requesting a contribution from the EU in the range of EUR 5 to 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Scientific and technological breakthroughs in the development of novel concepts in hybrid materials design for industrial heterogeneous catalysis;
- Proposals addressing novel C-C bond forming and recyclable hybrid catalysts are expected to produce valuable chemicals of biological and pharmaceutical importance;
- The activity of the novel solid hybrid catalysts is expected to be higher than the counterpart homogenous catalyst, improving process efficiency providing economic and environmental benefits;
- Considering the leading-edge character of the proposed field, the impact for the European industry in terms of market entry of new and improved products based on project results is expected to be in the medium to long term (5 – 10 years after project end).

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Research and Innovation action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

## **NMBP-02-2016: Advanced Materials for Power Electronics based on wide bandgap semiconductor devices technology**

Specific Challenge: Power electronic components, modules and systems including wide bandgap devices technology are of high strategic importance in Europe. It is still possible to retain parts of the value chain in Europe; the related application areas are based on the deep knowledge and market position in aerospace<sup>5</sup> and automotive industry, industrial electronics, energy transmission, renewable power generation (wind power, PV), healthcare, smart factories and prominent know-how for reliable materials for electronic assemblies. Contribution to the objectives of the SET-Plan in term of energy saving, efficiency, CO2 reduction are therefore part of this challenge.

Scope: The proposals should address the development of advanced, cost-effective, sustainable materials, architectures and processes for power electronics suitable for use in energy technologies.

The activities should focus on advanced materials for innovative power components and module, including packaging, new product development and application which will increase the reliability and operational lifespan of components under realistic and/or extreme conditions.

Considerable improvement of the operation of power-electronics devices based on the improved properties of the materials, device architectures, heat dissipation and/or processes should be addressed at component, module and system level. Realistic solution should be provided in term of operational characteristics like voltage, current level and sensitivity or switching frequencies or other relevant performance factors as well as in long term maintenance-free operation (resilience and reliability) with respect to the particular and stringent demand of the envisaged application.

Improvement in the cost and use effectiveness, including maintenance intensity should be quantified. Proposals may develop manufacturing concepts for the construction of components and modules with fewer production defects;

International cooperation with Japan<sup>6</sup> is encouraged to tackle societal challenges, which are global by nature;

**The implementation of this topic is intended to start at TRL 4 and target TRL 6.**

This topic addresses cross-KET activities.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 8 million would allow this specific challenge to be addressed appropriately.

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<sup>5</sup> In the LEIT Space part of this Work programme, the topics COMPET-I-2016 and COMPET-I-2017 could also be of interest to certain applicants.

<sup>6</sup> Co-funding opportunities from the Japan Science and Technology Agency exist for Japanese partners. For more information, please consult [http://www.jst.go.jp/sicp/announce\\_eujoint\\_03\\_GeneralInfo.html](http://www.jst.go.jp/sicp/announce_eujoint_03_GeneralInfo.html).

Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Substantial improvement of the wide bandgap semiconductors materials and device performance;
- Reduced long-term in-service degradation, lowering maintenance needs and costs;
- Time to market of new materials and devices will be optimised (shortened);
- Development of Wide Band Gap semiconductor technologies to bring them closer to the applications for the leadership of European sector of power electronics industries;
- Creation of smart global value chains that enable value capture to Europe.

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Research and Innovation action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

**NMBP-03-2016: Innovative and sustainable materials solutions for the substitution of critical raw materials in the electric power system**

Specific Challenge: The ambition of the European Union to achieve a secure, competitive and sustainable energy system by 2050 has become a priority. The electric power system will play a pivotal role in the overall energy mix, with particular challenges to achieve a balance between electricity supply, conversion, transport and use of energy. Critical raw materials<sup>7</sup> (CRM) can become a bottleneck to the supply-chain of the different technologies used in the electric power system with implications for materials demand under different scenarios described in the EU Energy Roadmap 2050.

Even if recycling rates for some of these materials could be optimised to the highest possible extent, the overall increasing demand for CRM urges the roll-out of substitution-based solutions within the next decade.

This specific challenge is covered by the Priority Area “Substitution of raw materials” of the European Innovation Partnership (EIP) on Raw Materials.

Scope: Proposals should deliver innovative, sustainable and cost effective materials solutions for the substitution of (i) heavy rare earth elements used in permanent magnets; and/or (ii) CRM used in energy storage applications; and/or (iii) CRM used in catalysts for applications

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<sup>7</sup> The 2014 revision of the list of critical raw materials for the EU can be found at [http://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical/index\\_en.htm](http://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical/index_en.htm)

to generate electricity; and/or (iv) CRM in materials used in photovoltaic cells. Substitution of CRM in electronics or lighting applications is excluded.

In order to ensure the industrial relevance and impact of the research efforts, the cost effectiveness and commercial exploitation potential of the proposed solutions compared to state-of-the-art solutions currently available on the market should be convincingly assessed in the proposal. The sustainability of the materials solutions should be analysed through a life-cycle assessment. Recycling/reuse should be addressed.

Where relevant, proposals should contribute to the "Expert network on critical raw materials". Refer to the part on 'Climate action, environment, resource efficiency and raw materials' of this Work Programme, topic SC5-15a-2016.

**The implementation of this topic is intended to start at TRL 3 and target TRL 5.**

In line with the objectives of the Union's strategy for international cooperation in research and innovation (COM(2012)497), international cooperation according to the current rules of participation is encouraged, in particular with Japan<sup>8</sup>. The quality of the international cooperation will be reflected in the evaluation of the proposal, under the criteria 'Excellence' and 'Impact'.

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- A strongly reduced or completely eliminated CRM content in the proposed solution(s) while keeping up or improving the materials performance levels as specified in the relevant parts of the SET-Plan Integrated Roadmap and its Annexes, available at <https://setis.ec.europa.eu/set-plan-process/integrated-roadmap-and-action-plan>
- A risk mitigation strategy from future bottlenecks in the material supply-chain of energy technologies used in the electric power system;
- Contribute to achieving the objectives of the EIP on Raw Materials, In particular, a substantial contribution to the demonstration of substitutes in targeted applications of critical raw materials.

Type of Action: Research and Innovation action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

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<sup>8</sup> Co-funding opportunities from the Japan Science and Technology Agency exist for Japanese partners. For more information, please consult [http://www.jst.go.jp/sicp/announce\\_eujoint\\_03\\_GeneralInfo.html](http://www.jst.go.jp/sicp/announce_eujoint_03_GeneralInfo.html).

**NMBP-04-2017: Architected /Advanced material concepts for intelligent bulk material structures**

Specific Challenge: The development of smart materials has been gathering pace over the past few years to develop novel concepts for intelligent components and structures with integrated functionalities that are able to communicate and interact with their environment, store data about their condition and react accordingly to external stimuli. Research in the areas of biomimetic bio-inspired engineering and nanomaterials can provide several examples of the development of smart materials and has seen a significant expansion. Examples include materials that can alter their physical properties, (e.g. viscosity, shape, colour and more) in response to temperature, stress, electrical or magnetic fields, convert sunlight into electricity, store energy, etc. Smart materials have also been used extensively in sensor developments in aerospace and automotive applications with the aim of producing intelligent structures and components that provide information of their in-service conditions. However, there are several concepts that have not yet been implemented in industrial scale. Such technologies include self-repair or self-healing materials, materials for vibration suppression, lightweight composites that can inform the user of any internal damage without the need of time consuming and expensive Non-destructive Examination (NDE), materials or structures that can undergo shape change either passively or by activation, Functionally Graded composite Materials (FGMs), energy storing components, etc. There is a need for predictive modelling of materials functionalities for those materials for which there are currently no accurate commercial or open-source codes available.

Scope: Proposals are sought to address specific industrial needs and facilitate the implementation of smart materials for applications in transport, consumer goods and ICT. The potential extension of these applications to other industrial sectors such as e.g. oil & gas and petrochemicals will be an asset. The technical challenges to be addressed relate to the development, processing and integration of smart materials with new functionalities, as e.g. for: advanced sensors (nanosensor technologies), damage detection, self-repair, self-actuation, self-sensing morphing, magnetic functionality (for non-magnetic materials), optical functionality, sound and vibration damping, thermal management in ICT applications. Material concepts based on bio-inspired solutions can also be considered. Modelling of the properties of relevance to manufacturing should be considered and further developed. Although the materials most suited to such development are lightweight advanced composites from different material classes, (like multiferroics, polymeric, ceramic, glass or metal matrix composites, organic fibrous materials). It is expected that such smart materials may make use of the unique properties possessed by nanoparticles and therefore the development of nanomaterial based intelligent components will be within the scope of the call. The development of such material structures has to be accompanied by high resolution analytical tools that are able to simulate and characterise the materials on all scales and, moreover, to track and reveal their function –structure relations in situ. The functionalities of smart materials will require the identification of gaps in standards and future pre-normative activities will have to be addressed as part of the scope. For this topic proposals should also be able to demonstrate in addition to the development concept, the feasibility of such



technologies in terms of cost, production and processing methodologies, reuse/recycling of materials at end of life and reliability. Industrial and/or additional experimental partners should ensure broad validation and adoption of both the software and the materials.

**The implementation of this topic is intended to start at TRL 4 and target TRL 6.**

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: The implementation of novel smart material technologies is expected to pave the way for innovative environmentally friendly smart products:

- Enhancing the market opportunities for European industries;
- Improving consumer safety;
- Reducing maintenance costs;
- Improving resource efficiency;
- Contributing to a future circular economy;
- Improved understanding of materials properties based on theoretical materials models.

Enhancing the knowledge base in the EU not only at the R&D level but also at the manufacturing and production level, creating a highly skilled workforce with improved levels of job satisfaction.

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Research and Innovation action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

**NMBP-05-2017: Advanced materials and innovative design for improved functionality and aesthetics in high added value consumer goods**

Specific Challenge: Creative industries have been defined as one of the most active, significant and relevant new emerging industrial sectors in the European economy (Report on Emergency Industries, PwC, 2012). The creative industries linked to manufacturing (e.g. architecture, automotive, art, crafts, supports for cultural items, decoration, fashion, furniture, lighting, interior design materials and products, jewels, luxury, media supports, publishing, sport and toys) are generators of competitive advantages that cannot be reproduced elsewhere, promoters of local development and drivers of industrial change (COM(2012)537 ‘Promoting cultural and creative sectors for growth and jobs in the EU’).

Creative SMEs in particular can make use of design as a strategic tool to create innovative products and services addressing new consumers' standards and societal challenges while assuring competitive and sustainable development.

However, the future European exploitation of this rich sector depend on the EU ability to support high-growth creative SMEs and start-ups in exploiting highly innovative technological advances in materials for commercial, cultural and societal applications.

To promote design-driven innovation, a number of action lines have been endorsed by the Commission, including integrating design into research and development and promoting new collaborative innovation strategies ('Implementing an Action Plan for Design-Driven Innovation', SWD(2013)380).

Scope: Proposals should address the development of innovative advanced material solutions (e.g. superhydrophobic/superoleophobic nanomaterials and nanoscale systems, self-cleaning and self-healing systems, smart textile fabrics and papers, biomimetic, shape change/memory materials, self-assembling systems, energy harvesters) for use in the creative industry sectors defined above to make urban living significantly easier, more sustainable, more comfortable, more secure and more functional. Creativity, cultural and societal values, alongside specialist knowledge, should be driving the material innovation (e.g. increased performance, lightness, safety, sustainability, improved lifetime) to add value to products through the use of new intangible material functionalities (e.g. creative design, artistic expression, trend translation, enhanced sensations, cultural values).

Proof of concept in terms of product and/or process must be delivered within the project, excluding commercially usable prototypes (in compliance with European Commission Communication 2006/C323/01), but convincingly demonstrating scalability towards industrial needs.

In order to ensure the industrial relevance and impact of the research efforts, the key properties improvement and commercial potential of the innovative technologies compared to state-of-the-art solutions currently available on the market should be convincingly assessed in the proposal. Sustainability aspects in the whole life cycle of the final products should be taken into account. The active participation of designers, artists, societal stakeholders, material scientists, materials suppliers, researchers, manufacturers and end users of the resulting products represents an added value and this will be reflected in the second stage of the evaluation. As relevant, the proposed activities should address sex and gender specific aspects<sup>9</sup>.

**Activities are expected to focus on Technology Readiness Levels 4 to 6, and target Technology Readiness Level 7.**

*A significant participation of SMEs with R&D capacities is encouraged.*

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<sup>9</sup> See definition of the 'gender dimension approach' in the introduction of this Work Programme part.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Novel, higher added-value, better performing, sustainable, versatile, appealing designs and creative solutions for consumer goods based on innovative advanced materials or structures;
- Good integrability of the proposed innovative materials in final products (e.g. using a modular approach) and quickly reconfigurable to new custom requirements;
- Promoting new collaborative innovation strategies and practices along the value chain to develop commercial, cultural and societal applications with a strong user orientation, creating new business opportunities for the European industry and contributing to the circular economy in terms of one or more of the following: increased competitiveness, faster recovery of investment, access to new markets, access to new customer segments, increased business effectiveness, increased customer engagement, increased environmental sustainability;
- Enhancing innovation capability and competitiveness of European SMEs by effectively combining and transferring new and existing knowledge with ‘intangible’ factors (e.g. creative design, artistic expression, trend translation, enhanced sensations, cultural values);
- Increasing awareness of designers about new materials;
- Contribute to achieving the relevant EU policy objectives in COM(2012)537, ‘Promoting cultural and creative sectors for growth and jobs in the EU’.

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Innovation action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

**NMBP-06-2017: Improved material durability in buildings and infrastructures, including offshore**

Specific Challenge: Durability is a key criterion for materials in many applications and environments. Longer performing materials can strongly reduce overall life time costs, such as lower usage costs through reduced maintenance and shorter service interruptions. Costs may also be reduced in the production phase (raw materials, energy, transport, formability), in the installation phase, and the materials may be more appropriate for end of life

reuse/recycling. Typical applications requiring excellent long term durability and high reliability are buildings, marine applications and infrastructures including off shore.

In many applications, operational durability needs to be better understood, particularly for innovative products which have no demonstrated long term performance. Durability has to be evaluated both theoretically and in real installation conditions (including within challenging environments when relevant) as these may influence final product performance.

Scope: Research proposals should address all of the following activities: theoretical understanding (and development of models if appropriate) of the factors which affect durability of materials, including corrosion and ageing phenomena; experimental methods to measure and reliably test durability, non-destructive inspection procedures and monitoring tools; development of new and more durable materials (possibly multifunctional); and “fit for purpose” validation of new materials through life testing in the planned application and environment.

The proposed solutions should go well beyond the state of the art and it should be demonstrated that materials with improved durability also fulfil all other properties necessary for the application proposed.

The following factors should also be all considered: principles of sustainability (the sustainability of each developed solution should be evaluated via life cycle assessment studies carried out according to the International Reference Life Cycle Data System - ILCD Handbook); ease of installation; realistic solutions at a reasonable price and appropriateness for the operational environment; resistance to harsh environments if applicable. When relevant, design considerations (optimal combination of new materials) should also be considered. Recycling/reuse of materials should also be addressed. Standardisation aspects should be considered when relevant. Proof of concept in terms of one (or more) component(s) containing the new materials developed should be delivered within the project, excluding commercially usable prototypes (2006/C323/01), but convincingly demonstrating scalability towards industrial needs. Information guides for applications, installation and any appropriate training on the new solutions should be provided before the end of the project.

**The implementation of this topic is intended to start at TRL 4 and target TRL 6.**

*This topic is particularly suitable for the participation of SMEs.*

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 6 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- At least 30% improvement in durability on the most relevant properties for the application;

- At least equivalent level for all other properties;
- At least 30% lower cost;
- Positive LCA balance over the whole life cycle;
- Proposals will have a higher impact if they are relevant to several applications;
- Contribution to strengthening competitiveness of the European industry, including in the field of “green” and/or offshore technologies.

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Research and Innovation action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

**NMBP-07-2017: Systems of materials characterisation for model, product and process optimisation**

Specific Challenge: As material systems and device structures become nanosized and nanostructured, significant challenges exist with respect to their design and the tailoring of their functions in a controlled way. The use of discrete materials models, as a bridge for linking and coupling nanostructure features to macroscopic device functionality is gaining increasing importance in the fast and reliable development of new materials, devices, and the control of the related production processes. Characterisation techniques and experimental data for process optimisation and model validation are key in such developments.

Europe has a large number of first-class laboratories for characterisation in the field of advanced materials and nanotechnologies. In some cases, regional hubs of laboratories addressing characterisation for specific industrial or application sectors have already been successfully established. Nevertheless, there is an ever increasing need for a strong transnational and trans-sectorial coordination and optimisation of existing characterisation technologies and their utilisation for the benefit of widespread process optimisation and model validation. This includes the need for widely agreed experiment protocols, multi-technique and multi-scale characterisation approaches, metadata descriptions of interpretation tools and accessible, relevant, and reliable data bases for raw and interpreted data.

Scope: In the triangle of manufacturing, modelling, and experimentation, the projects should develop an open innovation environment for the optimisation of materials, materials behaviour and/or nano-device manufacturing processes, and for the validation of materials models<sup>10</sup> based on experimental characterisation.

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<sup>10</sup> [http://ec.europa.eu/research/industrial\\_technologies/modelling-materials\\_en.html](http://ec.europa.eu/research/industrial_technologies/modelling-materials_en.html)

An open innovation environment should be created linking characterisation laboratories with capacities adapted to process optimisation and model validation needs. Also information on characterisation tools and expertise should be included.

Commonly agreed validation and measurement protocols should be developed which address the most relevant issues related to experiments, process optimisation and model validation. Projects should also document their protocols for the interpretation of raw experimental data and document reliable models for data interpretation where needed. The project may seek to agree standards for interpretation protocols. Meta data to describe all protocols should be agreed.

The same metadata should be used for interfacing existing characterisation databases to make search and linking between different, distributed databases effective and easy. The metadata should allow future extension to other sectors. Strategies and test rules pertaining to data integrity and quality mechanisms should be established. A concept to make raw and interpreted data citable should be developed and implemented for this system. The project should ensure wide spread participation.

Projects should bring together a representative number of players from public and industrial nanoscale characterisation laboratories, from manufacturers, and from the academic and industrial materials modelling communities. To ensure a wide coverage, these players should cover several industrial or application sectors. Existing regional/national hubs may also participate, but they need to connect in the project to players in other countries, possibly also other regional/national hubs.

The proposal should present a credible business plan for the maintenance of the open environment after the project duration.

Proposers are strongly encouraged to consult the stakeholders outside the consortium through existing groups such as the European Materials Modelling Council or the Characterisation cluster. Appropriate resources should be foreseen for clustering activities.

**The implementation of this topic is intended to start at TRL 4 and target TRL 6.**

*This topic is particularly suitable for SMEs.*

*International standardisation, e.g. with the ISO, may be considered.*

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 4 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Increased speed of material and/or nano-device development through development of an open innovation environment;

- Wide acceptance of the proposed solutions beyond the consortium;
- Use of the protocols and systems in other relevant areas or sectors beyond the ones covered by the project;
- Use of the protocols in the development of new standards;
- Clear, prospects for quantified, socio-economic gains from the proposed solutions should be addressed, supported by quantifications;
- The maintenance aspect of the developed databases beyond the lifetime of the project should be addressed.

Type of Action: Research and Innovation action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

## **GREEN VEHICLES**

The societal benefits deriving from the LEIT-NMBP technologies and their convergence<sup>11</sup> (including with the other key enabling technologies) will be showcased in two important areas, healthcare and energy. These areas can demonstrate the value of vision-inspired science, and technologies brought to bear on critical societal issues. Efforts in these areas are also justified by the relative maturity of the underlying technologies. New production and business models will support climate and environment goals.

Proposals are invited against the following topic(s):

### **NMBP-08-2016: Affordable weight reduction of high-volume vehicles and components taking into account the entire life-cycle**

Specific Challenge: One of the principal levers to improve the energy efficiency, performance and range of vehicles, and reduce their impact on the environment, is to decrease their weight. This is particularly important for conventionally-powered vehicles to reduce CO<sub>2</sub> emissions but also for EVs in which the relatively limited range and high costs, linked to the still comparatively low production volumes, remain critical factors that determine their competitiveness.

Previously-conducted EU research projects have already demonstrated the fact that the adoption of advanced grades of steel, metal alloys, aluminium, novel plastics and biomaterials, novel high-strength light-weight ceramics and composites can lead to a drastic

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<sup>11</sup> Convergence of nanotechnologies, materials and other KETs is defined as the escalating and transformative interaction among seemingly different disciplines, technologies, communities, and domains of human activity to achieve mutual compatibility, synergism and integration, and through this process to create added value and branch out to meet human needs and shared goals.

reduction in the weight of a wide range of vehicle components. However the outcome of these activities is also that the additional cost for each kilogram saved is still too high to represent a revolutionary approach enabling intensive use of such lightweight materials particularly in vehicles intended for mass-production.

Correspondingly it is necessary to address this issue directly and urgently in order to identify solutions for the significant weight reduction of vehicles, and in particular electrified cars, which are cost-effective and viable with respect to the intended production volumes and from the entire life-cycle perspective, improving performance without compromising crashworthiness and durability. Specifically the principal focus should be on large production volumes exploiting economies of scale, targeting production volumes of at least 50000 units per annum, while investigating also the opportunity for developing common solutions across different types of vehicle.

Scope: The principal focus should be on large production volumes exploiting economies of scale, targeting production volumes of at least 50000 units per annum, while investigating also the opportunity for developing common solutions across different types of vehicle.

A holistic, integrated and cost-driven approach should be pursued in order to optimize the use of lightweight materials solutions in all vehicle structures, subsystems and components (with the exception of concepts for stand-alone powertrains), considering the entire value chain from a life-cycle perspective: materials, tools, process, assembly and end-of-life.

Materials engineering should address the development of new low density/high strength and highly formable materials (e.g. steels, alloys, aluminium, castings, polymers, biomaterials, ceramics and reinforcements) and their combination (e.g. composites, sandwiches, high strength foams) at affordable prices starting from less expensive sources, also via recycling and/or processes which are less energy-demanding. Furthermore, materials engineering should address corrosion, thermal expansion, joining (e.g. bonding, riveting, friction-stir based technologies, etc.) and recycling issues of multi-material designs, one essential prerequisite being the widespread availability and minimal CO<sub>2</sub> footprint of the candidate materials.

Manufacturing engineering should address both the need to use less energy-intensive and more sustainable technologies, and the opportunity to speed-up and improve the efficiency of lightweight part production also through the combination of different manufacture steps, moving towards new approaches specific for new materials, including cost-effective multi-material joining technologies as well as the formability of tailored blanks material hybrid parts, and considering also effective multi-material surface treatments.

Design should pursue approaches based on both “right material for the right application” and “multi-functional optimization” in order to exploit the lightweight materials properties, optimizing their use through functional integration of multi-material solutions, including design for recycling. In view to further reduce the environmental footprint of the vehicles, the use of recycled high added-value materials should be considered.



Virtual engineering should support the multi-functional design for the optimization of performance (including crashworthiness, durability, etc.), developing and applying methods and tools to enable the efficient and effective simulation of multi-functional, multi-material solutions as well as of sustainable manufacturing technologies in order to minimize material use and energy consumption. Importantly Life Cycle Analysis (LCA) should support the entire design and development process.

The activities are required to identify solutions for the weight reduction of vehicles, including, but not limited to, electrified cars which, through a comprehensive analysis, should be demonstrated to be both viable, in terms of cost and production, and sustainable from the life-cycle perspective.

The solutions must be validated at the application level, with full verification of the virtual engineering approach, to demonstrate improved performance without any compromise in terms of crashworthiness and durability. An assessment of the applicability of the solutions developed across different vehicle types is also expected.

This topic is a NMBP contribution to the European Green Vehicles Initiative (EGVI) and was developed in close collaboration with EGVI. It complements the EGVI activities in the Work Programme part of the Societal Challenge “Smart, green and integrated transport”.

**The implementation of this topic is intended to start at TRL 4 and target TRL 6.**

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: Specific targets that should be achieved in short- to medium-term (within a time frame of about 6 years following the completion of the project) include:

- 10 % reduction in energy consumption of vehicle due to weight reduction (with corresponding impact in terms of CO<sub>2</sub> emissions depending on the vehicle type);
- Cost-effective weight savings depending on intended production volumes, eg.:
  - For 50000 units per annum: at least 6 €/kg-saved;
  - For 100000+ units per annum: at least 3 €/kg-saved;
- At least 6% improvement in LCA environmental impact ("from cradle to grave") in terms of GWP (Global Warming Potential).

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Research and Innovation action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

## **ADVANCED MATERIALS AND NANOTECHNOLOGIES FOR HEALTHCARE**

Nanomedicine activities aim at shortening the long research, development and regulatory approval process, reducing the associated costs, so as to deliver safe, efficacious and cost effective products to meet the demands for improved healthcare. Operationally, they should target translation of new products from "lab-to-bedside". This should apply to all aspects of nanomedicine, including biomaterials for tissue engineered products, nanosystems and nanodevices for targeted drug delivery, diagnosis and molecular imaging, etc. Activities will be positioned with respect to the activities of Societal Challenge 'Health, demographic change and well-being' (including Micro-Nano-Biosystems and e-Health), the European Research Council (Frontier Research), Research Infrastructures, involvement of the European Medicines Agency, and others. In particular, it is expected that the societal challenge 'Health, demographic change and well-being' will provide support for the clinical investigations for nanotechnology-derived approaches and products.

Proposals are invited against the following topic(s):

### **NMBP-09-2016: Biomaterials for diagnosis and treatment of demyelination disorders of the Central Nervous System**

Specific Challenge: The aim of this topic is to develop innovative approaches for biomaterials for health that are easily transferable from industry to the clinic and based on new methodologies directed to the improvement of the treatment and prognosis of demyelination disorders (one specific disorder to be chosen), where regrowth and regeneration of affected areas of the nervous system is the key to successful therapy. These disorders are often of chronic duration and associated with increasing levels of disability. In the European Union, at least 1 000 000 people are affected with these disorders and many more times than that world-wide. They are often diagnosed between the ages of 20 and 40 when families and careers are developing and can represent the most common cause of disability affecting young adults, thereby having a strong economic impact for society in terms of healthcare costs.

Scope: Proposals should focus on the development of new multifunctional biomaterials, as part of eventual Medical Devices<sup>12</sup> or Advanced Therapies<sup>13</sup>, so that they can function as effective eventual therapeutic interventions. They can include biocompatible and

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<sup>12</sup> As defined by Council Directive of 20 June 1990 on the approximation of the laws of the Member States relating to Active Implantable Medical Devices (90/385/EEC) (OJ L 189, 20.7.1990, p. 17) (as amended), Council Directive 93/42/EEC of 14 June 1993 concerning Medical Devices (OJ L 169, 12.7.1993, p. 1) (as amended) and Directive 98/79/EC of the European Parliament and of the Council of 27 October 1998 on In Vitro Diagnostic Medical Devices (OJ L 331, 7.12.1998, p. 1) (as amended) and with the relevant Implementing Measures and all succeeding measures.

<sup>13</sup> As defined by Regulation (EC) No 1394/2007 on advanced therapy medicinal products (gene therapy, stem cell therapy and tissue engineering)

biodegradable biomaterials as part of minimally invasive treatments and theragnostic materials. Funding for the development of new drug candidates for these conditions or for any form of clinical trial will not be considered.

The development of new integrated experimental and computational approaches aimed to describe interface processes and their determinants should be considered as key step for the design of safe and performing biomaterials. Experimental protocols should be planned taking due account of current good laboratory practice (GLP) and ISO guidelines. Manufacturing processes will need to be addressed, including up scaling, good manufacturing practice (GMP), process analytical technology (PAT), technology transfer and regulatory work in respect of relevant regulations as appropriate<sup>14,15</sup>. At least one type of tissue engineering construct should be delivered at the end of the research project together with a proof of concept of its therapeutic potential and preclinical validation.

In order to ensure relevance and impacts of the research efforts, the active participation of industrial partners and clinicians represents an added value to the proposals and this will be reflected in the evaluation under the criterion “Impact”. A multidisciplinary approach is preferred; taking into account both surgical, minimally invasive and pharmacological approaches, as well as prevention and rehabilitation strategies, including robotics if necessary. The expected results should improve the quality of life of the affected population and their careers. They should be measurable even for optimising research costs of the enterprises and for reducing time-to-market of new products. The project should include training and dissemination activities. As relevant, the proposed activities should address sex and gender specific aspects<sup>16</sup>.

**The implementation of this topic is intended to start at TRL 3 and target TRL 5.**

*This topic is particularly suitable for SMEs.*

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

**Expected Impact:**

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<sup>14</sup> As defined by Council Directive of 20 June 1990 on the approximation of the laws of the Member States relating to Active Implantable Medical Devices (90/385/EEC) (OJ L 189, 20.7.1990, p. 17) (as amended), Council Directive 93/42/EEC of 14 June 1993 concerning Medical Devices (OJ L 169, 12.7.1993, p. 1) (as amended) and Directive 98/79/EC of the European Parliament and of the Council of 27 October 1998 on In Vitro Diagnostic Medical Devices (OJ L 331, 7.12.1998, p. 1) (as amended) and with the relevant Implementing Measures and all succeeding measures.

<sup>15</sup> As defined by Regulation (EC) No 1394/2007 on advanced therapy medicinal products (gene therapy, stem cell therapy and tissue engineering)

<sup>16</sup> See definition of the 'gender dimension approach' in the introduction of this Work Programme part.

- Innovative bio/nano-materials for the treatment of patients with demyelination disorders of the Central Nervous System, improving their quality of life due to minimally invasive action and/or longer duration of implants and devices;
- reduced direct and indirect costs linked to these diseases and their treatment;
- enhance competitiveness of the biomaterials and biomedical industries in the EU, in particular through technology transfer effects on biotechnology companies, with particular regard to SMEs and new forms of cooperation between academia, research centres and the private sectors. Such effects should be balanced to match sustainability principles and values, and to enforce competitiveness in terms of reducing time-to-market and trial costs for European industries;
- Dissemination of results, contributing to increase social awareness about more efficient and less costly therapies – based upon innovative approaches and broader accessibility – with improved patient compliance.

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Research and Innovation action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

### **NMBP-10-2016: Nanoformulation of biologicals**

Specific Challenge: Many biomolecules (e.g. proteins, peptides, nucleic acid, enzymes), in opposition to classical small molecules, have demonstrated interesting therapeutic activities in vitro. However, they are too often not druggable because once in pre-clinical in vivo development, they show disappointing loss of efficacy and/or unacceptable toxicity. For example, a high in vitro efficacy of a therapeutic biomolecule can disappointingly become low in vivo, because the biomolecule is processed by the immune system or by enzymes of the host before reaching its targeted tissue. Nanotechnology represents a promising opportunity to overcome these drawbacks. Indeed, the formulation of nanocarriers containing biomolecules ('biologicals') for drug/vaccine delivery can greatly improve their in vivo efficacy and/or decrease their toxicity and provide the capability to cross biological barriers (e.g. intestinal, blood-brain barrier, nasal, ocular, pulmonary, skin).

Scope: This call addresses nanoformulation of biologicals (like proteins, peptides, nucleic acids and enzymes). With an appropriate formulation the biologicals can be effectively transported through the relevant biological barriers to the targeted organs, tissues and cells.

Formulation of nanomedicines has in general been empirical and often produced in an amorphous or undefined structure, which produces regulatory and manufacturing control issues. The aim of the research is to achieve excellent quality control of the assembly by using self-assembling systems. The resulting processes should provide a high degree of control over

the physico-chemical parameters like shape, size and chemical composition while incorporating non-Lipinski molecules such as nucleic acids, proteins or peptides. Characterisation aspects of the nanoformulations therefore have to be properly addressed. The benefit will be easier manufacturing and process control, as well as optimised nanoformulation of biologicals with tailored transport through biological barriers.

Projects will develop a nanoformulation of biomolecules to provide a solid pre-clinical proof of concept, address scale-up to the quantities needed for late pre-clinical and clinical study and prepare for future clinical testing. Partners will also have to describe how the various barriers for advancing their new therapy to clinical application will be overcome; they will especially take into account the medical regulatory requirements and the scale-up production for clinical study. As relevant, the proposed activities should address sex and gender specific aspects<sup>17</sup>.

The clinical focus should be notably on age related diseases, neglected diseases and rare diseases or inflammatory diseases, but excluding cancer and infectious diseases.

**Activities are expected to commence at Technology Readiness Levels 3 /4 and reach 5/6.**

*This topic is particularly suitable for SMEs.*

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 6 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Developments of new solutions for the particularly needed delivery of biologicals;
- Radical improvement of therapy through the development of new nanoformulation solutions for the delivery of biologicals;
- Foster the translation of nanoformulation of biomolecules towards clinical development / application;
- Improvement of the competitiveness of the European healthcare industry through accelerated introduction of new nanotechnology enabled therapies;
- Improved understanding by academics and research organisations of the requirements of the pharmaceutical and medical devices industry and of medical regulators.

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Research and Innovation action

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<sup>17</sup> See definition of the 'gender dimension approach' in the introduction of this Work Programme part.

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

### **NMBP-11-2016: ERA-NET on Nanomedicine**

Specific Challenge: Strengthening Europe's position in nanomedicine research requires concentrated action on common European research priorities in view of implementing joint initiatives. The Nanomedicine Strategic Research and Innovation Agenda gives a strategic and perspective frame for increasing uptake of nanomedical research and innovation through joint undertakings notably with large pharma or diagnostics companies, thereby contributing to the emergence of a nanomedicine industrial sector.

Scope: The proposed ERA-NET Cofund aims at coordinating the research efforts of the participating Member States, Associated States and Regions in the field of nanomedicine, continuing the activities started by the ERA-NET EuroNanoMed and fostering the competitiveness of European nanomedicine actors, and to implement a joint transnational call for proposals (resulting in grants to third parties) with EU co-funding to fund multinational innovative research initiatives in this domain.

The action will link with existing PPP or Joint programming initiatives such as IMI to leverage public funding and increase joint projects with Industries and to create a positive environment for the uptake of innovation nanomedicine.

The Commission considers that proposals requesting a contribution from the EU between EUR 8 and 10 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

**No more than one action will be funded.**

Expected Impact:

- Synergies and coherence in key fields of nanomedicine research at national and regional level;
- Implementation of relevant parts of the Nanomedicine Strategic Research and Innovation Agenda;
- Favourable conditions for an increased uptake of nanomedical technologies into industrial medical products.

Type of Action: ERA-NET Cofund

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

**NMBP-12-2017: Development of a reliable methodology for better risk management of engineered biomaterials in Advanced Therapy Medicinal Products and/or Medical Devices**

Specific Challenge: The development of new biotechnology-based products needs to be complemented with a scientifically valid identification of the potential hazards from these biomaterials to human health and to the environment, together with the monitoring and reduction of the risk that these new technologies pose. Current knowledge is still incomplete and the established methods may be inappropriate for specific materials in view of their eventual deployment. The necessary integration of physical, chemical, biochemical and clinical methods is an open challenge. Hence, future production system engineering requires development of integrated and validated methodologies as basis for an appropriate integrated risk management.

Scope: The development of new biotechnology-based products needs to be complemented with a scientifically valid identification of the potential hazards from these biomaterials to human health and to the environment, together with the monitoring and reduction of the risk that these new technologies pose. Current knowledge is still incomplete and the established methods may be inappropriate for specific materials. Hence, future production system engineering requires validated methodologies as basis for an appropriate integrated risk management. As relevant, the proposed activities should address sex and gender specific aspects<sup>18</sup>.

Projects are expected to initiate and support standardisation of the proposed biomaterials and methods, including methods that will reflect their eventual deployment as part of Advanced Therapy Medicinal Products and/or Medical Devices.

The expected projects should be related to validating, adapting and/or developing a reliable methodology for risk assessment and thorough overarching hazard identification for engineered biomaterials and should address the following areas:

- Comparison and validation of current (and/or development including validation of new) test methods and test schemes, including in vitro and in silico methods, to detect adverse effects from biomaterials to:
  - human health including acute and chronic toxicity (oral, inhalation, dermal);
  - modelling toxicity behaviour of engineered Biomaterials, including development of ready-to-use predictive models (web services etc);
  - the environment; eco-toxicity tests, bioaccumulation, persistence, bioavailability and life cycle impacts onto all forms of biota.
- Relevant reference and/or certified reference materials;

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<sup>18</sup> See definition of the 'gender dimension approach' in the introduction of this Work Programme part.

- Management of accidental risk including explosion and massive release;
- Methods for performance assessment of hazard and exposure monitoring systems and on the field detection systems;
- Methods for evaluation of risk reduction strategies and systems.

**The implementation of this topic is intended to start at TRL 4 and target TRL 6.**

*This topic is particularly suitable for international cooperation.*

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Development of comprehensive understanding of the properties, interaction and fate of engineered biomaterials in relation to human health and environment;
- Support to policy and decision making concerning biomaterials research in respect to various stakeholders: public authorities, industry, researchers and citizens;
- Validated test methods and schemes for the identification of potential adverse effects from biomaterials and contribution to the future definition of appropriate measures, where needed;
- Support to pre and co-normative activities, such as with reference to the implementation of the REACH regulation<sup>19</sup>;
- Support to good governance in biomaterials research following the safe, integrated and responsible approach as laid down in "Nanosciences and Nanotechnologies: An action plan for Europe".

Type of Action: Research and Innovation action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

**NMBP-13-2017: Cross-cutting KETs for diagnostics at the point-of-care**

Specific Challenge: Research and technology development at the interface of key enabling technologies has the potential to provide novel technological Micro-Nano–Bio integrated

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<sup>19</sup> Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC and amendments



Systems (MNBS) platforms to enhance the ability to sense, detect, analyse, monitor and act on phenomena from macro (e.g. body, organ, tissues) to nano scale (e.g. molecules, genes). These developments have a high potential for facilitating personalised and preventive healthcare. However, the translation of laboratory proven concepts to the clinical environment involving pre-clinical and clinical testing, prototyping, and small series manufacturing is currently lagging. Business development and market growth are therefore still limited. The challenge is to bring new promising laboratory proven MNBS concepts for addressing priority healthcare needs from the laboratory to the clinic.

Scope: The focus is on further development into a clinical setting of novel MNBS platforms, techniques and systems that have already been proven in a laboratory setting (laboratory Proof-of-Concept). These must pertain to one or more of the following:

- a. In vitro/in vivo diagnostics that are deployed at the point of care;
- b. Therapy monitoring at the point of care.

Proposals should pay attention to facilitate clinical data harvesting, e.g. for medical regulatory purposes and/or to enhance epidemiological monitoring of health and disease patterns. As relevant, the proposed activities should address sex and gender specific aspects<sup>20</sup>.

Proposals should demonstrate clear compliance with applicable Good Laboratory Practice /Good Clinical Practice /Good Manufacturing Practice, and be consistent with ISO and other regulations (both national and European). The translation from the pre-clinical phase to early clinical testing, including design and pilot manufacturing in appropriate volume for clinical testing (small series), pre-clinical and early clinical testing is a necessary part of the work-up. Attention should be paid to the requirements for Health Technology Assessment (HTA). Standardisation issues have to be taken into account where appropriate.

**Activities are expected to commence at Technology Readiness Levels 3/4 and reach 5-6.**

*A significant participation of SMEs with R&D capacities is encouraged.*

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: Proposals should address one or more of the following impact criteria and provide metrics to measure and monitor success.

- Address priority needs in healthcare diagnostics and / or therapy monitoring, for the benefit of patients;
- Provide affordable systems with unique features that address specific well identified requirements in healthcare;

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<sup>20</sup> See definition of the 'gender dimension approach' in the introduction of this Work Programme part.

- Progress the development of advanced integrated MNBS based diagnostic health platforms, techniques or systems from the laboratory Proof-of-Concept to the clinical setting;
- Establish a world-class European competitive industrial R&D and manufacturing competence in Micro-Nano-Bio Systems integration for healthcare diagnostics applications;
- Strengthening the industrial value chain and progress to marketisation;
- Early involvement of regulatory bodies and patients in the new developments.

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

This topic will be co-funded by LEIT-ICT and LEIT-NMBP within the context of a Cross-KET initiative for Health, for a total budget of EUR 15 000 000.

Type of Action: Research and Innovation action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

#### **NMBP-14-2017: Regulatory Science Framework for assessment of risk benefit ratio of Nanomedicines and Biomaterials**

Specific Challenge: The application of nanotechnology and nanobiomaterials has great potential to advance medicine for the benefit of citizens. However, the use of these new technologies poses considerable challenges for assessing the quality, safety and efficacy of the novel nanomedicines and medical devices.

Scope: Proposals should advance the field of medical regulatory science and practice through the development and validation of science based regulatory knowledge and standardisation of innovative technical tools and methods. The intention is to lead to a new and better methodology for pre-clinical and clinical evaluation and help to take appropriate stock of and to apply innovative scientific advances as and when they occur. As relevant, the proposed activities should address sex and gender specific aspects<sup>21</sup>.

Proposals should focus on the development of new regulatory standards and tools that are based on scientific principles that already have a Proof-of-Concept at the laboratory scale.

Where appropriate, proposals should make use of the opportunities for obtaining scientific advice from medical regulatory bodies to support the qualification of innovative development methods.

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<sup>21</sup> See definition of the 'gender dimension approach' in the introduction of this Work Programme part.

International cooperation and participation of Member States funding programmes with complementary funding is encouraged to facilitate development of new regulatory science on the global scale.

**Established methods, including related equipment, should be brought to Technology Readiness Level 6 and beyond, whereas those based on new concepts are expected to reach TRL 5.**

*This topic is suitable for international cooperation.*

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

**No more than one action will be funded.**

Expected Impact:

- To reduce the cost of pre-clinical and clinical development for new medical products and therapies, that are based on the application of nanotechnology and nanobiomaterials;
- To reduce the time for innovations to reach the patients;
- To provide a set of tools for more informed risk assessment and decision making;
- To improve standardisation of regulatory practice at the European and international level;
- To establish a close collaboration among regulators, industry, science and patients with regard to the knowledge required for appropriate risk management, and create the basis for common approaches, mutually acceptable datasets and risk management practices;
- To establish a European Consortium for the Advancement of Regulatory Science in Biomaterials and Nanomedicines, involving industrial, medical, academic, regulatory and patient representative stakeholders;
- To identify within the consortium critical issues for innovative products and establishment of an action plan for further studies;
- To establish links with existing European Infrastructures active in the field, along with relevant European Research Networks;
- To elaborate an action plan for a better integration of the European Union with other regions of the world.

Type of Action: Research and Innovation action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

**NMBP-15-2017: Nanotechnologies for imaging cellular transplants and regenerative processes in vivo**

Specific Challenge: Detection and monitoring of cell and tissue transplants in vivo is of utmost importance for development of clinical cell therapy. Suitable nanotechnology-based imaging approaches with high sensitivity should allow for monitoring of cell viability, engraftment and distribution, also through the use of nanomaterials for cells marking. Appropriate imaging techniques have been developed for application in small animals, but are not available yet for use in preclinical large animal models and patients. In particular, such technologies will represent an important safety measure enabling early detection of cell based therapy.

Scope: Proposals should focus on the following:

- Development of highly sensitive imaging approaches enabling discrimination of living cell and tissue transplants based e.g. on optical imaging, magnetic resonance imaging and / or nuclear medicine techniques;
- Monitoring should be highly sensitive, in best case allowing for detection of single cells and cell morphologies;
- Possibility of non-invasive whole body monitoring (magnetic, optical) in large animals;
- Development of clinically applicable imaging approaches, taking into account medical regulatory aspects;
- Interpretation of the data with theoretical models (to be developed if necessary).

As relevant, the proposed activities should address sex and gender specific aspects<sup>22</sup>.

**Activities are expected to commence at Technology Readiness Levels 3/4 and reach 5/6.**

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Availability of novel highly sensitive nanotechnology-based imaging approaches allowing for monitoring of survival, engraftment, proliferation, function and whole body distribution of cellular transplants in preclinical large animal models and patients;
- Imaging technologies facilitating the provision of new regenerative therapies to patients;

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<sup>22</sup> See definition of the 'gender dimension approach' in the introduction of this Work Programme part.

- Opening of a new market sector for imaging equipment and supplies, reinforcement of the European healthcare supply chain and improvement of the competitiveness of the European healthcare sector.

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Research and Innovation action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

### **NMBP-16-2017: Mobilising the European nano-biomedical ecosystem**

Specific Challenge: Developing innovative nanomedical products for a more personalized, predictive and efficient medicine requires further integration of nanotechnologies aiming at applications in human health notably with further Key Enabling Technologies. It also needs a functioning ecosystem of actors, in which the research, translation, regulation, standardization and take-up of innovative nanomedicines by the different European healthcare systems is stimulated. End-of-life/disposal and recyclability issues should also be addressed as appropriate.

Scope: Supporting the development of an ecosystem for nanomedicine in Europe, including activities such as coordinating national platforms and regional clusters; developing common training material and services; international cooperation related to community building, road-mapping, regulation, manufacturing, reimbursement and pricing, standardization and recyclability; and reaching out to attract the interest of citizens, young talents and young entrepreneurs. Collaborations with relevant technology platforms or similar initiatives in Europe or worldwide will allow deeper and more effective cross-KETs activities for innovative integrated solution and well as a consolidated international strategy for the sector.

Attention should be paid to achieve a cross-regional, cross-sectoral and cross-technological approach, based on the analysis of relevant roadmaps, strategic research agendas or smart specialisation strategies which have listed nanomedicine or personalised Medicine as one of their priorities. These different approaches might for instance be united into one “meta” roadmap.

The Commission considers that proposals requesting a contribution from the EU between EUR 1 and 2 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

#### Expected Impact:

- Increased take-up of innovative Nanomedicine solutions by industry and SMEs, end-users, regulatory and public authorities, healthcare insurances, doctors and patients, research organisations and academia;

- Improvement of cross-KETs activities to provide better integrated healthcare solutions;
- Increased international networking with new potential market opportunities;
- Improvement of the competitiveness of the European healthcare sector.

Type of Action: Coordination and support action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

## **ADVANCED MATERIALS AND NANOTECHNOLOGIES FOR ENERGY APPLICATIONS**

Activities will focus on providing advanced materials and nanotechnologies solutions in support of implementing the European energy policy, which addresses the energy system as a whole with a focus on its sustainability and security of supply while generating affordable energy. Cost reduction through the development of new technological options for promising energy technologies considering the whole value-chain, in an approach that takes into account consumers and market factors, successful diversification of energy sources, increasing the share of energy production from renewables, decentralising energy production, development of flexible energy storage and decarbonisation of fossil energy sources rely on cross-cutting KETs. Relevant innovations in advanced materials and nanotechnologies that would contribute to address the energy challenges leverage existing R&D results and project clusters for reaching market deployment and activities will also contribute to implementation of the integrated roadmap with support of all relevant stakeholders, such as EMIRI.<sup>23</sup> Clear performance and deployment targets are being identified, in the context of a complete portfolio for energy, coordinated with the activities under the Societal Challenge 'Secure, clean and efficient energy'.

Proposals are invited against the following topic(s):

### **NMBP-17-2016: Advanced materials solutions and architectures for high efficiency solar energy harvesting**

Specific Challenge: High efficiency solar energy harvesting (high-efficiency photo-voltaics (PV) or concentrated solar power (CSP)) is an important building block in installing a secure, competitive and sustainable energy system. Increased efforts have to be made to make these technologies cost competitive under suitable electricity market conditions. Novel functional materials and material combinations throughout the solar system manufacturing chain enhance the efficiency of solar energy harvesting beyond that of the current state-of-the-art technologies. These new materials and processes allow the European materials supply sector to expand its industrial leadership towards the next generation of solar energy harvesting which is expected to reach the markets beyond 2020.

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<sup>23</sup> Energy Materials Industrial Research Initiative

Scope: Proposals should develop durable materials solutions for novel high efficiency solar (PV or CSP) technologies, to enhance system conversion efficiencies, while preserving lifetime and ensuring materials resource efficiency. Activities related to concentrated PV are out of scope of this topic. Research efforts must focus on delivering advanced materials (including but not limited to particles, thin films, nanostructures, heat transfer fluids, phase change materials and receptors), and/or their combinations into innovative device architectures. The proposed solutions need to demonstrate their added value in terms performance or unique application options and their viability in terms of manufacturability, yield and stability. Finally, the high efficiency concepts should be assessed for technical and economic viability and developed towards readiness for upscaling the materials production.

This topic calls for proposals with focus on advanced materials solutions and architectures. A complementary topic is published in the “Secure, clean and efficient energy” part of this Work Programme (LCE-7a/b-2016-2017: Developing the next generation technologies of renewable electricity and heating/cooling), calling for proposals on solutions with a technology-approach.

**The implementation of this topic is intended to start at TRL 4 and target TRL 6.**

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: The performance levels of the proposed materials solution(s) should be in line with those specified in relevant parts of the SET-Plan Integrated Roadmap and its Annexes, available at <https://setis.ec.europa.eu/set-plan-process/integrated-roadmap-and-action-plan>

- A deeper understanding of the material and interface characteristics and their long-term performance;
- The demonstration of device designs and fabrication processes for high efficiency technologies of at least 22% efficiency at cell level and above 18 % efficiency at module level;
- The demonstration of material manufacturing readiness to accommodate emerging and/or novel high efficiency technologies with a potential levelized cost of electricity of 0.05 – 0.10 €/kWh (PV) for an irradiation range of 2000 – 1450 kWh/(m<sup>2</sup>a) and 0.10 – 0.15 €/kWh (CSP) for a direct normal irradiation in the range of 2700 – 2100 kWh/(m<sup>2</sup>a) in 2020.

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Innovation action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

**NMBP-18-2016: Advanced materials enabling the integration of storage technologies in the electricity grid**

Specific Challenge: Reliable access to cost-effective electricity is the backbone of the EU economy, and electrical energy storage is an integral element in this system. Without significant investments in stationary electrical energy storage, the current electric grid infrastructure will increasingly struggle to provide reliable, affordable electricity, thereby jeopardizing the transformational changes envisioned for a modernized grid. Investment in integrating energy storage refurbishing the grid is essential for keeping pace with the increasing demands for electricity arising from continued growth in productivity and the projected increase in distributed and/or intermittent energy sources. The technical aspects that will be posed by an improved grid include inventing new technologies requiring new advanced materials. Some materials will improve the current technology, while some will enable emerging technologies.

Scope: By the development and demonstration of solutions based on advanced functional particles, filaments, layers, coatings and new functionalities, proposals should contribute to the integration of storage devices in the electrical grid. Targeted applications could include, but are not limited to, high capacity cables with optimized strength and conductivity, and superconductors, (extra) high voltage cables and accessories up to 1000 kV, materials for medium voltage (2kV to 35kV) and smart electrical accessories, new materials for extreme conditions and surface treatment of existing materials to protect and improve performances within the context of the electricity grid.

Activities addressing the development of materials specifically for energy storage technologies and for power electronics are outside the scope of this call. A dedicated topic on materials research for power electronics is included in this Work Programme under topic NMBP 02-2016 "Advanced Materials for Power Electronics based on wide bandgap semiconductor devices technology". The proposed solutions should be assessed on their technical and economical viability.

This topic calls for proposals with focus on advanced materials solutions for electricity grid related technologies. A partially complementary topic is published in the "Secure, clean and efficient energy" part of this Work Programme (LCE 1-2016: Next generation innovative technologies enabling smart grids, storage and energy system integration with increasing share of renewables: distribution network), calling for proposals on solutions starting from the technology part of the value chain.

**The implementation of this topic is intended to start at TRL 5 and target TRL 6.**

The Commission considers that proposals requesting a contribution from the EU between EUR 6 and 8 million would allow this specific challenge to be addressed appropriately.



Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: The performance levels of the proposed materials solution(s) should be in line with those specified in relevant parts of the SET-Plan Integrated Roadmap and its Annexes, available at <https://setis.ec.europa.eu/set-plan-process/integrated-roadmap-and-action-plan>

- Significant enhancement of power supply reliability, managing volatility of the grid considering the connection of renewable energy sources, increased grid efficiency;
- Alleviation of geographical constraints for low carbon energy production with increased efficiencies at a reduced cost;
- Reduction of the barriers to increase the penetration rate of distributed and/or intermittent renewable energy sources.

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Innovation action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

#### **NMBP-19-2017: Cost-effective materials for “power-to-chemical” technologies**

Specific Challenge: Energy storage will play a key role in enabling the EU to develop a low-carbon electricity system. Energy storage can supply more flexibility and balancing to the grid, providing a back up to intermittent renewable energy. Chemical energy storage is the transformation of electrical energy into chemical energy carriers. It consequently involves exchange of energy between different vectors of the energy system. Once the energy is transformed to chemicals the concept opens for many ways to use the primary electric energy, e.g., for re-electrification, heating and mobility. For such chemical energy storage, hydrogen or chemicals are considered. In particular the production of chemicals (e.g. methanol, ethanol, methane and syngas amongst others) by co-electrolysis is very promising technology in which R&I efforts should result in a substantial increase of the efficiency of the processes.

Scope: Proposals should focus on the development of advanced materials, materials solutions or new chemistries, to up-scale the chemical storage of energy in chemicals or hydrogen to economically viable levels. The proposals should select one or more of the following subjects:

- The development of low cost advanced materials for solid state storage of hydrogen at low pressure, targeting at the same time improved storage density and cycling durability;
- The development of direct synthesis of chemicals from CO<sub>2</sub>-H<sub>2</sub>O co-electrolysis using materials and reactors made of sustainable, non-toxic and non-critical raw materials<sup>2</sup>;

- The development of efficient low cost photochemical water splitting reactors with optimized flow behaviour, as well as new catalysts with longer lifetimes;
- The optimization of low-cost electro-chemistries to separate and purify hydrocarbon streams.

The technical validation in an industrially relevant environment and economic viability of the proposed solutions should be addressed in the proposal.

This topic calls for proposals with focus on cost effective materials solutions for “power-to-chemical” technologies. A complementary topic with focus on using solid oxide electrolysis cells (SOEC) to convert renewable electricity into hydrogen and, via hydrogen, into other products is included in the 2015 Work Plan of the FCH Joint Undertaking (JU).

**The implementation of this topic is intended to start at TRL 3 and target TRL 5.**

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: The performance levels of the proposed materials solution(s) should be in line with those specified in relevant parts of the SET-Plan Integrated Roadmap and its Annexes, available at <https://setis.ec.europa.eu/set-plan-process/integrated-roadmap-and-action-plan>

- Significant increase of the durability under current and temperature cycling of co-electrolysis technology based on sustainable, non-toxic and non-critical raw materials;
- Alleviation of geographical constraints for low carbon energy production with increased efficiencies at a reduced cost;
- Reduction of the barriers to increase the penetration rate of distributed and/or intermittent renewable energy sources.

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Research and Innovation action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

### **NMBP-20-2017: High-performance materials for optimizing carbon dioxide capture**

Specific Challenge: Carbon capture and storage (CCS) is a key element in the EU low-carbon policy. Presently, the roll-out has been hampered by costs and techno-economic uncertainties of the CCS, where CO<sub>2</sub> capture is a major part. While there is a need to demonstrate currently

state-of-the-art capture technologies in real market conditions, promising new material solutions have been under development for the next generation CCS technologies that are expected to reach the markets beyond 2020. These solutions could dramatically improve the efficiency of CO<sub>2</sub> capture but the materials manufacturing processes should be further developed towards higher yields while conserving functionality at a lower cost.

Scope: Proposals should capitalise on promising material solutions for the next generation CO<sub>2</sub> capture technologies (such as pre-combustion or post-combustion capture, oxygen combustion or other novel technologies or concepts). Recent work on such materials and capture techniques, based on, inter alia, nanostructured hybrid materials, membranes, solid and liquid-based adsorbents has made progress to the extent that their cost and performance competitiveness with respect to the state-of-the-art technologies (at least at demonstration level) should now be tested. The proposed solutions need to prove their added value in terms of sustainability and performance or their ability to address unique applications, and their viability in terms of manufacturability, yield, stability, long working-life and easy regeneration. Finally, the high efficiency concepts should be assessed for technical and economic viability and developed to readiness for pilot manufacturing to integrate the high-performance materials in existing demonstration projects.

This topic calls for proposals with focus on the manufacturability high performance materials for CO<sub>2</sub> capture. A partially complementary topic is published in the “Secure, clean and efficient energy” part of this Work Programme (LCE 24-2016: International Cooperation with South Korea on new generation high-efficiency capture processes), calling for proposals on the development of high potential novel technologies or processes for post- and/or precombustion CO<sub>2</sub> capture.

**The implementation of this topic is intended to start at TRL 5 and target TRL 6.**

The Commission considers that proposals requesting a contribution from the EU between EUR 6 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: The performance levels of the proposed materials solution(s) should be in line with those specified in relevant parts of the SET-Plan Integrated Roadmap and its Annexes, available at <https://setis.ec.europa.eu/set-plan-process/integrated-roadmap-and-action-plan>

- Improved security of supply by reducing the need for extra fuel to produce goods and power, increased use of indigenous resources;
- Increased competitiveness of CCS, in particular by reducing the cost of CO<sub>2</sub> capture and the sustainability of the final products;
- integrate the high-performance materials in existing and next generation demonstrators;
- A strengthened European materials industry in a highly competitive market.

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Innovation action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

## **ECO-DESIGN AND NEW SUSTAINABLE BUSINESS MODELS**

These activities will focus on new concepts and methodologies for knowledge-based, specialised production, which can fulfil the requirements of sustainability, globalised value chains, changing markets, and emerging and future industries.

Proposals are invited against the following topic(s):

### **NMBP-21-2016: ERA-NET on manufacturing technologies supporting industry and particularly SMEs in the global competition**

Specific Challenge: Pooling resources can foster the competitiveness of Europe's advanced manufacturing industry, by the co-funding of manufacturing research projects performed by transnational consortia involving enterprises and their strategic partners. A strategic and industry relevant approach is needed in order to address key manufacturing priorities, covering the entire value chains and gathering national and regional research and innovation capacities, thereby mobilising all relevant European stakeholders and in particular SMEs.

Scope: The proposed ERA-NET aims to coordinate the research and innovation efforts of the participating Member States, Associated States and Regions in the field of advanced manufacturing, continuing the activities started by MANUNET and followed by MANUNET II, supporting in particular SMEs and with a special focus on the key areas of new production processes, adaptive manufacturing systems and technologies for the factory of the future, and to implement a joint transnational call for proposals (resulting in grants to third parties) with EU co-funding to support multi-national innovative research initiatives in this domain.

Coordination with the relevant players at European level such as those in the Factories of the Future cPPP and relevant European Technology Platforms is expected and the strong involvement in the transnational projects of SMEs with innovation potential is encouraged.

International cooperation on R&I issues on manufacturing at global level should be properly addressed and the potential participation in the proposed ERA-NET of regions from third countries with local funding programmes on manufacturing is encouraged.

The Commission considers that proposals requesting a contribution from the EU between EUR 8 and 10 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

**No more than one action will be funded.**

Prospective participant organisations should note that the impact of this ERA-NET could be enhanced by using resources coming through the European Structural and Investment Funds (provided that the appropriate policy measures together with the corresponding national contribution for them have been foreseen in the relevant Operational Programme). In such a case, participants should understand that ESI Funds cannot replace partly or wholly the expected national contribution(s) for matching the expected Horizon 2020 grant. However ESI Funds (together with national funds) can be used for enhancing the impact of the ERA-NET mobilising additional national funds for this purpose.

Expected Impact:

- Synergies and coherence in key fields of advanced manufacturing research at national and regional level;
- Input to strategy and policy in the domain of advanced manufacturing
- Creation of a sustainable cooperation structures at regional, national and transnational level supporting research and innovation in key priority areas of the manufacturing sector in Europe.

Type of Action: ERA-NET Cofund

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

**NMBP-22-2017: Business models and industrial strategies supporting novel supply chains for innovative product-services**

Specific Challenge: The current lack of stability in the markets does not create strong incentives for industry for long term investments in tangible fixed assets, and a quick response to market demand is crucial to market success. At the same a new generation of highly flexible production and process technologies and equipment, such as 3D-printing, has become available, enabling industry to adapt faster to the market demand and to produce in smaller series.

All European companies, especially SMEs, need to have access to technology infrastructure with appropriate manufacturing facilities to help them develop their innovative product-services from the early stage of feasibility assessment up to the fabrication of first series of prototype's products. Purchasing is not always the best option.

It is also important to develop value systems that take into account the new extended supply chain from the early stage of the design process up to the end-of-life activities. In addition, the real production can nowadays take place anywhere in the world and leave Europe with unused or outdated production capacities. The current overall process does not necessarily take into account economic, social and environmental benefits for Europe.

Scope: Business models supporting the novel supply chains for innovative product-services would need to facilitate the flow of information on free utilisation capacity among service providers, which could be dedicated business set-ups for that kind of product-services, or just existing manufacturers with free production capacity at certain moments in time and business companies seeking short term solutions for their capacity shortages.

New equipment, internet, digital technologies and social media have the potential to support new supply chain models that are focused on business-to-business (B2B) as well as business-to-consumer (B2C) relationships, on improving the use of manufacturing capacity in Europe.

Solutions should facilitate the flow of information on free manufacturing capacity among service providers (which could be dedicated businesses or existing manufacturers with spare capacity).

The research activities should focus on all of the following areas:

- New, adaptive business models, networks and configurations to optimise the integration of KETs in industrial contexts, in order to increase the leadership of EU industry in the global markets. The approaches to integrate KETs should lead to a new model for European industrial production and consumption, based on more sustainable and efficient production and consumption patterns, supporting increasingly customised sustainable products.
- New business solutions for extended supply chains and the integrated sustainable European framework, which would take into account the needs of design, production, utilisation and end-of-life and overcome the risk of under-utilised capacity.
- Solutions that would enable businesses in the supply chain to use new flexible production and processing systems tailored to their needs; to increase connectivity and inter-operability to rapidly coordinate; and to react to market demand as a whole system.
- Solutions for local cooperation and supply, which can reduce the environmental footprint. These solutions should converge into high value-added production capable of responding dynamically to competing global economies demonstrating how the EU could benefit from international cooperation.

Project activities will focus on new concepts and methodologies for knowledge-based, specialised product-service, which can fulfil the requirements of fast changing markets for innovative product-services. The service could be supplemented by after-sale services and extended guarantees provided by any entity from the supply chain base on common agreement.

Social Sciences and Humanities (SSH) elements should be considered, such as economics and business administration. In particular, proposals should address the role of consumers and users as active participants in the innovation process.

**Activities are expected to focus on Technology Readiness Levels 4 to 6.** This topic addresses cross-KET activities.

*This topic is particularly suitable for SMEs.*

The Commission considers that proposals requesting a contribution from the EU between EUR 2 and 4 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Decreased production costs in Europe, through a better use of the available manufacturing capacity;
- Increased investment in the manufacturing industry in Europe;
- Reduced environmental footprint compared to products produced in traditional value chains, by the use of local and regional product-services capacity;
- Development of novel supply networks for organisations, and of solutions that could be also applied by other industrial sectors;
- Creation of new embedded services supporting the business-to-business supply chain;
- Possibility for further development of the new supply chains for other business scenarios;
- Creation of novel models of work organisation and sustainability-driven networks/clusters, able to integrate the product-service life-cycle stages in the same industry, as well as across industries.
- Creation of sustainable networks and clusters, by integrating the various suppliers devoted to the collection, disposal, recycling and reuse of critical materials and components into a perspective of sustainability and corporate social responsibility

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Research and Innovation action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

## **BIOTECHNOLOGY**

Biotechnology has achieved spectacular progress as an enabling technology to drive long term

sustainability and growth across various economic sectors, in particular in the health, pharmaceutical and chemical industries, and in plant breeding.

Under “Biotechnology-based industrial processes driving competitiveness and sustainability”, activities aim in two directions: 1) to bridge the gap from lab to market. This includes new approaches to valorising new feedstock resources (e.g. renewables, waste, by-products), and increasing overall bioprocess efficiencies by pushing existing technology concepts beyond current boundaries. 2) To speed up innovation, the development of new bioprocess concepts, improved data integration and valorisation and new production techniques will be supported. Under “Cutting-edge biotechnologies as future innovation driver” and “Innovative and competitive platform technologies”, activities will contribute further to sectors such as health, chemicals and agriculture by developing new technological platforms related to biocatalysis and biodesign. The overall “Leitmotiv” for these activities is to facilitate cross-sectoral transfer of know-how and exploiting relevant synergies (e.g. regarding process technologies or advanced materials) to create added value for Europe through convergence of approaches.

In line with the technological, economic and societal potential of applied biotechnology, enhancing industrial competitiveness of EU enterprises and addressing societal challenges remain of paramount importance. The LEIT biotechnology work programme 2016/17 will address challenges such as improving resource efficiencies and overall process sustainability (including CO<sub>2</sub> re-use), as well as improving product yields, recovery and quality in this area. The other areas, “Cutting-edge biotechnologies as future innovation driver” and “Innovative and competitive platform technologies”, are fully integrated into these aims and are expected to provide the necessary technology tools and instruments, e.g. new microbial chassis platforms, optimization of biocatalysis and of downstream processes. Although most parts of the work programme focus on a TRL level ranging between 3 and 5, demonstration activities, feasibility studies, life-cycle assessments and other elements are considered essential for proving the viability of the proposed solutions and beneficial to strengthen closer collaboration between academia and industry to speed-up innovation.

The biotechnology activities supported under LEIT-NMBP, having a focus on technology development (incl. synergies) and demonstration and will complement and contribute to applications under the Societal Challenges and the Bio-Based Industry JTI (BBI JTI).

Complementary to the above, it is foreseen that activities, such as foresight, and open engagement with policy makers and the public will be intensified. The provision of best-practice examples and of independent and balanced information, e.g. on synthetic biology, is expected to address related ethical, and health and safety concerns among others.

Proposals are invited against the following topic(s):

### **BIOTEC-01-2016: ERA-NET Cofund on Biotechnologies**

Specific Challenge: During the last two decades major progress was made in terms of industrial applications of biotechnology. Relevant national and FP7 research programmes and projects in the Biotechnology area have significantly contributed to improve European



economic and environmental protection. Innovation in biotechnology also provides opportunities to transform the global economy from an extensive dependence on fossil raw material to a sustainable “bio-economy”.

However, economic indicators suggest a need for urgent action to maintain Europe’s global lead in biotechnology. In order to increase the competitiveness of EU industries, broader and deeper collaboration across relevant sectors and Member States is necessary. It will also be necessary to better use research advances in areas such as systems and synthetic biology for applications and demonstration in industrial biotechnology.

Scope: Proposals should gather a critical number of relevant programme managers and funders in the field, and implement a joint transnational call for proposals (resulting in grants to third parties) with EU co-funding, focusing on Technology Readiness Levels in the range of 3 to 6. They should build on the previous success of ERA-IB-2, ERASysAPP, ERASynBio under FP7, allowing for the seamless integration of the areas covered, together with the bioinformatics area and be complementary to related health initiatives. The ultimate aim is to speed-up research and innovation in industrial biotechnology, establishing systems biology and synthetic biology as technology drivers while focusing on downstream industrial applications. The significant involvement of industry in the activities developed up to the exploitation of results will be an important element to achieve this goal. Extensive communication activities should foster the European leadership role in advanced biotechnological research and innovation.

The proposals will address Social Sciences and Humanities (SSH) elements, in particular for outreach activities and in terms of the public perception of biotechnologies for industrial uses.

The Commission considers that proposals requesting a contribution from the EU between EUR 8 and 10 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

**No more than one action will be funded.**

Expected Impact:

- Better align current EU and national biotechnology initiatives with the goals of the KET Biotechnology area under Horizon 2020, in particular by focusing on application-oriented research and demonstration activities and by developing a European Biotechnology hub, acting as a facilitator and multiplier in this regard.
- Improved use of synergies and coherence of current research funding activities in particular through the launch of calls for proposals and the use of existing research infrastructures (e.g. bioinformatics).
- Increase the financial commitment of participating countries and additional private sector resources compared to the three previous ERA-NET projects.

- Increase the visibility of the potential benefits of a bio-based economy for the society, in particular through dissemination and exploitation of results.

Type of Action: ERA-NET Cofund

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

### **BIOTEC-02-2016: Bioconversion of non-agricultural waste into biomolecules for industrial applications**

Specific Challenge: Following the principle of a circular economy, industrial by-products and waste from non-agricultural sectors, could be considered feed stock for bio-conversion into value-added industrial products.

However, most of these bio-waste fractions are used nowadays for low-value applications only, such as for energy generation in incineration facilities, as fodder in livestock industries and as fertilisers in agriculture. Therefore, responding to the need to improve industrial resource efficiency, the current main challenges are to identify economically viable links between waste generation and waste utilization, and to develop the necessary technologies (including biotechnologies) for bioconversion of waste into higher added-value products.

Scope: The objective of this topic is to develop biotechnology approaches for the conversion of municipal solid bio-waste fractions and sludgy bio-waste from other industries, like the food industry, as well as from water treatment facilities, into higher added-value bio-based products, such as chemicals and chemical building blocks, biopolymers, materials and bioactive compounds. This includes sustainable downstream steps for product separation and purification. Physico-chemical technologies concomitant to the enzymatic/microbial processes are also needed. Proposals should address the current technical state-of-the-art regarding waste utilisation for bioproducts taking into account the current market and legislative barriers in the EU. The feasibility of integrating the newly developed approach into existing value chains should be assessed and demonstrated.

Proposals should have a strong industry drive and prove the techno-economic viability of the proposed value chain. They need to also take into account the optimisation of the final product's "end of life" through, for example, biodegradation or recycling. A life cycle assessment of the entire value chain should be included.

**Activities are expected to focus on Technology Readiness Levels 3 to 5.**

*The participation of SMEs is encouraged.*

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Develop at least 2 new bio-based value chains, utilising either industrial by-products and/or relevant bio-waste fractions for bio-product generation.
- Propose outline business plans which include the assessment of the potential impact of the proposed value chains in terms of EU jobs and growths in the short and medium term. The expected impact of the value chains should be clearly described in qualitative and quantitative terms (e.g. in terms of turnover, employment, market size, IP management, sales, return on investment and profit).
- Demonstrate the environmental feasibility of the proposed value chains and conduct relevant outreach activities.

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Research and Innovation action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

### **BIOTEC-03-2016: Microbial chassis platforms with optimized metabolic pathways for industrial innovations through systems biology**

Specific Challenge: Systems biology deals with the understanding and controlling the complexity of living beings as opposed to studying their constituent parts. As such, systems biology can be considered as a cross-discipline, i.e. the integration of varied types of biological information and the development of models and networks, which together provide greater understanding of the biological system under study. Systems biology relies on cutting-edge technologies, including those in the fields of "omics" (genomics, transcriptomics, proteomics, metabolomics) and bioinformatics, all offering massive amounts of data, most of which remain stored and underexploited. Therefore, it is a growing area of science that builds information from the translation of biological data and strives to transfer knowledge to society in the form of valuable products and processes.

On the other hand, microbes are attractive candidates to serve as cell factories for the production of many valuable compounds useful for the food, feed, fuel, cosmetics and pharmaceutical industries. The current availability of genome sequences and metabolic models offers the adequate resources for the full exploitation of systems biology in industrial biotechnology, which can boost the design of novel and more efficient microbial platforms for the production of industrial compounds through the sound knowledge of their molecular constituents.

Scope: Proposals should use systems biology approaches integrating "omics" data analysis, mathematical modelling and knowledge of interactions between cellular components under different environmental conditions, to enable useful applications for a broader set of microorganisms, while also achieving some of the following:

- More efficient metabolic pathways of current microbial platforms, adapting them to high performing manufacturing processes
- Improving existing cell factories or developing new ones with enhanced properties for harsh process conditions in industrial applications
- Development of efficient cell factories for the industrial production of novel high-value products.
- Identification of new microbial strains with beneficial characteristics for industrial applications such as those originating from extremophiles and related activities to develop relevant industrial host organisms.

**Activities are expected to focus on Technology Readiness Levels 3 to 5.** This topic addresses cross-KET activities.

*The participation of SMEs is encouraged.*

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Development of at least two new high added-value products
- Boosting technological innovation for European industries to keep the leadership in biotechnology in particular in the food, feed, fuel, cosmetics and pharmaceutical industries.
- An offer of substantial opportunities for an increasing number of SME to uptake innovative research.
- Development of widely exploitable microbial hosts for the production of industrial goods.

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Research and Innovation action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

**BIOTEC-04-2016: KET Biotechnology foresight identifying gaps and high-value opportunities for the EU industry**

Specific Challenge: Although Europe enjoys a lead position in science and technology, including biotechnology, in comparison with other world regions European technology base is often scattered and very diverse in terms of regional and national capacities. If Europe is to keep its leadership in Biotechnology, its R&D&I funding agencies, in particular the European Commission, need to stay abreast of progress in the areas they fund to ensure utmost relevance of their activities. In the Biotechnology areas stakeholder roadmaps and scientific publications are often outpaced by rapid progress made in research. The cross-cutting nature of biotechnology also requires targeting the limited funds available in the most efficient way. It is thus essential to forecast the future of R&D&I needs closely, in order to identify major opportunities that are not only readily feasible but also of high value, while achieving a positive public perception of biotechnologies and the potential they hold.

Scope: Proposals should use a multidisciplinary approach, including modelling and simulation, to provide comprehensive and dependable information about the future industrial biotechnology scenario (including pharmaceuticals) in the EU in the short and medium-term. Proposals should consider the potential of industrial biotechnology innovation for enabling the European industry to deliver high-value products satisfying evolving consumer needs, the creation of new commercial opportunities and the possible risks for people's health and the environment. European capacities in terms of human resources, infrastructures, research and development and public and private stakeholders should be taken into account. Proposals should also identify links with policy development, and the preparation of the future programmes beyond Horizon 2020. It should be demonstrated that the proposed activities are complementary to related activities under the Societal Challenges 'Health, demographic change and well-being', 'Food security, sustainable agriculture and forestry, marine, maritime and inland water research'; 'Secure, clean and efficient energy'; and the Bio-Based Industries JTI.

Insofar as possible, proposals will address Social Sciences and Humanities (SSH) elements, for example changing consumers' needs and the public perception of biotechnologies for industrial uses.

The Commission considers that proposals requesting a contribution from the EU between EUR 350000 and 500000 and with a duration of one year would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

**No more than one action will be funded.**

Expected Impact:

- A reliable priority-setting scenario for funding industrial biotechnology in the EU in the short to medium-term which is relevant to EU based value chains.

- An instrument to enhance collaboration between all Member States, building on the strengths of each of the countries and allowing weaknesses to be overcome.
- A general vision of European industrial biotechnology capacity and needs that will serve to target and strengthen Europe-wide R&D&I cooperation in particular boosting the participation of smaller countries.

Type of Action: Coordination and support action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

**BIOTEC-05-2017: Microbial platforms for CO<sub>2</sub>-reuse processes in the low-carbon economy**

Specific Challenge: Nowadays CO<sub>2</sub> re-use is one of several technological ways to reduce otherwise harmful CO<sub>2</sub> emissions, thus making CO<sub>2</sub> a valuable commodity rather than a pollutant. However, the research behind full development of CO<sub>2</sub> reuse technologies is in its early stages. Some of these technologies use CO<sub>2</sub> as a feedstock for chemicals and plastics, thus increasing the industrial biotechnology potential for enhancing European economic competitiveness. In this way, tackling the CO<sub>2</sub> challenge includes interesting possibilities for encouraging innovation and sustainability.

An industrial biotechnology route for CO<sub>2</sub> re-use is fermentation, where CO<sub>2</sub> is fermented into a desired molecule using hydrogen as a source of energy. However, there are technical issues that need to be resolved, because the biochemical reactions involved are not yet self-supporting in terms of energy for the industrial scale conversion of CO<sub>2</sub> into chemicals. Moreover, the final yield of the products is low and the process needs optimisation. Ultimately, the success of CO<sub>2</sub> reuse technologies will depend on developing processes which are less energy and material intensive than the processes they aim to replace and which can be scaled to an industrial level of production. In this context, an important consideration or advantage would be the ability of the microbes to process raw CO<sub>2</sub> (low concentrations, presence of impurities, etc.). Therefore, substantial research is required to achieve the goal of a CO<sub>2</sub> economy.

Scope: Proposals should address current limitations of CO<sub>2</sub> reuse technologies based on microbial platforms, by developing their full potential, and need to cover one or more of the following issues:

- Microbes with an improved ability to convert CO<sub>2</sub> as a feedstock into chemicals and plastics.
- Discovery of new, more active and robust enzymes for improved bio-catalysis.
- Design of new synthetic microbial systems to produce useful enzymes.
- Improved microbes with resistance to impurities, by-products and target products.

- Exploring the potential application sectors of the products and technologies to be developed.

Proposals should address elements of Social Sciences and Humanities (SSH), exploring the public perception and acceptance of the technology of CO<sub>2</sub> reuse.

**Activities are expected to focus on Technology Readiness Levels 3 to 5.** This topic addresses cross-KET activities.

*Insofar as possible, proposals will involve SMEs and engage in international cooperation,*

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Development and validation of at least two microbial cell factories;
- Development of concepts for solving challenges expected by an industrial-scale implementation;
- Contribution to the reduction in CO<sub>2</sub> emissions in the medium to long term;
- Supporting the EU in becoming a global leader in CO<sub>2</sub> re-use technologies through the utilisation of microbial platforms.

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Research and Innovation action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

**BIOTEC-06-2017: Optimisation of biocatalysis and downstream processing for the sustainable production of high value-added platform chemicals**

Specific Challenge: The bio-based production of chemical building blocks from renewable resources has become an interesting alternative to inherently non-sustainable petrochemical-based processes, which are neither low-carbon nor resource-efficient. However, despite the discovery and development of numerous platform cell factories, bio-based production is not (or not fully) competitive in terms of economics and remains, therefore, a niche market application dedicated to high-value specialty products.

To overcome current limitations, it is necessary to further improve the efficiency of bio-based production processes by creating better performing platform cell factories and relevant downstream processes.

**Scope:** The objective is to optimise already existing or newly developed platform cell factories for the production of platform and fine chemicals and biofuels (excluding pharmaceuticals), following the cascading use of resources. Proposals should include areas such as bioinformatics, systems biology and synthetic biology where appropriate. Furthermore, applicants should take into account integrated approaches from sourcing of renewable biomass to bioconversion and downstream processing, including the final consumers of the bio-based product.

Proposals will have a strong industry drive and include demonstration activities to prove the techno-economic viability of the proposed value chain on the basis of a full Life-Cycle-Assessment, including the preparation of a model business plan to be developed during the project. The optimisation of the final product's 'end of life' through, for example, biodegradation or recycling should also be considered. Promotional activities, beyond the usual web-based approaches, targeted at all groups of participants should be included.

**Activities are expected to focus on Technology Readiness Levels 5 to 7 and centred around TRL 6.**

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

**Expected Impact:**

- Reduction of the production costs of the proposed bio-based products by at least 30%.
- Demonstration of the economic feasibility of the proposed value chains.
- Full set of promotional and outreach activities, targeted at specific stakeholder groups, and based on the full Life-Cycle-Assessment and business plan prepared.

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

**Type of Action:** Innovation action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

**BIOTEC-07-2017: New Plant Breeding Techniques (NPBT) in molecular farming: Multipurpose crops for industrial bioproducts**

**Specific Challenge:** Molecular farming involves the production of pharmaceutical and industrial compounds in plants through advanced technologies and it offers a competitive platform for the manufacturing of high-end products. Examples are plant-derived vaccines and the production of other commercially valuable proteins or small molecules. Indeed, plants are highly amenable to the production of a wide range of proteins, some of which are specific.



In addition, the scalability allowed by plants exceeds that of other production systems. Molecular farming represents a development opportunity for a set of new high-value crops, for the health, chemical and agricultural industries and their related technology sectors. However, the expansion of molecular farming has been dawdling, due to its reliance on standard genetic modification and the hurdles it poses for commercialisation.

In the past ten years, complementary and more sophisticated new plant breeding techniques (NPBT) have been developed to produce new plants with the desired traits circumventing the main drawbacks of standard genetic modification (i.e. no foreign DNA is contained in the resulting end product). The use of NPBT for molecular farming could provide opportunities for new crops for the production of bioproducts, while maintaining the position of leadership of the European plant breeding sector in research and innovation.

Scope: Proposals should use the technologies comprised in the NPBT set<sup>24</sup>, in particular those that avoid final genetic modification products, with plants amenable to be used as green factories in order to yield industrial high-value products. Proposals should address at least one of the following areas:

- Minor, underutilized and non-food crops suitable for the extraction of bioactive compounds.
- Crops that grow more efficiently and have higher yields of the target bioproduct, while being more tolerant to adverse environmental conditions.
- Improved plant-based low-cost platforms for commercial production of bioproducts.

Proposals should address elements of Social Sciences and Humanities (SSH), contributing to a better understanding of plant breeding and related biotechnologies by the general public.

**Activities are expected to focus on Technology Readiness Levels 3 to 5.**

*Insofar as possible, proposals will involve SMEs and engage in international cooperation.*

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Contribution to the EU goals of increased sustainability of agriculture and the bio-based economy by developing new types of useful crops.
- New data for the assessment of innovative NBPT as tools for future plant breeding and their potential for a speedy uptake in general breeding practice

<sup>24</sup>

SANCO [http://ec.europa.eu/food/plant/gmo/new\\_breeding\\_techniques/index\\_en.htm](http://ec.europa.eu/food/plant/gmo/new_breeding_techniques/index_en.htm) and JRC <http://ftp.jrc.es/EURdoc/JRC63971.pdf>

- Innovation in the way plant breeding technologies is presented to the public for an improved understanding of biotechnology and informed decision making

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Research and Innovation action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

### **BIOTEC-08-2017: Support for enhancing and demonstrating the impact of KET Biotechnology projects**

Specific Challenge: Dissemination, exploitation and transfer of project results are crucial activities during project life-time and beyond in order to make sure that projects have the expected impacts. Clustering of project activities, according to objectives and addressed themes, and linking them with corresponding existing technology transfer activities are effective ways to stimulate the uptake of project results and the exploitation of synergies. An adequate monitoring of such activities during the project lifetime and beyond is also needed to ensure an effective implementation at programme level.

Scope: The coordination action should aim in particular to actively cluster existing activities under the KET Biotechnology programme of Horizon 2020 and might also include related prior activities launched under FP7.

Activities may include:

- Reviews of recent technological developments, publications, international R&I programmes within the technological area of the cluster;
- Workshops with top-ranked international experts from various disciplines aiming at the elaboration of future KET Biotechnology priorities within this cluster and identifying research gaps;
- Science Intelligence: Gathering information about business trends and market prospects within and outside the EU, including relevant analytical and information/publication activities;
- Promotion of the activities of the cluster, e.g. organizing international conferences, and national or international road shows highlighting the achievements within the cluster, involving also policy makers and/or the general public.

The Commission considers that proposals requesting a contribution from the EU between EUR 700000 and 1000000 would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Speeding up industrial exploitation and uptake of results of KET Biotechnology projects.
- Stimulating network and alliance formation for further RTD and industrial innovation based on KET Biotechnology achievements, including the development and practical application of a clustering model.
- Added value beyond the original scope of the KET Biotechnology projects by exploiting synergies and sharing best practice. Increased public awareness of the activities in this area by targeted communication activities.
- More effective execution of activities of common interest, such as IPR management, standardisation and policy making.

Type of Action: Coordination and support action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

## **MODELLING FOR THE DEVELOPMENT OF NANOTECHNOLOGIES AND ADVANCED MATERIALS**

Materials and product developers have the need for information and knowledge-based systems that combine physical, chemical, biological and processing data around models that simulate and engineer future materials, processes and products interfaced with product life management (PLM) systems for fast development.

The principal aim of this part is to stimulate the use of existing materials modelling software by the European manufacturing industry. Activities will focus on delivering materials modelling software and making it available to industrial end-users, including service provision (research done for industry with these software packages); translator services, to generate new solutions and support technology transfer through materials modelling, characterisation, accompanied by relevant metrology, instrumentation, standardisation as well as business decision support tools.

Proposals are invited against the following topic(s):

### **NMBP-23-2016: Advancing the integration of Materials Modelling in Business Processes to enhance effective industrial decision making and increase competitiveness**

Specific Challenge: Sustaining and growing businesses requires continuous product innovation. Making meaningful business strategy decisions is an ever more challenging task in a global context. The combination of materials and business modelling to explore what technical solutions are economically viable is not yet exploited to the extend it could. The sheer volume of data and information combined with its dynamic nature demands an ever better understanding of possible options. There is a need for a Business Decision Support

System that supports the selection of the optimal material and process taking into account the implementation costs but also the associated risks, uncertainties and costs related to the modelling and simulation; a priority, especially for SMEs.

Scope: The proposals should develop an integrated Business Decision Support System (BDSS) that can support decisions on new materials and new processes by calculating through hypothetical scenarios.

The BDSS should enable the integration of materials modelling and business tools and databases into a single work-flow, allowing for flexibility of application to different industrial sectors.

Proposals should create a framework that allows the flexible integration of existing or future discrete and continuum materials models with structured and unstructured data from multiple data bases containing materials data, commercial data and information on market trends, pricing, customer needs and demands.

The BDSS should enable a multi-criteria optimisation over all stages of product development by allowing the end-user to mirror the operational framework of their company. The structure of the BDSS should allow back-engineering from the end-goal. BDSS should be designed such as to optimise the integration of humans in new more complex industrial environments. The tool should be available to and usable by decision makers in manufacturing companies in the form of a platform which can be confidentially applied by a company. The tool should be validated against measurements, existing data and real financial arguments. Validation of the developed systems on public case studies and training of translators on the system is required.

Development of innovative methodologies should be included addressing innovative ways to connect existing and future models and how to use them in varying contexts (adaptive systems and networks). If appropriate, model development in terms of accuracy, robustness, uncertainty qualification and speed to allow a large design space to be explored may be included in order to enable exchange of modules and to prove flexibility of the framework. The consortium is expected to provide expertise on multiple discrete and continuum materials models<sup>25</sup>, business decision support systems, data search technology (incl. optimisation, genetic algorithms, symbolic regression, machine learning and cognitive learning).

**Activities are expected to target Technology Readiness Level 5.**

*This topic is part of the open data pilot.*

Funded proposals will be invited to participate in a cluster, to agree on standards to achieve seamless integration of their frameworks and of the modules to be linked into the framework. Projects are expected to contribute actively to on-going activities e.g. in the EMMC (European Materials Modelling Council), and EU funded clusters.

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<sup>25</sup> [http://ec.europa.eu/research/industrial\\_technologies/modelling-materials\\_en.html](http://ec.europa.eu/research/industrial_technologies/modelling-materials_en.html)

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 4 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Reduction of company costs and increased performance and commercial impact based on effective materials models driven business decisions;
- Guidance to companies in developing their strategies with an effective, user friendly materials models driven business decision system;
- Increased industrial use of existing materials knowledge and effective materials models;
- Improved trust of industrial decision makers in materials modelling and their commercial advantage;
- Essential company savings in time and money, especially via the elimination of the need for (some) plant trials.

Type of Action: Research and Innovation action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

**NMBP-24-2016: Network to capitalise on strong European position in materials modelling and to allow industry to reap the benefits**

Specific Challenge: Predictive multi-scale material modelling has the potential to enable economic advantages for all manufacturing industries. There is a need for enhanced and effective interaction between all stakeholders, in particular between those engaged in different types of materials modelling (electronic, atomistic, mesoscopic and continuum materials, process and device modelling) and between translators, who translate industrial problems into materials modelling and manufacturers. In addition a lack has been identified for clear road maps for research on the application and use of materials modelling in industry. Moreover, there is a need to collate different methodologies and support further development of standards for efficient and effective implementation and use of materials modelling tools. Also there is a need to increase the interoperability of software to facilitate integration of various tools in processing and product design.

Scope: The proposed coordination and support action should network the stakeholders and a platform is to be established to advance the use of materials models by industry and to agree on open tools with the wide stakeholder community.

Road Maps for materials and related product and process modelling in industry with a focus on how discrete (electronic, atomistic and mesoscopic) models can be further developed and

coupled or linked to continuum models are to be elaborated. The proposers should support the elaboration of methodologies and workflows.

A materials modelling data repository of validated sources should be designed with coherent and concerted connections. Existing communication standards between models and databases should be further developed, alleviating the language gap between different vocabularies. An open simulation platform based on these standards should be designed to allow the flexible use of software components of different vendors. Provision of validated data by third parties should be stimulated.

Benchmarking of tools and experimental data should be supported.

A jointly agreed guidance on software development for academics is to be established and promoted so that such software can be used by industry. Technology Readiness Levels for software, which could help in selecting the right model/software for the end user, should be agreed with the wide community.

The translation of industrial problems into material problems that can be solved by computational simulation should be facilitated.

Training and dissemination should be stimulated across Europe to make the different stakeholders aware of the technical and economic benefits of active use of discrete and continuum materials modelling throughout company operations.

Networking activities such as developing interest groups, workshops, training events, market studies and engaging with regulatory and benchmarking authorities if appropriate can be included.

*This topic is part of the open data pilot.*

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 4 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

**No more than one action will be funded.**

Expected Impact:

- Improved accessibility of materials modelling and related databases by manufacturing end-users;
- Increased integration of discrete (electronic, atomistic, mesoscopic) and continuum materials models and databases for industrial use;
- Increased efficiency and industrial effectiveness of materials models in industry and research;

- Establishment of technical and business-related quality attributes (Key Performance Indicators) that inspire trust in materials modelling;
- Industrial best practice (methodologies) for end-users increasing speed of development in industries.

Type of Action: Coordination and support action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

**NMBP-25-2017: Next generation system integrating tangible and intangible materials model components to support innovation in industry**

Specific Challenge: Innovation in manufacturing industries can be much faster, if materials modelling is used to focus experimental efforts. Novel modelling solutions need all determining components to be interwoven and available to the entire European community allowing the quick development and market deployment of new materials. Industry wants to know the risks and gains of materials modelling and the resources necessary to use the models efficiently. The industry needs education and/or support by translators analysing the industrial problems and proposing modelling solutions to the companies requesting this, supported by benchmarking. The above services need to be accompanied by tangible components like models, software packages, data, state of the art and connections to key actors. An open simulation platform providing interoperability between discrete and continuum models based on widely agreed communication standards would facilitate the use of materials modelling.

Scope: The project should establish a web based marketplace linking various activities and databases on models, information on simulation tools, communities, expertise, course materials, lectures, seminars and tutorials for at least two manufacturing sectors of the European industry.

Projects should address sectors that in the design of materials and their manufacturing processes have common problems with models describing phenomena at, and ranging over, time and space scales spanning from femto-, pico-, nano- to the meso-scale.

The project should aim at agreement with the wide European scientific and industrial community a standard for organizing modeling data needed to make search and linking between different databases effective and easy. Strategies and test rules pertaining to data integrity and quality, e.g., by user and analytic feedback mechanisms should be established. The proposal should develop practical solutions for the ownership, control and management of distributed databases. The project should ensure wide spread participation.

The project should provide novel tangible avenues for integrating multiple materials models that can address industry relevant challenges. The project should establish methods for software interoperability that can later on be used for the integration of materials models (discrete and continuum applied at nanoscale) and databases in open simulation platforms.

The development of homogenisation models and the elaboration of wrappers should be stimulated.

The proposal should establish a validation system to provide reliability and accuracy of models and for the comparison of results of simulations between materials models and for comparison with experiments.

The project should stimulate the exploitation of existing software via advice on modelling, education of companies and the stimulation of the provision of translation services especially for SMEs.

The proposal should present a credible business plan for the maintenance of the hub after the project duration.

**Activities are expected to target Technology Readiness Level 6.**

*This topic is part of the open data pilot.*

Funded proposals will be invited to participate in a cluster, to agree on metadata for the description of software and measurement tools and databases; to agree on software development standards; and to achieve seamless integration of their platforms across the different manufacturing-targeted application areas to achieve a true common marketplace. Projects are expected to contribute actively to on-going activities e.g. in the EMMC (European Materials Modelling Council), and EU funded clusters.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Increased innovation in industry based on materials modelling;
- Awareness of industry in general and SMEs in particular of the rapid progress of contemporary computational materials modelling tools, and increased use of materials modelling by the manufacturing companies (end-users);
- Broad, fast, and easy information management and exchange both between the modelling community and industry and within the modelling community;
- Ability for manufacturing companies (end-users) to do an effective search of numerical tools and/or providers of numerical simulations who could best suit their needs;
- Supply of software developers with comprehensive information about the potential clients and industrial tasks where numerical simulations would be highly desirable;
- Effective information exchange within the academic simulation community to enable faster general progress of material modelling methods;



- Speed up the use of materials modelling by standards and requirements of modelling data repositories including possibly data, modelling codes and validation repositories;
- Increased demand for data and materials models;
- Increase the use of materials simulation to comply with regulations;
- Rapid deployment of novel materials modelling solutions in particular manufacturing-targeted domains.

Type of Action: Innovation action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

## **SCIENCE-BASED RISK ASSESSMENT AND MANAGEMENT OF NANOTECHNOLOGIES, ADVANCED MATERIALS AND BIOTECHNOLOGIES**

The real or perceived uncertainties surrounding the potential health or environmental risks of Engineered Nano-Materials (ENMs) and their diverse applications, as well a lack of regulatory clarity, have a negative effect on the development, uptake and exploitation of these materials. The challenge posed by such uncertainties requires thorough understanding to measure material properties, adequate knowledge of ENMs interactions with biota and capacities to engineer-out or reduce non-acceptable risk in a convincingly reliable manner. Successful implementation of nanotechnologies depends on the capacity to define and quantify acceptable risk in order to get insured in terms of liabilities. In order to ensure safety and consolidate success communication and outreach are necessary to make sure that perception of risk resulting from chronic or acute exposure is close to science-based risk analysis. Cooperation between stakeholders at global level is necessary to legitimise risk management practices.

At regulatory research level the ongoing activities for the quantification of hazards and exposure, and the safe-by-design technologies are deemed adequate at European level for the period. It is expected that they will be complemented by national and private efforts before passing to the next stage.

At market support level risk management is administered at national level by especially dedicated nano-risk centres or platforms. At European level networking is the main vehicle for addressing issues of common interest.

Overall research efforts must be implemented in a holistic manner, on the basis of roadmaps, with adequate international cooperation and networking at global level.

This scientific domain is expected to gain from and open access to research results publications (compulsory level) and open access to research data (pilot level). Stakeholders and projects are expected to actively contribute to the nano-safety cluster and international organisation (OECD, ISO, CEN, UN, etc.) and standardization efforts.

Proposals are invited against the following topic(s):

**NMBP-26-2016: Analytical techniques and tools in support of nanomaterial risk assessment**

Specific Challenge: Nanomaterials are very diverse groups of materials with greatly varying properties. Thorough physico-chemical characterisation of nanomaterials, in their pristine forms but also in the tested environment, is nowadays being recognised as essential for sound assessment of their biological and environmental properties. In order to enable prediction of impacts, itself nowadays a pre-requirement for insuring industrial activity, a classification based on key parameters or biological interactions should be established and scientific foundations established on very well defined and characterised systems. Yet, suitable analytical techniques, instrumentation and equipment for the testing of nanomaterials properties, skilful operators, and inter-laboratory studies that would establish confidence are still lacking, even in the “simple”, and most addressed, case of particle size distribution measurements which many laboratories struggle to tackle adequately when confronted with poly-dispersed materials. At the lower limits of the nano-scale these same problems aggravate further. An additional factor is the high cost of the available techniques something that hinders smaller laboratories, innovation oriented SMEs, and discourages start-ups.

Scope: The objective is to develop new, or further improve, relevant analytical methods and corresponding equipment, relevant to hazard and exposure testing strategies, that enable characterisation of ensembles of nanomaterials particle sizes, complex shapes, surface area and surface chemistry, coating stability or multiple composition (multicomposites engineered nanomaterials), including the necessary building up of confidence through benchmarking. The analytics could also enable studying the longer term fate of particles following their interactions with in complex matrices, i.e. in living systems, or longer term environmental fate, e.g. after wear and tear or weathering.

**Established methods, including related equipment, should be brought to Technology Readiness Level 6 and beyond, whereas those based on new concepts are expected to reach TRL 5.**

*This topic is part of the open data pilot.*

*This topic is particularly suitable for SMEs and for international cooperation.*

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Enable the identification of key descriptors that can be used to reveal correlations associated with health and environmental impacts and meaningful basis for grouping, read-across and QSARs purposes;

- Increased confidence in nanosafety studies and findings through sound physico-chemical characterisation methods and standard operating procedures;
- Reduced costs related to the physico-chemical characterisation of nanomaterials in relevant environments;
- On top of safety related objectives, proposals should seek synergies with applications of the methods in other areas such as quality control, product traceability, labelling and counterfeiting.

Type of Action: Research and Innovation action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

**NMBP-27-2016: Promoting safe innovation through global consolidation and networking of nanosafety centres and strengthening the European industry through cooperation in nanosafety**

Specific Challenge: The rapid expansion of nanotechnology has brought the question of the safety of the emerging applications and the risk management measures. Considerable effort has been put by FP6 and FP7 projects for answering basic scientific and technical questions and will continue under H2020. There is a need to support regulatory aspects by providing the technology, skills and conventions necessary for implementation of existing rules and consistent development of new ones. This supposes developing the capacity to routinely assess and reduce risks in regulatory terms, both for toxicity and exposure, and the capacity to develop and implement safe-by-design processes and products with the aim of keeping risk level below pre-defined values.

Scope: The objective of this topic is to support safe innovation related aspects by providing the technology, skills, and processes, necessary for science-based best NanoSafety practices in industrial and commercial activities.

This objective is being addressed by nano-risk excellence centres currently being established in several EU member states and globally. A wide variety of national and (EU) regional platforms and centres can be observed which are dedicated to research, market follow-up, dissemination of nanosafety. There is the need to consolidate and further develop these first initiatives so as to make available to industry and other stakeholders concerned a European-wide, up-to-date, science-based, organisational structure capable of managing risks and supporting safe innovation. It should also ensure providing scientific support to more general questions on product quality, technical approvals, counterfeiting, training and certification system for nanosafety at work and providing reliable information for the public.

The proposed CSA should aim at networking these platforms, including the nanosafety cluster, at European level and cooperate with third countries. The foundation and basis for the development of the European nano-network will be based on the interaction and adequate communication to generate a step-change in the risk management process. It may include

work and resources specific to the participants or other public and private sources. The CSA can be used to pool resources and organise calls for market oriented activities which are of common interest for the platforms.

To ensure fast transfer of knowledge from basic research to market implementation, the proposed CSA should strengthen and support the Nanosafety Cluster activities, in particular those aiming at communication and outreach.

*This topic is part of the open data pilot.*

In line with the objectives of the Union's strategy for international cooperation in research and innovation (COM(2012) 497), international cooperation according to the current rules of participation is encouraged, in particular with Brazil, South Korea and the United States of America. The quality of the international cooperation will be reflected in the evaluation of the proposal, under the criteria 'Excellence' and 'Impact'.

The Commission considers that proposals requesting a contribution from the EU between EUR 1 and 2 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

**No more than one action will be funded.**

Expected Impact:

- An independent science based EU nanosafety reference platform for all stakeholders in nanotechnology that collates information into a comprehensive and accessible European network portal and providing a solution to the problem of data accessibility and transferability, by removing barriers which currently limit knowledge distribution;
- The CSA should mark progress for Guidance to market actors (industry, safety service providers, and public authorities), best practice, standards, technical approvals, environment protection, and operational certification systems;
- The platforms network should prepare a European Hub to provide services and support for stakeholders (e.g. industry, governments, researchers etc.) to create in a sustainable way marketable, societal approved products and goods;
- Involvement of highly renowned actors in the research field and from leading stakeholders from regulatory bodies, standardization bodies, into a seedless dialogue;
- Significant research outputs efficiently disseminated to national and international communities.

Type of Action: Coordination and support action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

**NMBP-28-2017: Framework and strategies for nanomaterial characterisation, classification, grouping and read-across for risk analysis**

Specific Challenge: The number of available nanomaterials is growing rapidly and testing each material thoroughly is virtually impossible. For convincingly managing eventual risk, precise quantification of hazards and exposure would be necessary for all cases and engineering-out or reducing risk must follow in cases of non-acceptable risks. All engineered nanomaterials (ENMs) would need characterising along all value chains and all used media and physiological chemistries. It is therefore essential to set the basis for an appropriate and sustainable framework and define strategies towards ENMs classification, grouping (categorisation for further purposes) and read-across for risk analysis in a regulatory perspective.

Scope: The existing and rapidly progressing knowledge in this domain, in terms of characterisation of material properties and of possible adverse effects from their applications, is expected to allow for classification of ENMs based on morphology, composition, complexity/functionality, and by bio or eco-interactions. The classification approaches should aim to support grouping of ENMs for further risk analysis, to help in developing intelligent testing strategies and identifying "ENMs properties of concern" that need to be tested more thoroughly. Methods for grouping and for read-across within or between groups, should be defined to reduce unnecessary efforts in testing. Grouping can take into account quantification of possible adverse effects depending on the use on ENMs in specific applications. Results from these studies should be collected and combined in a consistent and progressive system enabling both the integration of newer data and the use of raw and aggregated data for regulatory purposes. Particular attention should be paid to supporting safer-by-design practices, so that novel products containing ENMs provide the benefits originally claimed by maintaining fullest possible intended functionality and at the same time pose the least possibly risks to humans, the environment and ecosystem services. The proposed projects should include appropriate data curation expertise, modelling (including development of theoretical models if appropriate) and input into the possible development of Q(n)SP/AR approaches in order to develop user friendly interfaces to enable data driven predictions from other ENMs with similar properties or behaviour, and predictive risk assessment tools.

**Activities are expected to focus on Technology Readiness Levels 5 to 7**

*This topic is part of the open data pilot.*

*This topic is particularly suitable for international cooperation.*

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

**No more than one action will be funded.**

Expected Impact:

- The research approach should be innovative and represent a significant advance beyond the current state-of-the-art in the whole area of nanomaterials hazard and exposure assessment;
- Sustainable solutions to the long-term challenge of nanosafety at a level that will allow both consistent integration of newer data and regulatory application of scientifically sound concepts;
- Cutting-edge progress towards a framework and methods for groupings and read-across useable in a regulatory environment;
- Demonstration of consistent, applicable and scientifically sound grouping and read-across strategies in specific value chains, ready for use by industry and regulators, enabling predictive hazard and exposure modelling for risk analysis, and including the input towards safer-by-design guidance;
- Outputs should be tailored to address the needs of each of the stakeholder communities, including the modelling community. Delivered predictive models and tools should be disseminated through publically available, ready-to-use applications.

Type of Action: Research and Innovation action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

**NMBP-29-2017: Advanced and realistic models and assays for nanomaterial hazard assessment**

Specific Challenge: Risk assessment is often largely based on the toxicological profile of the material in question. The reason is that the costs related to hazard assessment are usually not in balance with the costs for exposure monitoring, let alone risk containment or risk mitigation. However with the very big number of new material likely to enter production and use, the usually short period between development and marketing and the increase in societal risk aversion, the classical toxicological testing paradigm so far focusing on in vivo testing is gradually but steadily shifting towards in-vitro and in-silico testing approaches. This is particularly true in the field of nanosafety where, in front of potentially thousands of different nanomaterials, economic constraints make it essential to develop and establish robust, fast and yet reliable and realistic methods that should be applied in figuring out "nanomaterials of concern".

Significant progresses have been made in assessing nanomaterial hazard. Yet, knowledge gaps remain on long-term effects (low doses, chronic exposure), both for human health and the environment. Questions also arise on the adequacy of the models used in existing in-vitro and in-silico testing and on the relevance of the exposure conditions (e.g. linked to the current understanding of the nanomaterial-biomolecule-cell interface) to correctly assess and predict real-life hazards. It is also necessary to prepare the ground for the next challenge, defining hazard profiles based on in-silico testing alone.

Scope: With a view to intelligent testing strategies (ITS) for nanomaterials, it is of high priority to develop and adopt realistic and advanced in vitro tests which have the potential to substantially improve the relevance of in-vitro approaches. Current in-vitro experiments mostly rely on established immortalized single cell lines, which often do not reflect the in-vivo situation. Therefore, new or advanced models, such as co-culture models, 3D cultures or primary cell models should be developed for relevant endpoints lacking, or having inadequate, in-vitro models. Transport through biological barriers could also be addressed, for instance with the objective of assessing the true internal dose of the materials to which living organisms are being exposed, as well as disease models or models with impaired barriers.

Low-level chronic exposure is a likely scenario as many ENMs will probably exist at very low concentrations in the environment and potentially be persistent. Thus, assays and models with low chronic exposure, elucidating toxicokinetics, different mechanisms of action and adverse outcome pathways, as well as specific disease models, should be developed and assessed against appropriate animal studies and could include for instance effects on kinetics, growth, reproduction, metabolism, and behaviour. Research could also focus on long-term, ecologically relevant, effects in realistic environmental concentrations of ENMs.

The transformations in biological or environmental matrices have been demonstrated as having potentially significant effect on the ENM tests results. Therefore, dosing with realistic exposure levels and conditions should be an integral part of the developments, taking into consideration the dynamic and complex nature of environmentally induced transformations with realistic external and internal forms and levels of exposure.

For validation purposes and to ensure that the experimental results can form a solid and meaningful basis for grouping, read-across, and modelling purposes, the testing should be performed on sets of well-defined and characterised libraries of nanomaterials and, when possible, on nanomaterials for which high-quality in-vivo data are already existing (to minimize animal testing).

**Activities are expected to focus on Technology Readiness Levels 4 to 6.**

*This topic is part of the open data pilot.*

*This topic is particularly suitable for international cooperation.*

The Commission considers that proposals requesting a contribution from the EU between EUR 10 and 13 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

**No more than one action will be funded.**

Expected Impact:

- The research approach should be innovative and represent a significant advance beyond the current state-of-the-art. Research should focus on provision of solutions to the long-term challenge of nanosafety and nanoregulation;
- New models and assays for use in in-vitro and in-silico testing improving prediction of chronic effects in a broad array of representative organisms and changes in ecosystem function;
- Improved predictive power of in-vitro and in-silico approaches for in vivo systems to support acceptance in a regulatory framework;
- Developed test guidelines for further standardisation, and ring testing (including guidance on design of the ring testing).

Type of Action: Research and Innovation action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

## **INNOVATIVE AND RESPONSIBLE GOVERNANCE OF NEW AND CONVERGING ENABLING TECHNOLOGIES**

An effective and informed dialogue with all stakeholders is an essential element of safe and responsible governance of nanotechnology, advanced materials and biotechnologies and their applications, enhancing public confidence. Their governance will deal with long term, global issues: integrating knowledge and technology for human potential (more creative and productive, better learning, active ageing); life security (sustainability, health, safety); and understanding and addressing the different value systems in society, concerning the deployment of technologies for societal benefits. The ethical and legal realities arising require sophisticated means to engage civic society. There is a need to improve the communication of risks and benefits and to address risk perception. Hence Social Sciences and Humanities (SSH) are particularly relevant to this area.

Proposals are invited against the following topic(s):

### **NMBP-30-2016: Facilitating knowledge management, networking and coordination in the field of formulated products**

Specific Challenge: Complex formulated products such as pharmaceuticals, medicines, cosmetic creams and gels, detergent powders, processed foods, paints, adhesives, lubricants and pesticides are ubiquitous in everyday life. The design and manufacture of formulated products is a highly significant value-adding step, with a value multiplier ranging from around 3 – 100. There is an estimated emerging global market of around € 1400 bn. The EU has a strong, competitive advantage in formulation and within the EU there are many significant centres for the industrial manufacture and R&D of formulated products.



In order for Europe to avail this opportunity, there is a need to share in a targeted manner, the diverse skills and expertise from different sectors and how this shared complementary expertise can enrich each of the partners' innovative capabilities through cross-learning and research at the precompetitive level.

Scope: Proposals should focus on and facilitate the exchange of non-competitive “know-how” in formulation technologies which will benefit the innovative potential and capabilities of diverse industrial sectors, relevant in both SMEs and large corporations in the following domains:

- Technologies for better delivery of active ingredients in products through innovative design of combined formulation and high throughput technologies to achieve an optimal use of ingredients;
- State-of-the-art modelling and high throughput metrology methods to better predict, measure, control and at an early stage, optimize the stability of formulated products, leading to higher sustainability, better regulatory compliance, better supply chain management, improved shelf-life properties and an exact correlation between lab-scale and production-scale properties;
- Intensification methodologies for better process design that utilize formulation technologies via a scalable and industrially relevant integrated digital platform in order to reduce the number of steps and use less energy than what is currently employed.

Activities may include the identification of the common scientific and industrial cross sectorial research and innovation challenges through the development of a shared vision and common roadmap.

Proposals should involve at least three sectors, such as Chemical, Pharmaceutical, Agrochemical, Food Science and Medical Technology, etc. Proposals should also involve at least three internationally recognized research establishments within the European Union.

The Commission considers that proposals requesting a contribution from the EU between EUR 300 000 to 500 000 would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Rational development of sustainable developed products and processes;
- Structuring and integration of value chains in the field of design and manufacturing of formulated products as a significant value added step leading to reduction of costs and time to market;

- Mobilisation of European industries to achieve global leadership in delivering innovatively formulated products within the context of Industry 4.0 and the Circular Economy.

Type of Action: Coordination and support action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

### **NMBP-31-2016: Presidency events**

Specific Challenge: An integral part of the LEIT-NMP part of Horizon 2020 is to organise events of a major strategic nature. Examples are events organised together with successive EU presidencies; and also EuroNanoForum, Manufuture, NMP Conferences and World Manufacturing Forum. The proposed Support Action(s) should contribute to creating better synergy between initiatives launched by the Commission and by the Member States, to the benefit of the coherence of the overall actions within the field of research and innovation within the Industrial Leadership part. Member States which will hold a forthcoming Presidency of the European Union are Malta and United Kingdom in 2017 and they may be particularly interested in this topic.

Scope: In order to ensure high political and strategic relevance, the active involvement of the competent National Authority(ies) will be evaluated.

Proposals should address topics of major relevance at the time of the events. An appropriate equilibrium should be present in the proposed action(s), with balanced presentations of various research and industrial elements and points of view. The conferences organisers should use modern technologies in all phases of the event life cycle, and should include interactive sessions. Outreach activities may be included, such as a press programme or events dedicated to the wider public or schools.

The Member States holding a Presidency of the European Union in the same year are invited to liaise in order to avoid overlaps, and to ensure that each event has clearly identified objectives, messages and target groups.

The commitment of the national authorities to support the event(s) (from a political point of view, but also with resources) should be a pre-requisite to submit a proposal. The application should be supported by the competent Minister, in a letter added to the application.

The Commission considers that proposals requesting a contribution from the EU between EUR 300 000 and 600 000 would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

**No more than one action will be funded for each Presidency (possibly covering more than one event).**

Expected Impact:

- Review of research, industrial and/or societal developments linked to the Industrial Leadership part areas, as appropriate;
- Sharing of information and comparison of points of views; and
- Networking various stakeholders and supporting their activities, e.g. natural scientists, social scientists, researchers, industrialists, SMEs investors, environmentalists, museums and schools, non-governmental organisations, ...

Type of Action: Coordination and support action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

### **NMBP-31-2017: Presidency events**

Specific Challenge: An integral part of the LEIT-NMP part of Horizon 2020 is to organise events of a major strategic nature. Examples are events organised together with successive EU presidencies; and also EuroNanoForum, Manufuture, NMP Conferences and World Manufacturing Forum. The proposed Support Action(s) should contribute to creating better synergy between initiatives launched by the Commission and by the Member States, to the benefit of the coherence of the overall actions within the field of research and innovation within the Industrial Leadership part. Member States which will hold a forthcoming Presidency of the European Union are Estonia and Bulgaria in 2018 and they may be particularly interested in this topic.

Scope: In order to ensure high political and strategic relevance, the active involvement of the competent National Authority(ies) will be evaluated.

Proposals should address topics of major relevance at the time of the events. An appropriate equilibrium should be present in the proposed action(s), with balanced presentations of various research and industrial elements and points of view. The conferences organisers should use modern technologies in all phases of the event life cycle, and should include interactive sessions. Outreach activities may be included, such as a press programme or events dedicated to the wider public or schools.

The Member States holding a Presidency of the European Union in the same year are invited to liaise in order to avoid overlaps, and to ensure that each event has clearly identified objectives, messages and target groups.

The commitment of the national authorities to support the event(s) (from a political point of view, but also with resources) should be a pre-requisite to submit a proposal. The application should be supported by the competent Minister, in a letter added to the application.

The Commission considers that proposals requesting a contribution from the EU between EUR 300 000 and 600 000 would allow this specific challenge to be addressed appropriately.

Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

**No more than one action will be funded for each Presidency (possibly covering more than one event).**

Expected Impact:

- Review of research, industrial and/or societal developments linked to the Industrial Leadership part areas, as appropriate;
- Sharing of information and comparison of points of views; and
- Networking various stakeholders and supporting their activities, e.g. natural scientists, social scientists, researchers, industrialists, SMEs investors, environmentalists, museums and schools, non-governmental organisations, ...

Type of Action: Coordination and support action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

**NMBP-32-2016: Support for National Contact Points**

Specific Challenge: Facilitate trans-national co-operation between National Contact Points (NCPs) within the Industrial leadership Part with a view to identifying and sharing good practices and raising the general standard of support to programme applicants.

Scope: Support will be given to a consortium of formally nominated NCPs in the area of LEIT-NMBP. The activities will be tailored according to the nature of the theme, and the priorities of the NCPs concerned. Various mechanisms may be included, such as benchmarking, joint workshops, enhanced cross-border brokerage events, training, and twinning schemes. Special attention will be given to helping less experienced NCPs rapidly acquire the know-how accumulated in other countries.

The focus throughout should be on issues specific to the Industrial Leadership part, with the possible inclusion of interdisciplinary approaches, e.g. by involving Social Sciences and Humanities. It should not duplicate actions foreseen in the NCP network for quality standards and horizontal issues under ‘Science with and for Society’.

The proposal consortium can include only NCPs from EU Member States and Associated Countries, who have been officially appointed by the relevant national authorities. The consortium should have a good representation of experienced and less experienced NCPs.

Submission of a single proposal is encouraged. NCPs from EU Member States or Associated Countries choosing not to participate as a member of the consortium should be identified and the reason explained in the proposal. These NCPs are nevertheless invited and encouraged to participate in the project activities (e.g. workshops).

NCPs from third countries who have been officially appointed by the relevant authorities are also welcome to participate in the project activities.

The costs incurred by the consortium for participation of officially appointed NCPs from EU Member States and Associated countries not participating in the consortium, and from officially appointed NCPs from third countries on the official list in part A of the General Annexes of the General Work Programme, e.g. travel costs paid by the consortium, may be included in the estimated budget and be eligible for funding by the Commission.

The Commission considers that proposals requesting a contribution from the EU between EUR 250 000 and 500 000 would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting another amount.

**No more than one action will be funded.**

Expected Impact:

- An improved and professionalised NCP service across Europe, thereby helping simplify access to Horizon 2020 calls, lowering the entry barriers for newcomers, and raising the average quality of proposals submitted.
- A more consistent level of NCP support services across Europe.

Type of Action: Coordination and support action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

**NMBP-33-2016: Networking and sharing best experiences in using regional clusters strategies with a focus on supporting innovation in the NMBP thematic area.**

Specific Challenge: The development of the smart specialisation strategies has put in place a more structured framework for programme and project implementation regarding regional/sector specialisations. This can help improve the knowledge that can be provided regarding NMBP related actions. Many Member States already identified the need to improve the articulation between NMBP and ESIF.

Regions find it still difficult to mobilise their internal resources in combining technology and regional development. Regional public private partnerships or regional clusters play a key role in this approach to connect EU-wide entrepreneurship and innovation (in particular in SMEs) to the European agenda.

The partners should show the EU innovation and industrial policy for new growth in NMBP needs to build on regional resources and potentials. Interlinking the regional eco-systems and clusters into new innovation driven cross-EU value chains could be the key to articulate competitive positions, meet global challenges and achieve a balanced and sustainable growth.

The proposal should bring together and integrate representatives from: higher education institutions; research centres; large companies; SMEs; relevant European organisations and associations; as well as national, regional and local authorities from Europe which are involved in preparing regional cluster strategies in the NMBP area.

Scope: The aim is to jointly identify good initiative and novel approaches, key success factors in driving actions forward and to shape strategic priorities for future regional cluster policies at European level in NMBP. Regional clusters or regional innovation hubs are a fertile field where synergies can be achieved.

Regional clusters have been active in the Smart Specialisation Strategy (RIS3) and KETs prioritisation process and can continue to play an important part in these processes, for example by acting as a resources channel towards SMEs and help structure KET based industrial value chains. Regional clusters or regional innovation hubs can be key delivery instruments for national and regional smart specialisation strategies, re-industrialisation and SME policy.

The proposal should take into consideration and build on existing or ended coordination actions in the NMBP area that tackled the issue of programming synergetic actions between EU and MS in the NMP Programme and generated results and recommendations for specific co-investment opportunities, linked to global market needs.

The Commission considers that proposals requesting a contribution from the EU between EUR 250 000 and 500 000 would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting another amount.

**No more than one action will be funded.**

Expected Impact:

- Boosting regional structural change through modern regional cluster policies;
- Identify and develop regional cluster, regional innovation hubs and business networks collaboration across borders and sectoral boundaries in the field of NMBP;
- Identification of best regional cluster strategies in the NMBP area;
- Identifying priorities for future regional cluster actions in NMBP; New trends, new models, challenges and visions for cluster policy;
- Defining the role of clusters for regional smart specialization (e.g. cluster mapping, strategic roadmaps, public procurement instruments).

Type of Action: Coordination and support action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

### **NMBP-34-2017: Governing innovation of nanotechnology through enhanced societal engagement**

Specific Challenge: In order to foster responsible research and innovation (RRI) in nanotechnologies, innovative processes are needed to improve the responsiveness of research & innovation processes to public values and concerns, and to ensure that research & innovation truly respond to societal challenges and take into account the social and environmental consequences from the outset.

Scope: The proposed action should build on previous EU and national projects in the field of public engagement by addressing the governance and implementation of responsible nanotechnology research and innovation. It will launch a participatory multi-actor engagement process (i.e. deliberations, workshops and/or working groups) focussing on early-stage product development in order to explore ways in which nanotechnologies can help address societal challenges while considering the needs and concerns of society. This multiactor engagement process should include researchers, producers, professional users, relevant civil society organisations and consumers/citizens. The proposed action should take into account the diversity of cultural contexts of processes and communication within Europe and should demonstrate state of the art public engagement concepts. The proposed project should also include an ex-post evaluation of the mutual learning process between stakeholders in previous relevant nanotechnology projects as well as societal debates on emerging technologies. Furthermore it will contribute to the concrete realisation of RRI conditions in nanotechnologies, and produce policy recommendations on how to govern research & innovation in nanotechnologies (and other emerging technologies) in a responsible way. The project must ensure a strong degree of policy alignment and be designed to deliver useful outcomes to relevant policy initiatives and innovation partnerships, such as European Technology Platforms.

Supporting activities to be undertaken in the project could include the empowering of stakeholders to co-create nanotechnology research and innovation by enabling them to formulate and communicate their needs and concerns, and designing ways to give them a voice in R&I processes. Additional activities could also include the development of: teaching material and the training of researchers and engineers in ways to include societal considerations in their work; training of researchers/scientists in science communication; establishing a 'journalist in the lab' exchange scheme; the development of balanced, reliable and easily accessible information on how nanotechnology is contributing to solving specific societal challenges and is used in daily life, e.g. published by the mass media with supplements and media micro sites or using existing multimedia and other relevant technology; guidance on how to bring about institutional changes that may contribute to a better engagement of civil society in nanotechnology-relevant R&I organisations; and policy recommendations on how best to integrate societal considerations in nanotechnology research & innovation.

This action is to be based on the concept of Mobilisation & Mutual Learning (MML) platforms. Proposals should include the appropriate disciplines of Social Sciences and Humanities (SSH). Gender aspects should be taken into account.

The Commission considers that proposals requesting a contribution from the EU between EUR 1.5 and 2 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

**No more than one action will be funded.**

Expected Impact:

- The early and continuous engagement of all stakeholders will be essential for sustainable, desirable and acceptable innovation in nanotechnologies, where R&I is aligned to the values, needs and expectations of society;
- The outcomes of the project are to be fed back into policy making and innovation partnerships such as European Technology Platforms, aiming to achieve a responsive R&I system and co-production of knowledge;
- The project will lead to enhanced public understanding of nanotechnology, will build trust and foster mutual understanding between citizens, and public and private institutions, leading to co-creation of new R&I and increased confidence of companies to invest in new technologies.

Type of Action: Coordination and support action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

**NMBP-35-2017: Innovative solutions for the conservation of 20th century cultural heritage**

Specific Challenge: Europe's highly diverse and rich cultural heritage (CH) is seen as a powerful common background that provides a sense of belonging amongst and between European citizens. Next to this societal impact, CH has also significant economic impact through activities such as tourism, restoration, maintenance, and cultural industry. However, tangible CH is endangered by significant deterioration of voluntary or involuntary anthropogenic origin and by other threats.

20<sup>th</sup> century cultural heritage is often confronted with different deterioration mechanisms than more ancient cultural heritage for reasons such as the use of modern materials. This requires additional research efforts regarding material composition, ageing processes, and the development of appropriate conservation technologies. While modelling and simulation based approaches in the development of advanced materials and devices play nowadays an important role, there is a need for development in the area of CH conservation.



Scope: Two main elements should be addressed:

- Projects should develop one or more innovative solutions (functional materials or techniques) for the conservation of tangible 20<sup>th</sup> century cultural heritage. To maximise the impact, the most relevant issues and objects should be identified and addressed. For this purpose, convergent contributions from relevant Social Sciences and Humanities (SSH) disciplines should be considered;
- Developments should be based on multi-scale modelling (in the sense of linking different types of models such as electronic, atomistic, mesoscopic and continuum etc.) approaches. Key issues such as compatibility, durability, ageing, and reversibility of interventions should be addressed by the modelling approaches. Modelling modules should be further developed if necessary.

The proposed materials/techniques are expected to ensure long term protection and security of cultural heritage, taking into account environmental and human risk factors. An environmental impact assessment of the proposed solutions is to be included to ensure the development of sustainable and compatible materials and methods. Focus on innovative and long-lasting solutions in the conservation of cultural assets is expected.

Projects are encouraged to base their modelling software development on on-going efforts in the development of open simulation platforms and to use to a large extent existing models. Projects should have an element of model validation based on experimental data. The majority of resources is expected to be invested in the actual material/technology development and testing, rather than the development of new models.

Standardisation and/or the production of (certified) reference materials and/or pre-normative research should be an integral part of the project.

The projects should present clearly measurable objectives for the proposed developments. The core activities regarding the materials/techniques are expected to reach TRL 6 by the end of the project.

A participation of relevant SSH disciplines is expected. SSH research should contribute criteria for targeting specific cultural heritage and analyse the expected long-term societal spill-over effects of the project.

Projects are expected to contribute actively to on-going activities e.g. in the EMMC (European Materials Modelling Council), and EU funded clusters.

**The implementation of this topic is intended to start at TRL 4 and target TRL 6.**

*A significant participation of SMEs with R&D capacities is encouraged.*

The Commission considers that proposals requesting a contribution from the EU between EUR 6 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Practical and affordable materials/technique solutions in terms of cost and/or complexity of operation by those who will use them;
- Increased quantified efficiency of materials/technique development for CH conservation, also beyond the specific cases selected by the proposers;
- Increased use of multi-scale modelling in the development of solutions for CH conservation;
- Improved modelling-based decision making regarding conservation interventions;
- Clear prospect for quantified socio-economic gains from the proposed solutions;
- Effective market uptake of the developed solutions within five years after the end of the project;
- Contribution to open repository of simulation and/or experimental data;
- Contribution to increased citizens' awareness of 20<sup>th</sup> century tangible CH.

*Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.*

Type of Action: Research and Innovation action

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

**NMBP-36-2016: Policy support for Industry 2020 in the circular economy**

Specific Challenge: Following the recent crisis, a key European priority is re-industrialisation, that is, the re-introduction and expansion of industry. Industry, and the manufacturing sector in particular, is important for Europe because it can create sustainable growth and jobs.

New digital technologies and advances in key enabling technologies provide unique opportunities for productivity gains as well as addressing new markets. A key feature in the latest industrial revolution is the linking of the physical and digital worlds through 'cyber-physical systems', which has the potential of making European industrial system truly flexible, resilient, resource efficient, human centred and highly competitive. Europe has to build on its strong capacities in all key enabling technologies (KETs); capitalise on digital technologies and systems; and bring smart manufacturing to innovative enterprises as well as traditional industries, including SMEs.

A re-industrialisation of Europe will have positive effects also in the context of the circular economy. New technologies help to make products, services, manufacturing and processing cleaner, safer, and more flexible in responding to customers' needs; and they help to use materials and energy as efficiently as possible and to reduce waste and emissions. Europe has

stringent legislation for clean industry, including rules to reduce greenhouse gas emissions and to foster energy efficiency. The more production is transferred back to Europe, the cleaner industry becomes.

At the same time, a fit-for-purpose eco-system needs to be created around these innovative technologies, to allow industry to be globally competitive and sustainable.

Scope: Proposals should assess the contribution of relevant EU projects in the area of KETs, e.g. pilot lines and demonstrators, to the vision of re-industrialisation in the context of the circular economy, as outlined in the specific challenge.

Proposals should build on the roadmaps of relevant European initiatives, such as the Factories of the Future and Sustainable Process Industries cPPPs, as well as relevant EU, national and regional initiatives supporting the transformation towards a more sustainable and competitive EU manufacturing industry.

Proposals should provide the evidence for the impact of R&I on industrial innovation and investments, growth and jobs, identifying also appropriate policy and public actions to further foster private investment into industrial and manufacturing.

Deliverables are expected in all of the following specific areas:

- A new vision for the EU industry-related to the circular economy in an international context, taking into account the SMEs dimension;
- An insight into high value-added production in competing economies, and the competitive position of European R&D&I in the NMBP areas, which can help EU industry benefit from international cooperation;
- An understanding of the interdependencies between science, technology, the economy and society, which are associated to the technology driven paradigm change in production and consumption;
- Concrete evidence and cases for the needs and framework conditions for industry and SMEs to invest and expand in Europe;
- An inventory of strategies for potential large-scale industrial investments in Europe to deploy technological advances in new products and services on the market, taking into account public and private funding and financing possibilities including through Important Projects of Common European Interest and the European Fund for Strategic Investments;
- An assessment of the contribution to this vision of relevant EU projects in the area of KETs, e.g. pilot lines and demonstrators; and
- Promotion of the results of NMBP projects in this context.

The analysis and strategy work should also take into account "future of work" and social aspects as well as managers' and consumer behaviour aspects. Appropriate contributions from Social Sciences and Humanities (SSH) are therefore essential to the success of these activities.

Complementarity should be sought between this work and the work in the ICT part of Factories of the Future (notably topic FoF-12-2017 on ICT Innovation for Manufacturing SMEs (I4MS)) in the effort of supporting the transformation of the EU's industrial fabric.

The Commission considers that proposals requesting a contribution from the EU between EUR 1000000 and 1500000, and having a duration not exceeding 18 months, would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

**No more than one action will be funded.**

Expected Impact:

- Improved understanding of the current situation and future perspectives for integrating key enabling technologies, in order to shape the future of the EU industry ensuring sustainable growth and jobs;
- Significant increases in public and private investments in Europe's manufacturing industry;
- Evidence for policy and other measures needed to improve the eco-system around the key enabling technologies, to help EU industry re-invest in Europe.

Type of Action: Coordination and support action

***The conditions related to this topic are provided at the end of this call and in the General Annexes.***

**Conditions for the Call - CALL FOR NANOTECHNOLOGIES, ADVANCED MATERIALS, BIOTECHNOLOGY AND PRODUCTION**

Opening date(s), deadline(s), indicative budget(s):<sup>26</sup>

Topics (Type of Action)	Budgets (EUR million)		Deadlines
	2016	2017	
Opening: 15 Oct 2015			
BIOTEC-02-2016 (RIA)	32.00		08 Dec 2015 (First stage)
BIOTEC-03-2016 (RIA)			24 May 2016 (Second stage)
NMBP-01-2016 (RIA)	78.08		08 Dec 2015 (First stage) 24 May 2016 (Second stage)
NMBP-02-2016 (RIA)			
NMBP-03-2016 (RIA)			
NMBP-23-2016 (RIA)			
NMBP-26-2016 (RIA)			
NMBP-09-2016 (RIA)	32.00		
NMBP-10-2016 (RIA)			
NMBP-17-2016 (IA)	32.00		
NMBP-18-2016 (IA)			
BIOTEC-04-2016 (CSA)	10.70		21 Jan 2016

<sup>26</sup> The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.

All deadlines are at 17.00.00 Brussels local time.

The Director-General responsible may delay the deadline(s) by up to two months.

The deadline(s) in 2017 are indicative and subject to a separate financing decision for 2017.

The budget amounts for the 2016 budget are subject to the availability of the appropriations provided for in the draft budget for 2016 after the adoption of the budget 2016 by the budgetary authority or, if the budget is not adopted, as provided for in the system of provisional twelfths.

The budget amounts for the 2017 budget are indicative and will be subject to a separate financing decision to cover the amounts to be allocated for 2017.

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NMBP-24-2016 (CSA)			
NMBP-27-2016 (CSA)			
NMBP-30-2016 (CSA)			
NMBP-31-2016 (CSA)			
NMBP-32-2016 (CSA)			
NMBP-33-2016 (CSA)			
NMBP-36-2016 (CSA)			
BIOTEC-01-2016 (ERA-NET-Cofund)	30.00		21 Jan 2016
NMBP-11-2016 (ERA-NET-Cofund)			
NMBP-21-2016 (ERA-NET-Cofund)			
NMBP-08-2016 (RIA)	16.00		21 Jan 2016
Opening: 11 May 2016			
NMBP-04-2017 (RIA)		114.19	27 Oct 2016 (First stage)
NMBP-05-2017 (IA)			04 May 2017 (Second stage)
NMBP-06-2017 (RIA)			
NMBP-07-2017 (RIA)			
NMBP-22-2017 (RIA)			
NMBP-25-2017 (IA)			
NMBP-28-2017 (RIA)			
NMBP-29-2017 (RIA)			
NMBP-35-2017 (RIA)			
NMBP-12-2017 (RIA)		40.00	
NMBP-14-2017 (RIA)			
NMBP-15-2017 (RIA)			
NMBP-19-2017 (RIA)		32.00	

NMBP-20-2017 (IA)			
BIOTEC-05-2017 (RIA)		48.00	27 Oct 2016 (First stage)
BIOTEC-06-2017 (IA)			04 May 2017 (Second stage)
BIOTEC-07-2017 (RIA)			
Opening: 20 Sep 2016			
BIOTEC-08-2017 (CSA)		5.20	19 Jan 2017
NMBP-16-2017 (CSA)			
NMBP-31-2017 (CSA)			
NMBP-34-2017 (CSA)			
NMBP-13-2017 (RIA)		15.00 <sup>27</sup>	19 Jan 2017
Overall indicative budget	230.78	254.39	

Indicative timetable for evaluation and grant agreement signature:

For single stage procedure:

- Information on the outcome of the evaluation: Maximum 5 months from the final date for submission; and
- Indicative date for the signing of grant agreements: Maximum 8 months from the final date for submission.

For two stage procedure:

- Information on the outcome of the evaluation: Maximum 3 months from the final date for submission for the first stage and maximum 5 months from the final date for submission for the second stage; and
- Indicative date for the signing of grant agreements: Maximum 8 months from the final date for submission of the second stage.

Eligibility and admissibility conditions: The conditions are described in parts B and C of the General Annexes to the work programme. The following exceptions apply:

<sup>27</sup> of which EUR 5.00 million from the 'Information and Communication Technologies ' WP part.

NMBP-32-2016	Support will be given only to a consortium of formally nominated NCPs in the area of LEIT-NMBP.
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Evaluation criteria, scoring and threshold: The criteria, scoring and threshold are described in part H of the General Annexes to the work programme. The following exceptions apply:

	<p><b>For single-stage and second-stage evaluations</b>, the threshold for the criteria Excellence and Impact will be 4. The overall threshold, applying to the sum of the three individual scores, will be 12.</p> <p>In case of equal overall scores in the ranked list, the priority order of proposals will be established in accordance with part H of the General Annexes, except that proposals will be ranked on the basis of individual scores for the Impact criterion before the Excellence criterion.</p> <p>In case of equal overall scores in the ranked list, the priority order of proposals will be established in accordance with part H of the General Annexes, except, when comparing <i>ex aequo</i> proposals of different topics, the proposals will be ranked first according to the position in the topic ranked lists</p>
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Evaluation Procedure: The procedure for setting a priority order for proposals with the same score is given in part H of the General Annexes.

The full evaluation procedure is described in the relevant [guide](#) published on the Participant Portal.

Consortium agreement: Members of consortium are required to conclude a consortium agreement, in principle prior to the signature of the grant agreement.



## **CROSS-CUTTING ACTIVITIES**

Full details on the **Industry 2020 in the Circular Economy** call (H2020-IND-CE-2016/17) are provided under the Horizon 2020 Work Programme Part – Cross-cutting activities (Part 17 of this Work Programme).

## **FAST TRACK TO INNOVATION PILOT**

Full details on this pilot are provided in the separate call for proposals under the Horizon 2020 Work Programme Part – Fast Track to Innovation Pilot (Part 18 of this Work Programme).

## **SME INSTRUMENT**

Full details on the continuously open SME instrument call (*H2020-SMEInst-2016-2017*) are provided under the Horizon 2020 Work Programme Part – Innovation in SMEs (Part 7 of this Work Programme).

## **BLUE GROWTH**

Full details on the Blue Growth - Demonstrating an ocean of opportunities call (H2020-BG-2016-2017) are provided under the Horizon 2020 Work Programme Part – Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy (Part 9 of this Work Programme).

## **Other actions<sup>28</sup>**

### **1. External Expertise**

This action will support the use of appointed independent experts for the monitoring of running projects, where appropriate.

Type of Action: Expert Contracts

Indicative budget: EUR 0.93 million from the 2016 budget and EUR 1.23 million from the 2017 budget

### **2. Interim Evaluation of the Horizon 2020 LEIT-NMBP**

This action will support the use of independent experts to advice on or support the design and implementation of EU research policy.

According to Article 32 of the Horizon 2020 regulation, an interim evaluation is due by end of 2017. It will be organised centrally but the evidence base will be prepared through horizontal and thematic evaluations and the project database. For LEIT-NMBP, the interim evaluation will be undertaken with the support of a group of individual experts who analyse the programme rationales, implementation and outcomes in the first three years of the programme, including the cPPPs that are managed by LEIT-NMBP. Final results of the NMBP specific interim evaluation are expected by end of 2016.

This action shall be provided by up to 5 individual experts covered by specific expert contracts with duration of up to 5 months for all experts together in total.

A special allowance of EUR 450/day will be paid to the experts appointed in their personal capacity who act independently and in the public interest.

Type of Action: Expert Contracts

Indicative timetable: 1st to 3rd quarter of 2016

Indicative budget: EUR 0.10 million from the 2016 budget

### **3. Providing information and expertise for monitoring the Horizon 2020 LEIT-NMBP**

This action will support the use of independent experts to advice on or support the design and implementation of EU research policy.

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<sup>28</sup> The budget amounts for the 2016 budget are subject to the availability of the appropriations provided for in the draft budget for 2016 after the adoption of the budget 2016 by the budgetary authority or, if the budget is not adopted, as provided for in the system of provisional twelfths.

The budget amounts for the 2017 budget are indicative and will be subject to a separate financing decision to cover the amounts to be allocated for 2017.

External expertise and assistance for measuring and assessing the outcomes of the NMBP related activities. This shall be provided by up to 10 individual experts, who are selected on the basis of their knowledge and experience in programme evaluation and monitoring related tasks.

This will include the analysis of technological and economic output and impact related data and of information from the proposals and projects. It will also look into the context of the wider European technological and industrial landscape that is relevant for the NMBP related objectives. This will also include the legally defined Horizon 2020 LEIT Key Performing Indicators. The aim is to further develop the monitoring and assessment tools and to set up a regular monitoring system of LEIT-NMBP. This action will be organised independently from the activities related to the overall Horizon 2020 interim evaluations and the specific interim evaluation of LEIT-NMBP (see above), but will contribute with its results on a regular basis to the aims of these activities.

In order to be flexible and to build on the results from other activities, it is anticipated to call in the experts on an individual and ad hoc basis, with the possibility to gather them in meetings and workshops to present, discuss and further develop the findings.

This action shall be provided by up to 10 individual experts covered by specific expert contracts with duration of up to 10 months for all experts together in total.

A special allowance of EUR 450/day will be paid to the experts appointed in their personal capacity who act independently and in the public interest.

Type of Action: Expert Contracts

Indicative timetable: 2016 and 2017

Indicative budget: EUR 0.10 million from the 2016 budget and EUR 0.10 million from the 2017 budget

#### **4. Final evaluation of EMRP and interim evaluation of EMPIR**

Two research metrology initiatives are currently running under article 185 TFEU. EMRP started in 2009 with the last year of calls for collaborative projects in 2013, while its successor EMPIR implemented its first call for proposals in 2014.

The decisions No 912/2009/EC and No 555/2014/EU of the European Parliament and of the Council for the Art.185 initiatives on Metrology under FP7 (EMRP) and under Horizon 2020 (EMPIR) require the Commission to carry out a final evaluation of EMRP and an interim evaluation of EMPIR with the assistance of independent experts, and deliver reports on these evaluations to the European Parliament and to the Council, including the Commission's conclusions of the evaluation and observations. Furthermore, the decision No 555/2014/EU requires that the result of the interim evaluation of EMPIR shall be taken into account in the interim evaluation of Horizon 2020.

The evaluations will assess the progress of EMRP and EMPIR programme towards achieving their objectives. The expert panel will assist the Commission in the ex-post evaluation of EMRP, as well as in the mid-term evaluation of EMPIR. The related Commission reports will need to be submitted by 2017 to the European Parliament and the Council.

A special allowance of EUR 450/day will be paid to the experts appointed in their personal capacity who act independently and in the public interest.

Type of Action: Expert Contracts

Indicative budget: EUR 0.11 million from the 2017 budget

### **5. Exploitation Strategy and Innovation Consultants (ESIC)**

External assistance to identify and address possible or actual obstacles to the future or imminent exploitation of the intended or already achieved results of projects (this includes Exploitation Strategy Seminars, support to standardisation, support to business plan development, and support to patenting)

Specific contracts on an existing framework contract (ESIC2)

Type of Action: Public Procurement - using an existing framework contract - Service Contract

Indicative timetable: from third quarter 2015 (up to 4 specific contracts)

Indicative budget: EUR 0.17 million from the 2016 budget

### **6. Exploitation Strategy and Innovation Consultants (ESIC)**

External assistance to identify and address possible or actual obstacles to the future or imminent exploitation of the intended or already achieved results of projects (this includes Exploitation Strategy Seminars, support to standardisation, support to business plan development, and support to patenting).

a) New framework contract

Indicative timetable: third quarter of 2015

Indicative budget: total amount EUR 4 million over the whole duration (four years)

b) Specific contracts on the above mentioned framework contract

Indicative timetable: several specific contracts (maximum 12) in 2016 and 2017

Type of Action: Public Procurement - Service Contract

Indicative budget: EUR 0.45 million from the 2016 budget and EUR 1.00 million from the 2017 budget

## **7. Ex post impact assessment of the FP7 NMP Theme**

The study shall focus on the output and impacts of projects financed by the FP7 NMP Theme. The ex post evaluation of the NMP Theme has been carried out in 2014, directly after FP7 finished. At that time, only about half of the projects have finished or been mature enough in order to analyse results and output. Output of projects that started only in the second half of FP7 or mid to long term impact could not be assessed. This dedicated ex post impact assessment study shall overcome the constraints of the ex post evaluation study by carrying out the analyses three years later, when most of the FP7 NMP projects have finished. The task includes the development of a methodology to track information on project related output and impact after the end of a project, which means that other sources of information than the project reporting need to be explored. Final results are expected by end of 2017, also as input for the ex ante impact assessment of LEIT-NMBP in Horizon 2020.

Type of Action: Public Procurement - using an existing framework contract - Service Contract

Indicative timetable: Fourth quarter of 2016

Indicative budget: EUR 0.15 million from the 2017 budget

## **8. From advanced materials research to innovation and growth**

The aim of the study is to analyse the contribution of Advanced Materials to economic growth and job creation in Europe and other major world regions, by market segments as defined by the societal challenges in Horizon 2020. The market potential and time-to-market of current and potential future technologies based on advanced materials should be analysed, following a value-chain oriented approach. The study is expected to update and go beyond the results of the study ‘Technology and market perspective for future Value Added Materials’ completed in 2012.<sup>29</sup>

Type of Action: Public Procurement - Service contract

Indicative timetable: Second quarter of 2016

Indicative budget: EUR 0.06 million from the 2016 budget

## **9. Intelligent Manufacturing Systems interregional Secretariat**

The IMS interregional secretariat will be supported with an amount of EUR 150 000 in 2016.

Type of Action: Subscription

Indicative timetable: 2016

Indicative budget: EUR 0.15 million from the 2016 budget

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<sup>29</sup> [https://ec.europa.eu/research/industrial\\_technologies/pdf/technology-market-perspective\\_en.pdf](https://ec.europa.eu/research/industrial_technologies/pdf/technology-market-perspective_en.pdf)



**Budget<sup>30</sup>**

	Budget line(s)	2016 Budget (EUR million)	2017 Budget (EUR million)
<b>Calls</b>			
H2020-EEB-2016-2017		49.00	54.00
	<i>from 08.020201</i>	<i>49.00</i>	<i>54.00</i>
H2020-NMBP-2016-2017		230.78	249.39 <sup>31</sup>
	<i>from 08.020201</i>	<i>230.78</i>	<i>249.39</i>
Contribution from this part to call H2020-BG-2016-2017 under Part 9 of the work programme		2.00	
	<i>from 08.020201</i>	<i>2.00</i>	
Contribution from this part to call H2020-FTIPilot-2016 under Part 18 of the work programme		10.10	
	<i>from 08.020201</i>	<i>10.10</i>	
Contribution from this part to call H2020-IND-CE-2016-17 under Part 17 of the work programme		183.00	213.00
	<i>from 08.020201</i>	<i>183.00</i>	<i>213.00</i>
Contribution from this part to call H2020-SMEInst-2016-2017 under Part 7 of		39.33	42.82
	<i>from 08.020201</i>	<i>39.33</i>	<i>42.82</i>

<sup>30</sup> The budget figures given in this table are rounded to two decimal places.

The budget amounts for the 2016 budget are subject to the availability of the appropriations provided for in the draft budget for 2016 after the adoption of the budget 2016 by the budgetary authority or, if the budget is not adopted, as provided for in the system of provisional twelfths.

The budget amounts for the 2017 budget are indicative and will be subject to a separate financing decision to cover the amounts to be allocated for 2017.

<sup>31</sup> To which EUR 5.00 million from part 5.i (budget line 09.040201) will be added making a total of EUR 254.39 million for this call

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the work programme			
<b>Other actions</b>			
Expert Contracts		1.13	1.44
	<i>from 08.020201</i>	<i>1.13</i>	<i>1.44</i>
Public Procurement		0.68	1.15
	<i>from 08.020201</i>	<i>0.68</i>	<i>1.15</i>
Subscription		0.15	
	<i>from 08.020201</i>	<i>0.15</i>	
<b>Estimated total budget</b>		<b>516.17</b>	<b>561.80</b>