

ADVANCED MANUFACTURING FOR ENERGY RELATED APPLICATIONS IN HARSH ENVIRONMENTS

A pilot initiative for EU interregional collaboration by the Vanguard Initiative
Led by Scotland and the Basque Country

INTRODUCTORY BRIEFING – January 2015

The aim of this initiative is to strengthen a sector of European manufacturing which is well positioned to dominate global markets. This will be achieved by building a strong network across those regions of Europe with a relevant *smart specialisation*. In turn, this network will support collaborations between enterprises, research centres and specialist support infrastructure, creating a pan-European ecosystem to stimulate the development of innovative products and services.

Context

The EU is strongly committed to supporting the development of industry-led value chains in areas where EU industry has key strengths in global markets. The Vanguard Initiative¹ – where Scotland and the Basque Country are members - strongly supports the European Commission's ambition to facilitate a pan-EU approach to the building of value chains. This new initiative has political commitment across all involved regions and has set out an ambitious agenda to develop and strengthen inter-regional collaboration, with its first piloting phase in the *advanced manufacturing* domain.

As recognised in the Commission's Energy Security Strategy², the EU's prosperity and security hinges on a stable and abundant supply of energy. Recent geopolitical and market developments have acted as a call to action for Europe to address its vulnerability to external energy shocks. Among key actions included in the strategy is the increase of Europe's indigenous energy sources, which includes oil and gas in the North Sea basin and substantial potential for offshore wind, wave and tidal energy around the Atlantic coastline.

Finding new solutions to access deep sea oil reserves faster and more efficiently and to reduce the lifetime costs of offshore/marine renewables will unlock these energy sources across a number of EU regions. This can maximise Europe's existing traditional and renewable energy resources while supporting the long term transition to a decarbonised energy system, with options to consider the decommissioning of fossil fuel fields and the application of carbon capture and storage.

Cost effective solutions for deep sea oil and gas and offshore renewables are also of global importance, with significant international market opportunities which can support a sustainable European manufacturing industry. Closely related to this, from a technology challenge point of view, are fast growing markets in unconventional oil and gas e.g. 'fracking', and 'blue mining' of minerals from the seabed.

Within the EU, there is already an established core of advanced manufacturing companies producing end equipment for these markets and these are supplied by a broad network of manufacturers providing high-specification components, materials and specialist manufacturing services. Therefore, innovation and investment in this sector is likely to spill-over into a variety of related sectors while strong networking will similarly enable this sector to benefit from related innovations in other demanding industries. For

¹ <http://www.s3vanguardinitiative.eu/>

² http://ec.europa.eu/energy/doc/20140528_energy_security_communication.pdf

example, many energy applications will benefit from developments in *3D Printing* and *Environmentally Sustainable Manufacturing*, which are parallel pilots within the Vanguard Initiative's Advanced Manufacturing programme.

Economic Case and Market Failure

These are all applications where cost is less important than quality, integrity and reliability and therefore well-suited to EU-based manufacture. In addition, there is a significant European presence in producing both complete systems for these markets and their specialist components, so the total value-chain would maintain most of the value in Europe. The end markets are global, so the prospects for exports are excellent.

However, developing new technologies for rugged components capable of operating in the harshest environments is an expensive, risky and specialised business which is generally beyond the level of investment that a single company, or even region can justify. Nevertheless, there are many diverse applications for such technologies which mean that, at the level of the EU economy, investment is likely to yield significant returns when aggregated across the industrial base. Therefore, it makes sense to align industry-driven investments with public and private sources at regional, member-state and EU levels to further incentivise and accelerate the industrialisation of these technologies.

The Opportunity

The combination of EU regional strengths across energy and advanced manufacturing domains within the Vanguard Initiative (and beyond) has significant potential to generate new ideas, technologies and applications. Therefore, Scotland and the Basque Country have begun to collaborate with other interested EU regions to create a pilot. The pilot will incorporate a network of facilities across the member regions which will develop, demonstrate and test innovative equipment and components to meet the challenges of growing resource extraction and renewables markets.

For offshore oil & gas these challenges include operation in deeper seas, higher pressures and temperatures and with increased levels of corrosive and erosive materials in the flow, whilst maintaining integrity, reducing operation and maintenance costs and meeting more stringent leakage prevention requirements.

For offshore renewables the challenges include increased water depths, more remote and distant site locations, with a resultant increase in logistical challenges for installation, operation and maintenance and survivability of marine devices in waves and tides.

Many of the challenges for both of these sectors can be addressed by approaches such as the use of new materials to improve resistance to corrosion, improve capability to operate at higher temperatures and pressures and to reduce weight. Other challenges can be met by employing improved advanced manufacturing techniques to provide higher integrity, increased reliability and durability of components.

The technologies and processes which will enable these solutions have wider application in other key sectors and domains including shale gas extraction, aerospace, rail, automotive, mining and extraction (especially "blue mining" of the ocean floor), agriculture and marine markets.

Our Approach

This new industry-led partnership will build on the early work of the Vanguard Initiative, to: **'learn, connect, demonstrate, upscale (and commercialise)'**.

Scotland and the Basque country will provide leadership and stimulus to develop the initiative. Ten other EU regions have committed to taking forward this activity. We have recently undertaken a **focused mapping exercise** which provides an initial basis on which to understand mutual strengths and capacity.

Industry must guide and direct this exercise. We are building an inventory of industrial capability as this process develops which will allow for the identification of **matching opportunities** – i.e. where ideas, approaches, expertise, infrastructure can be brought together to generate projects and investments for enhanced market development.

This will generate the momentum for **specific co-investment opportunities**, linked to global market needs. A coordination group of key stakeholders will drive this process and address the most attractive opportunities, as these emerge through focused dialogue with industry from the participating regions.

There is strong EU policy and funding support (e.g. Interreg Europe, Horizon 2020, the proposed KIC in Advanced Manufacturing and Important Projects of Common European Interest - IPCEI) in the energy / advanced manufacturing 'space' which could significantly leverage inter-regional and private sector investments.

Scope

The range of manufactured products of potential relevance to this pilot is broad at both component and system level but some illustrative examples are provided below:

- Subsea umbilicals, risers, flowlines, control systems, production and processing equipment for oil and gas applications, and related components
- Valves, anti-corrosive pipelines, specialist pumps
- Autonomous Underwater Vehicles (AUVs) and the sensors, control systems, power and drive components they need
- Wave and tidal energy extraction systems
- Subsea electrical systems and components
- Blades, gears for tidal energy systems
- Materials and coatings for corrosive, high-temperature and high-pressure applications
- Products related to the maintenance and servicing of marine and subsea systems

The most important factors are the level of innovation, specialist design and high production quality required in such equipment and components which adds value and differentiates them from commodity products.

The range of relevant technologies could include (but are not limited to):

- Identification and development of optimal materials (e.g. for lightweighting)
- Forming and forging of components
- More efficient manufacturing processes
- Application of additive manufacturing to build on strong structures
- Joining technologies
- Integration of sensors for lifetime monitoring
- Surface treatments
- Modelling and simulation
- Embedded software for analysis and control
- Method of manufacture selection
- Testing and verification techniques

The services offered to industry by this new ecosystem could include:

- Connecting players across the EU value chain from materials suppliers to end users
- Consultancy to identify the most appropriate materials and manufacturing technologies
- Simulation tools and methodologies
- Development and demonstration of manufacturing processes to meet high integrity requirements, including validation and verification of part geometry, microstructure and integrity / reliability
- Manufacture of test pieces, prototypes and small volume pilot production runs
- Training in manufacturing methodologies and use of modelling and simulation

We are open to consider adding other related technologies and services which are well aligned with this proposal, as it is further developed.

What will Success Look Like?

The EU will be the global leader in the development and production of robust, high integrity equipment and components for applications related to marine renewables and to energy and resource extraction in the most demanding sub-sea and deep-underground environments.

This will be achieved by:

- A deep understanding of evolving markets globally
- Shared roadmaps for key technologies ensuring the industry moves forward in step
- European OEMs working with the best European component suppliers in close relationships which encourage innovation in technology, processes and business models
- Funding mechanisms to spread the burden and leverage the opportunity of funding innovation on technologies where a group of companies can benefit
- Shared specialist facilities to test new technologies and products
- A skilled labour pool well matched to industry needs

As a result, European companies will be a significant net-exporter to the wider world in these markets and many high value jobs will be created and sustained.

Get Involved

Any regions, clusters, companies or research institutions with a strong interest in this area are invited to get in touch with [Alison Hunter](#) or [Aitor Mintegui](#) in the first instance