Progress of offshore wind through R&D in FP7 and H2020

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Research and Innovation

Renewable Energy Policy Framework in Europe

- ***EU 2020 strategy:*** *sustainable, smart and inclusive growth encapsulating the three 20 % targets on renewables, energy efficiency and GHG emissions*

  → *need to boost the renewables industry, promote technological innovation and employment in Europe and achieve:*

- ***EU 2050 roadmap****: reducing GHG emission levels by 80-95% compared to 1990 and becoming less dependent on imported energy*

Wind Energy for Europe

- *Policy context: Europe 2020 strategy comprising the three 20% targets.*
- *Wind energy: 33-49% of the EU's electricity demand by 2050*
- ***Key clean alternative** to fossil fuels, contributor to **securing the energy supply** and **reducing GHG emissions***
- Benefits from ***promising and evolving RE technology*** and from widespread distribution of resources across MSs

Research and Innovation

EU Wind power progress

Focus on offshore wind technology:

sector's full development by 2030

- ***Investment costs in offshore*** *wind farms >> onshore facilities;* ***partly offset by a higher total electricity generation*** *due to stronger offshore wind intensity*

- ***EU Policy implementation and financial incentives*** *paved the way for recognizing the offshore wind sector's brimming potential*

Research and Innovation

EU policy and financial support: at the heart of wind energy growth

- ***SET-Plan**: instrumental role in advancing the deployment and roll-out of wind energy technology*

***EU contribution** devoted to:*

- ***R&DD:** FP7 funding (**€135 million**)*
- ***Demo:** European Energy Recovery Programme (**€565 million**), NER300 funding mechanism (**€273.1 million**)*
- ***Commercialisation:** IEE, RSFF, loans by EIB and EBRD*
- ***Market diffusion:** EIB, EBRD, MS action: feed-in tariffs, portfolios*

External conditions, resource assessment and forecasting for wind energy

NORSEWInD – aug 2008-jul 2012

- **Compiling and analysing LiDAR data resulting in an offshore wind atlas of North, Irish and Baltic Seas – wind mapping for offshore applications**

SAFEWIND – sept 2008- aug 2012

- **Improving wind power predictability - External conditions, resource assessment and forecasting for wind energy**

WINDSCANNER.EU – oct 2012 –sept 2015

- **The European windscanner facility focussed on improving infrastructure and measurement methodologies**

Aerodynamic and structural reliability of wind turbines – wind turbine design

RELIAWIND – march 2008-march 2011

- **Focused on optimising wind energy systems design, operation and maintenance: tools, proof of concepts, guidelines for a new generation**

INNWIND.EU – nov 2012- oct 2017

- **Innovative Wind Conversion Systems (10-20 MW) for Offshore applications – light weight rotor, innovated irect drive generator, and substructure**

AVATAR – nov 2013 –sept 2017

- **AdVanced Aerodynamic Tools for lArge Rotors facilitating the development of large wind turbines (10-20 MW)**

Aerodynamic and structural reliability of wind turbines – wind turbine design

DEEPWIND – okt 2010 –sept 2014

- **Future Deep Sea Wind Turbine technologies – floating wind turbine**

HiPRWind – nov 2010 –oct 2015

- **High Power, high Reliability offshore wind technology – design support structure and mooring system for floating wind turbine**

Development of design tools for offshore wind farm clusters

EERA-DTOC – jan 2012-june 2015

- **Multidisciplinary integrated software tool for an optimised design of individual and clusters of offshore wind farms**

ClusterDesign – dec 2011- may 2016

- **Innovative Wind Conversion Systems (10-20 MW) for Offshore applications – light weight rotor, innovated direct drive generator, and substructure**

Development of offshore multi-purpose RE conversion platforms

ORECCA– march 2010-august 2011

- **Offhshore Renewable Energy Conversion platforms – coordination action – research roadmap for activities in the context of offshore renewable energy**

Marina Platform – jan 2010-june 2014

- **New infrastructures for both offshore wind and ocean energy convertors – design, engineering and economic evaluation of multifunction marine platforms**

TROPOS – feb 2012- jan 2015

- **Modular Multi-use Deep Water Offshore Platform harnessing and servicing mediterranean, subtropical and tropical marine and maritime resources – modular approach including floater concept**

H2Ocean – jan 2012 –dec 2015

- **Wind-wave power open sea platform equipped for hydrogen generation as green energy carrier**

Grid integration

Twenties – april 2010-march 2013

- **Transmission system operation with large penetration of wind and other renewable sources in networks of innovative tools an**

Logistics

LEANWIND – dec 2013–nov 2017

- **Innovative transport and deployment systems for the offshore wind energy sector**

IRPWIND – Start 01/03/2014

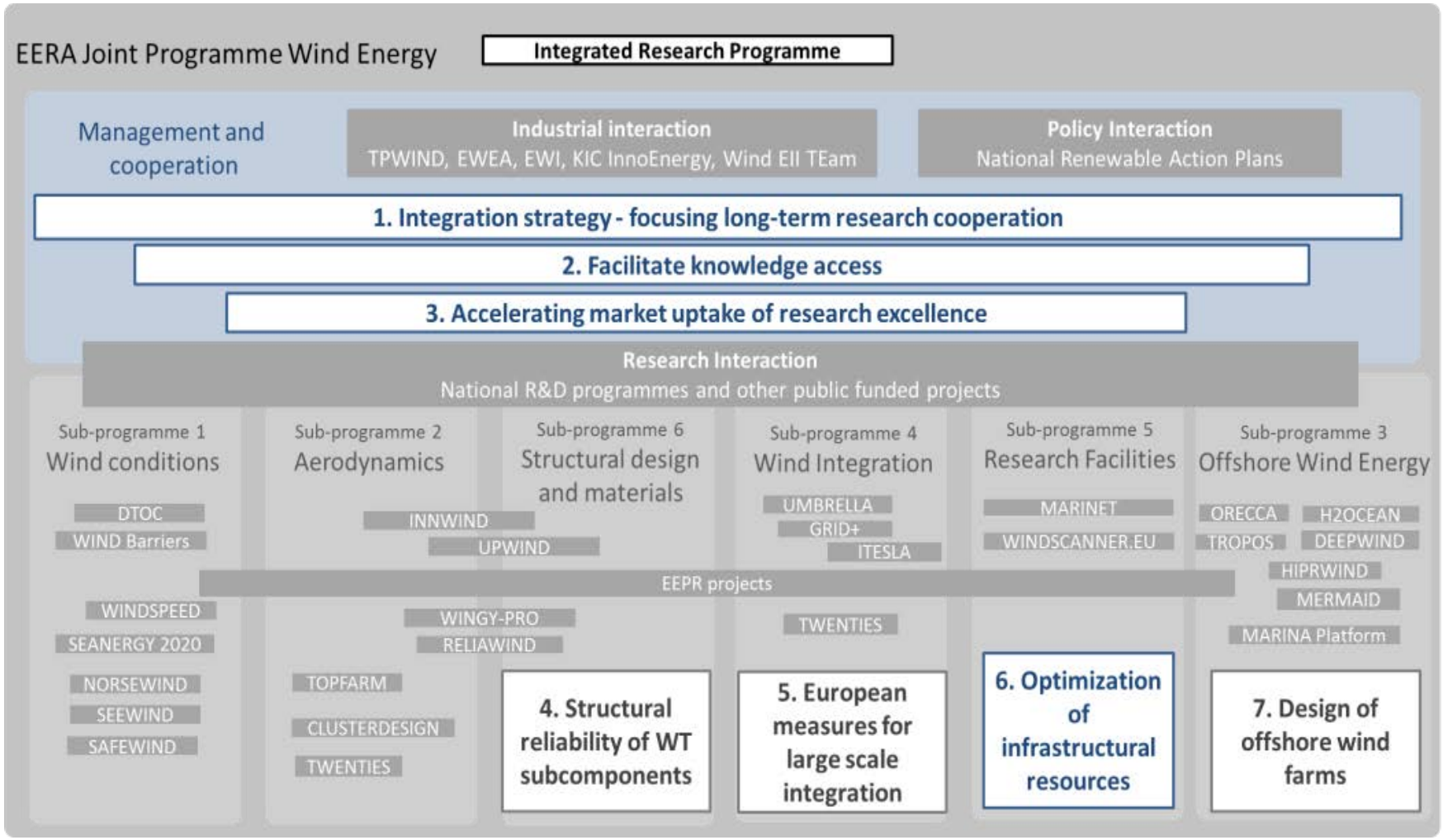


Figure 7- Rationale behind IRPWIND: Identification of gaps within the framework of EERA JP Wind

Implementing actions: Integrated Roadmap

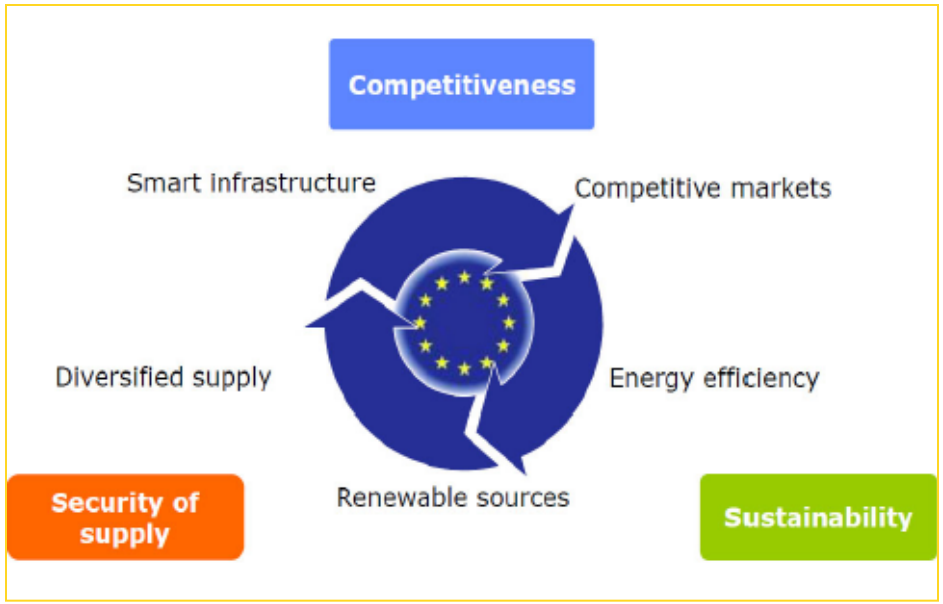
*Prioritise the **development of innovative solutions** for the **European energy system** by 2020, 2030 and beyond*

*Challenge-based approach for **R&I actions** to be undertaken in the following **6 years**:*

- *holistic perspective on the R&I chain (Actions and Actors)*
- *R&I ⟺ energy policy*
- *expert-based, open and transparent approach*

Integrated Roadmap

***Technology & innovation**: key component of EU energy policy and priorities*



I. Energy Efficiency

II. Competitive, efficient, secure, sustainable and flexible energy systems

III. Innovation in real environments, market uptake

IV. Horizontal issues

SETPlan Integrated roadmap – wind challenges

- ✓ *Increase deployment possibilities and repowering process of onshore wind*
- ✓ *Reduce cost, increase reliability and availability of offshore wind*
- ✓ *Mass manufacturing turbines and components*
- ✓ *Infrastructure for offshore wind, dedicated ports*
- ✓ *Enable system integration*
- ✓ *Minimise environmental impact, increase social impact and spatial planning techniques*
- ✓ *Improve wind energy forecasts and understanding conditions*

EWEA report *Deep water – July 2013*

- *Offshore wind is one of the fastest growing sectors*
- *Deep offshore designs are necessary to unlock the promising offshore market potential*
- *The technology is still at very early stage development*
- *Policy, economic and technological recommendations*

HORIZON 2020

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Research and Innovation

The Multiannual Financial Framework 2014-2020:
European Council conclusions, 8 February 2013

***Key challenge*:** *stabilise the financial and economic system while taking measures to create economic opportunities*

1. **Smart & inclusive growth (€451 billion)**

2. **Sustainable growth, natural resources (€373 billion)**
3. **Security and citizenship (€16 billion)**
4. **Global Europe (€58 billion)**
5. **Administration (€61.6 billion)**

TOTAL €960 billion

Research and Innovation

What is H2020 and how is it new?

- ***€70.2 billion*** R&I funding programme
- ***A single programme*:** brings together 3 separate programmes/initiatives*
- ***Coupling research ⇔ innovation*:** from research to retail, all forms of innovation
- ***Focus on societal challenges*:** faced by EU society (e.g. health, clean energy)
- ***Simplified access***: for all companies, universities, institutes in the EU & beyond

* The 7th Research Framework Programme (FP7), innovation aspects of Competitiveness and Innovation Framework Programme (CIP), EU contribution to the European Institute of Innovation and Technology (EIT)

Strong focus on SMEs

- **20% of budget**
  - ✓ **from societal challenges and LEITs**
- **New SME instrument**
  - ✓ **> € 500 million in 2014-2015**
- **Support measures under 'Innovation in SMEs'**
- **Access to risk finance**
- **Participation with Member States** (Public-Public)
  Eurostars joint programme

Research and Innovation

Major Simplification for the benefit of applicants

1. **A single set of rules for all funding under Horizon 2020**
   - ✓ **Fewer, more flexible, funding instruments**
2. **Simpler reimbursement: 1 project = 1 funding rate**
   - ✓ **100% of the total eligible costs** (70% for innovation actions)
   - ✓ **Non-profit legal entities can also receive 100% in innovation actions**
   - ✓ **Single flat rate for indirect costs** (25% of eligible costs)
3. **Faster time to grant**
   - ✓ **Within 8 months of call deadline**

Major Simplification for the benefit of applicants

4. **Fewer, better targeted controls and audits**

5. **Coherent implementation**
   - ✓ **Through dedicated agencies**
   - ✓ **Single IT system**

6. **Simplification in grant agreements**

Research and Innovation

New approach to Work Programmes and Calls

- **2-year work programmes**
  (2014-2015: > € 15 billion)

- **Less prescriptive calls**
  (64 calls in 2014)
  - ✓ **Challenged-based approach, broader and fewer topics**
  - ✓ **First call deadlines as from March 2014**

- **Cross-cutting actions**

- **Use of *TRLs***

Three priorities

European Commission

Work Programme 2014
Funding for calls

Societal Challenges Pillar: ~ € 2.8 billion

- **Health, demographic change and wellbeing** (2 calls) **€ 600 million**
- **Food Security, Sustainable Agriculture and Forestry, Marine and Maritime and Inland Water Research and the Bioeconomy** (3 calls) **€ 300 million**
- **Secure, clean and efficient energy** (4 calls) **€ 600 million**
- **Smart, green and integrated transport** (3 calls) **€ 540 million**
- **Climate action, environment, resource efficiency and raw materials** (3 calls) **€ 300 million**
- **Europe in a changing world – inclusive, innovative and reflective societies** (5 calls) **€ 112 million**
- **Secure Societies** (4 calls) **€ 200 million**

In addition

- **Spreading Excellence and Widening Participation** (3 calls) **€ 50 million**
- **Science with and for Society** (4 calls) **€ 45 million**

Thematic scope of the Energy Challenge (according to the Horizon 2020 Specific Programme)

- Reducing energy consumption and carbon footprint by smart and sustainable use

New concepts, components and systems for buildings, cities, industry and people

- **Low-cost, low-carbon electricity supply**

Novel RE, efficient and flexible fossil fuel plants & CCS, or CO2 re-use tech

- **Alternative fuels and energy sources for mobility**

Bio-energy, power & heat, all forms of transport, H and fuel cells, new forms

Thematic scope of the Energy Challenge (according to the Horizon 2020 Specific Programme)

- A single, smart European electricity grid

Smart energy grid technologies, storage, systems & market designs for inter-operable networks, standards, emergency

- Market uptake of energy innovation

Applied innovation, standards, non-tech barriers, smart & sustainable use

- **New knowledge and technologies**

Multi-disciplinary research for energy technologies (including visionary actions)

- **Robust decision making & public engagement**

Tools, methods, models and perspectives for a robust and transparent policy support

Four Calls and their indicative budget

1. **Energy efficiency**
2. **Smart cities & communities**
3. **Competitive low-carbon energ**
4. **SME's and Fast Track to Innovation for Energy**

Part B - other actions

-Support to policy development & implementation

-Support to Technology Platforms

-IEA Implementing Agreements

-etc.

Calls	2014 (M€)	2015 (M€)
Energy Efficiency	92	98
Smart Cities and Communities	74	87
Competitive Low-Carbon Energy	359	372
SMEs and Fast Track to Innovation	34	37
Part B – other actions	*77*	*63*

Call LCE: Competitive Low-Carbon Energy

- New knowledge and technologies
- **Renewable electricity and heating/cooling**
- Modernising the single **European electricity grid**
- Flexibility through enhanced **energy storage technologies**
- **Sustainable biofuels and alternative fuels** for the European transport fuel mix
- Enabling the decarbonisation of the use of fossil fuels during the transition to a low-carbon economy
- Supporting the development of a **European Research Area in the field of Energy**
- **Social, environmental and economic aspects of the energy system**
- **Cross-cutting issues**

Call LCE: areas to be addressed

	AREA	TRL	TYPE	Deadline
LCE 1	New knowledge and technologies	2 > 3-4	RIA	01/04/2014 (stage 1) 23/09/2014 (stage 2)
Renewable electricity and heating/cooling				
LCE 2	Developing the next generation technologies of renewable electricity and heating/cooling	3-4 > 4-5	RIA	01/04/2014 (stage 1) 23/09/2014 (stage 2)
LCE 3	Demonstration of renewable electricity and heating/cooling	5-6 > 6-7	IA	10/09/2014
LCE 4	Market uptake of existing and emerging renewable electricity, heating and cooling technologies	7-9	CSA	07/05/2014

Types of Actions

- ***Research and Innovation Actions***

Actions primarily designed to establish new knowledge and/or to explore the feasibility of a new or improved technology, product etc, including testing and validating on a small scale laboratory prototype.

- ***Innovation Actions***

Aimed at producing plans and arrangements or designs for new, altered or improved products, processes or services. May include prototyping, testing, demo, large-scale validation & market replication.

- ***Coordination and Support Activities***

Accompanying measures such as standardisation, dissemination, awareness-raising and communication, networking, policy dialogues, etc.

Technology Readiness Levels

TRL 0: **Idea**. Unproven concept, no testing has been performed.

TRL 1: **Basic research.** Principles postulated and observed but no experimental proof available.

TRL 2: **Technology formulation**. Concept and application have been formulated.

TRL 3: **Applied research**. First laboratory tests completed; proof of concept.

TRL 4: **Small scale prototype** built in a laboratory environment ("ugly" prototype).

TRL 5: **Large scale prototype** tested in intended environment.

TRL 6: **Prototype system** tested in intended environment close to expected performance.

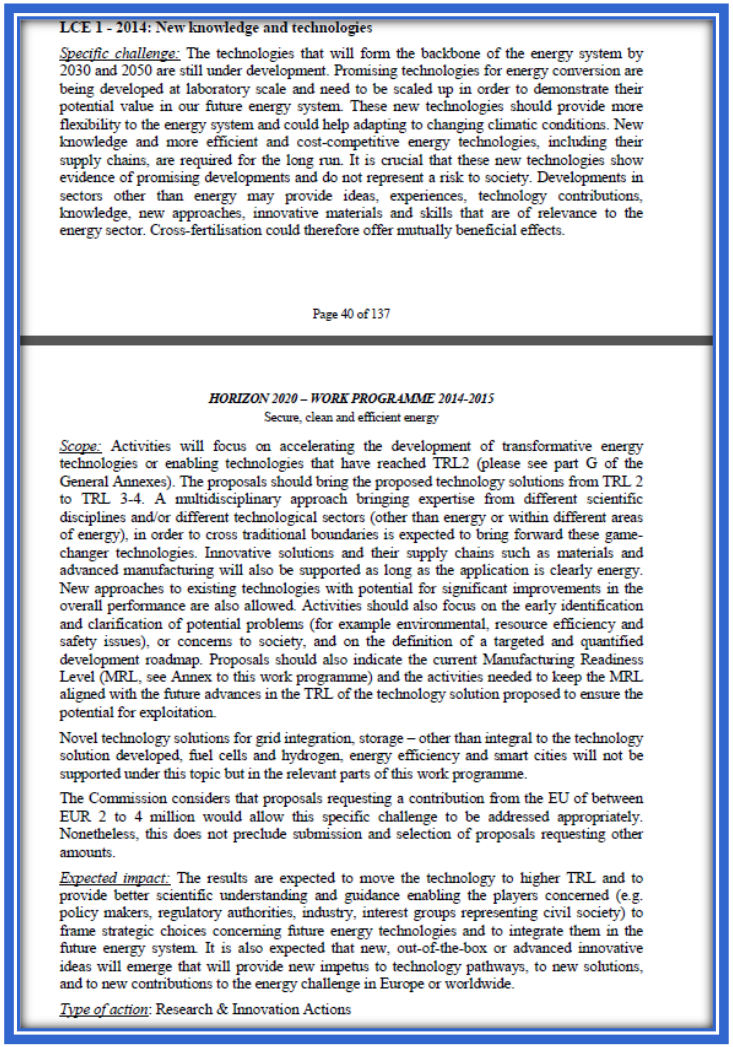
TRL 7: **Demonstration system** operating in operational environment at pre-commercial scale.

TRL 8: **First of a kind commercial system**. Manufacturing issues solved.

TRL 9: **Full commercial application**, technology available for consumers.

Structure of the call topic

- ***Specific Challenge***
- ***Scope***
- ***Expected Impact***
- ***Type of action***



LCE 1 - 2014: New knowledge and technologies

Specific challenge: The technologies that will form the backbone of the energy system by 2030 and 2050 are still under development. Promising technologies for energy conversion are being developed at laboratory scale and need to be scaled up in order to demonstrate their potential value in our future energy system. These new technologies should provide more flexibility to the energy system and could help adapting to changing climatic conditions. New knowledge and more efficient and cost-competitive energy technologies, including their supply chains, are required for the long run. It is crucial that these new technologies show evidence of promising developments and do not represent a risk to society. Developments in sectors other than energy may provide ideas, experiences, technology contributions, knowledge, new approaches, innovative materials and skills that are of relevance to the energy sector. Cross-fertilisation could therefore offer mutually beneficial effects.

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HORIZON 2020 – WORK PROGRAMME 2014-2015

Secure, clean and efficient energy

Scope: Activities will focus on accelerating the development of transformative energy technologies or enabling technologies that have reached TRL2 (please see part G of the General Annexes). The proposals should bring the proposed technology solutions from TRL 2 to TRL 3-4. A multidisciplinary approach bringing expertise from different scientific disciplines and/or different technological sectors (other than energy or within different areas of energy), in order to cross traditional boundaries is expected to bring forward these game-changer technologies. Innovative solutions and their supply chains such as materials and advanced manufacturing will also be supported as long as the application is clearly energy. New approaches to existing technologies with potential for significant improvements in the overall performance are also allowed. Activities should also focus on the early identification and clarification of potential problems (for example environmental, resource efficiency and safety issues), or concerns to society, and on the definition of a targeted and quantified development roadmap. Proposals should also indicate the current Manufacturing Readiness Level (MRL, see Annex to this work programme) and the activities needed to keep the MRL aligned with the future advances in the TRL of the technology solution proposed to ensure the potential for exploitation.

Novel technology solutions for grid integration, storage – other than integral to the technology solution developed, fuel cells and hydrogen, energy efficiency and smart cities will not be supported under this topic but in the relevant parts of this work programme.

The Commission considers that proposals requesting a contribution from the EU of between EUR 2 to 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: The results are expected to move the technology to higher TRL and to provide better scientific understanding and guidance enabling the players concerned (e.g. policy makers, regulatory authorities, industry, interest groups representing civil society) to frame strategic choices concerning future energy technologies and to integrate them in the future energy system. It is also expected that new, out-of-the-box or advanced innovative ideas will emerge that will provide new impetus to technology pathways, to new solutions, and to new contributions to the energy challenge in Europe or worldwide.

Type of action: Research & Innovation Actions

LCE 1 - 2014: New knowledge & technologies

- *Aim: accelerating the development of transformative energy technologies or enabling technologies that have reached **TRL2*** ⇨ ***TRL 3-4***
- *Activities should also focus on the early identification and clarification of **potential problems to society**, and on the definition of a targeted and quantified **development roadmap***
- ***Novel ideas**: provide impetus to technology pathways and address the energy challenge in Europe & beyond.*

LCE 2: Developing the next generation techn of renewable electricity & heating/cooling

2014 Wind energy:

Develop control strategies and innovative substructure concepts

- *Control strategies and systems for new and/or* **large rotors and wind farms** *(on- and offshore);*
- **New innovative substructure concepts**, *incl. floating platforms, to reduce production, installation and O&M costs for water depths of more than 50m.*

2015 Wind energy:

Substantially reduce the costs of wind energy

- *There is a need for* **innovative integrated dedicated offshore systems** *(e.g. with a significant lower mass per unit power installed) to reduce production, installation and O&M costs for water depths of more than 50m.*

LCE 2: Developing the next generation techn of renewable electricity & heating/cooling

Scope

- *From TRL 3-4 to 4-5*
- *Life-cycle perspective*
- *Environment, health and safety issues shall be considered*
- *Increased understanding of risks in each area*
- *Increased performance and reduced costs*
- *Manufacturing Readiness Levels*

- *Indication EU contribution 3-6 million Euro*

LCE 2: Developing the next generation techn of renewable electricity & heating/cooling

Expected impacts of proposals

- *Significantly increased technology performance*
- *Reducing life-cycle impact*
- *Improving EU energy security*
- *More predictable and grid friendly*
- *Strengthening European technology base*
- *Reducing renewable energy technologies installation time and costs*
- *Increasing reliability an lifetime*
- *……see work programme*

LCE 3: Demo of renewable electricity & heating/cooling technologies

2014 Wind energy:

Demonstrating and testing of new nacelle and rotor prototypes

- *Demonstration and testing of* **new nacelle and rotor prototypes** *with a significant lower mass and material intensity and applicable to several types of* **large-scale wind turbines**.

2015 Wind energy:

Demonstrating innovative substructure and floating concepts

- *Demonstration of* **innovative bottom-fixed substructure** *concepts for water depths of 30 to 50m capable of reducing costs;*
- *Demonstration of innovative* **floating wind turbine** *concepts.*

LCE 4: Market uptake of existing and emerging renewable electricity, heating & cooling techn

CSA: *focus on best practices and quantified indicators of the market impacts of future policy*

- *Ensuring sustained* **public acceptance** *of RE projects;*
- *Speedy and user friendly* **permitting procedures***;*
- *Implementing* **RE policies***, codes and legislations at EU, national, regional and local levels in a* **coordinated way***;*
- **Capacity building** *and further development of policy;*
- *Deployment of improved* **business models** *and innovative* **financing schemes**

First H2020 calls
12 focus areas

Some examples:

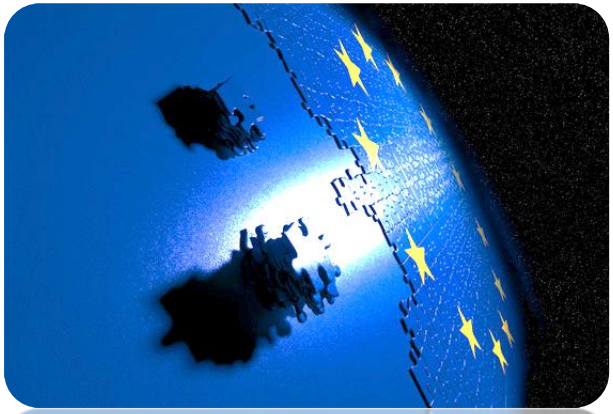
- ✓ **Personalising health and care (€ 549 million)**
- ✓ **Blue growth: unlocking the potential of seas and oceans (€ 100 million)**
- ✓ **Overcoming the crisis: new ideas and strategies to overcome the crisis in Europe (€ 35 million)**

WP in the area of Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy

BG-5-2014: *Call for Blue Growth: Unlocking the potential of Seas and Oceans*

Budget: *€2,000,000*

***DDL**: **2014-06-26** +17:00:00 (BXL)*



Topic:** **Preparing for the future innovative offshore economy (CSA)

This should include a review of marine renewable energy farms (both **wind and ocean energy**), offshore aquaculture facilities, multi-use offshore platforms projects and their business models, as well as issues of competing access to marine space between different activities and, more broadly, all social & env. impacts

Other parts of H2020 of direct relevance to Energy

- LEIT – KET materials, nano, electronics, manufacturing, processing
- FET-open and FET-pro-active
- Research Infrastructures
- ERC, EIT
- SME instrument (directly paid from Energy SC budget)
- JRC direct actions (IET, IPTS)

Close links – societal challenges

European Commission

Thank you for your attention!

More information:
www.ec.europa/research/horizon2020

HORIZON 2020