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COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

Energy Technologies and Innovation

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COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

Energy Technologies and Innovation

1. INTRODUCTION

Technology and innovation are crucial to all our energy challenges…

The EU needs to do more to bring new, high performance low-cost, low-carbon sustainable energy technologies to the market. New technologies are vital to achieve all of the EU 2020 objectives[1] in energy, climate, economic and social policy, as well as those for 2030 and 2050. The EU must have a strong and dynamic technology and innovation strategy both to deliver its policy goals strengthen its competitiveness and to better coordinate investments.

… complementing EU energy legislation

EU policies on the internal energy market, energy efficiency and renewables support technologies onto the market, from Photovoltaic (PV) panels to efficient appliances, smart meters or home automation. The EU needs to further reinforce the role of technology and innovation within energy policy, not just with specific technologies, but also by triggering new business models, market and social adaptation and energy system improvements that offer a longer term strategic perspective for investments.

….in a constantly evolving energy landscape

As a result of EU policies, global investments in renewables have progressed steadily requiring a greater flexibility and energy management. The phasing out of nuclear power in some countries and the rapid expansion of unconventional gas production is changing the economics of energy worldwide. To support European industrial competitiveness the EU's energy technology and innovation policy needs to deliver on reducing costs rapidly and speeding up the introduction of new sustainable technologies to the market. This is particularly important in a time of economic downturn which has direct consequences on private investments and national budgets.

2. WHAT HAS THE EU ACHIEVED?

2.1. Legislation has pulled technology and innovation onto the market

The EU internal energy market helps to create open and competitive markets where industry players invest in new and innovative technologies and services. The scale of the internal energy market provides the space for market forces to stimulate technological development and innovation. This is supported by efforts to modernise, integrate and expand grid

[1] as stated in the Communication on SET Plan in 2007 (COM (2007) 723) and in the Communication on Investing in low carbon technologies in 2009 (COM (2009) 519)

infrastructure up to 2020 and beyond, notably for electricity. The EU has identified 12 priority corridors, among others to integrate more wind and solar electricity while ensuring uninterrupted supply. The technical rules being developed for the internal market (i.e. network codes) focus on the integration of technologies in response to the changing energy system. As part of this work Transmission System Operators (TSO) are developing new modelling methods and smarter grid operation tools. Making consumers active players in an integrated energy market, means that EU policy is also driving the development of "smart" and IT-related technologies, such as smart metering, electric cars, demand response, micro-generation and local storage technologies to allow for flexible demand and better control of consumption.

To meet the 2020 goals, EU energy policy supports a shift to low carbon generation technologies. Spurred by the Renewable Energy Directive and support in Member States there has been a strong growth in renewables and significant reductions in cost. As part of the transition to a low carbon energy system, EU policy has pushed Carbon Capture and Storage (CCS) technologies and a safer nuclear energy generation.

Through EU energy efficiency policy and legislation, including the Energy Efficiency and Eco-design Directives, technologies are being rolled out onto the market. In parallel, sectoral energy efficiency legislation on eco-design is pulling the development and deployment of energy efficient appliances (e.g. boilers, washing machines, TVs, computers) and brings energy savings to consumers. In the buildings sector, EU legislation promotes energy efficient building renovation and the construction of nearly-zero energy buildings. In the transport sector, low emission and electric vehicles are encouraged.

The EU Emission Trading System and the Effort Sharing Decision have made the Green House Gas (GHG) emissions price part of EU business operational and investment decisions and has contributed to substantial emissions reductions but it's role as a major driver towards long term low carbon investments is being questioned due to the low and volatile carbon price signal it has produced in response to the crisis.

2.2. Improving framework conditions for research and innovation

The Innovation Union set out an integrated research and innovation strategy, improving public funding and tackling the barriers that hold back private investment. Significant progress has been made to improve framework conditions, including unitary patent protection (dramatically reducing patent costs), an effective EU-wide venture capital regime, and modernising public procurement rules. The European Research Area is improving the impact of Member State research funding and the framework conditions for researchers, including by better aligning funding from different Member States, improving researchers' careers and mobility and giving researchers access to world-class scientific infrastructures.

2.3. The SET Plan - driving the EU 7th Framework Programme for Research

The EU's Strategic Energy Technology (SET) Plan was established in 2008 as the technology push framework of the EU's energy and climate policies. It is based on a three pillar implementation structure: a Steering Group, European Industrial Initiatives (EIIs) and the European Energy Research Alliance (EERA) and is supported by an information system

(SETIS) [2]. The Steering Group on Strategic Energy Technologies has enabled a structured dialogue with Member States resulting in increased alignment of national energy research and innovation policies and has promoted a move towards joint actions to deliver common objectives with greater speed and effectiveness.

The SET Plan prioritised those technologies most relevant to the energy and climate policy objectives for 2020: wind, solar, electricity networks, CCS, bioenergy, nuclear, fuel cells and hydrogen, energy efficiency. The EIIs set-up for all these sectors have defined priority research and innovation areas through Technology Roadmaps including a dedicated roadmap on materials[3] and focused their action on large projects of European value. Through the EERA national research capacities are pooled to develop new solutions that will impact beyond 2020.

European funds have been made available, primarily under the 7th Research Framework Programme (FP7) through the mobilisation of different parts such as Energy and Key Enabling Technologies (e.g. ICT and Materials). From 2007 to 2012, the FP7 Energy Theme supported with some €1.8 billion about 350 projects. FP7 has also provided substantial support through public private partnerships and financial instruments (see below). In addition, support at the level of the EU has been provided through the European Institute of Innovation and Technology (EIT) and its Knowledge and Innovation Community InnoEnergy. Substantial additional funding came from European Energy Programme for Recovery (EEPR) as well as the from New Entrance Reserve (NER) 300 Programme. Public and private investments in technological development for the SET Plan sectors increased from € 3.2 billion in 2007 to € 5.4 billion in 2010[4] (Figure1). Today industry makes about 70% of the total research and innovation investment in the SET Plan priorities while Member States account for about 20% and the European Commission for 10%.

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2 The SET Plan Steering Group, composed of EU Member States, is mandated to conceive joint actions and make resource available for the implementation of the SET Plan. The EIIs are based on the European Technology Platforms, and propose Technology Roadmaps to align the efforts of the EU, Member States and industry to achieve common goals. The EERA groups the leading EU energy research establishments and is mandated to implement joint programmes through the sharing of national capacities in Europe. The Smart Cities and Communities European Innovation Partnership started as the energy efficiency component of the SET Plan and now integrates at the level of cities and communities real scale applications of energy, transport and ICT innovative solutions. The Commission's Strategic Energy Technologies Information System (SETIS) is led and coordinated by EC Joint Research Centre (JRC)

3 SEC(2011) 1609 - Commission staff working document *"Materials Roadmap Enabling Low Carbon Energy Technologies"*

4 (COM (2009) 519) has estimated that €8 billion per year are needed to effectively move forward the SET-Plan actions

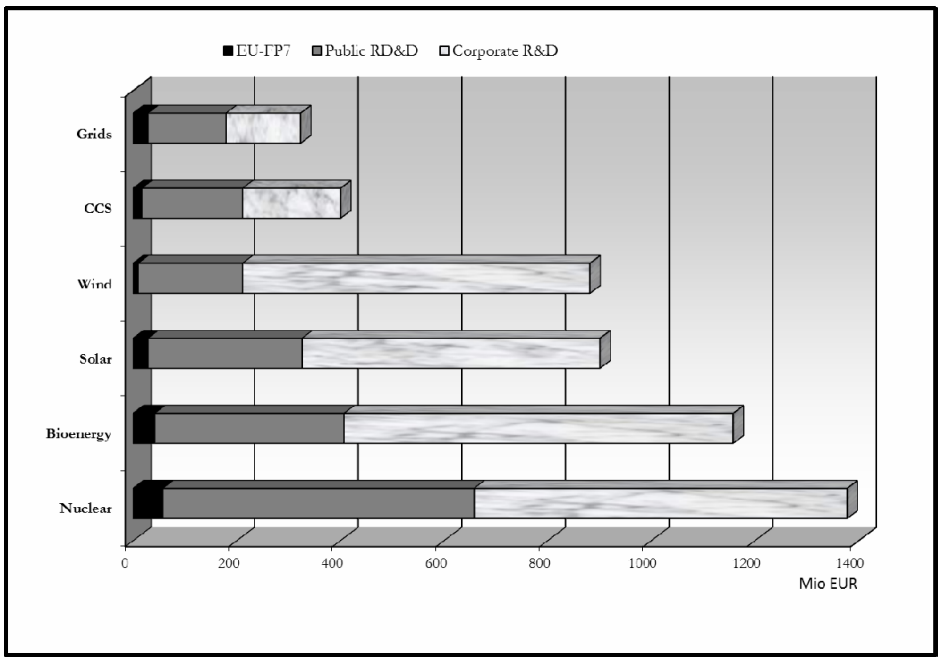

Figure 1 Estimate of public and corporate R&D investments in 2010 by technology and by source (JRC/SETIS)[5]

As a result of these efforts, important achievements in technological developments and cost reduction have been made for SET Plan technologies.

Over the last two decades Photovoltaic (PV) system prices have decreased all over the world, significantly driven by technology and market developments. The cost of PV modules decreased sharply (by 3 times in two years)[6]. The SET Plan target of 1 €/kW[7] by 2030 may be a reality by 2020 thus significantly reducing the costs for society.

Wind power (mainly on-shore) already contributes a significant share of energy generation: 106 GW of wind capacity installed at the end of 2012 generated 210 TWh or 7% of European electricity production[8]. Annual turnover of major wind equipment suppliers reached €20 billion in 2012. Whilst wind is a global market, it has a strong local influence: turbine manufacturer's worldwide market share depends strongly on how their home market performs. EU efforts also continue with offshore wind applications where the technology is still improving and cost are decreasing.

In the transport sector, EU efforts focus on reaching 10% of energy consumption from renewables, in particular through alternative fuels. To address indirect land use change (ILUC), the Commission proposed that no more than half of the 10% target should be achieved with conventional biofuels, increasing the demand for advanced biofuels to 6 Mtoe or 15 plants, each with an annual capacity of 100 Ktoe. A positive start has been made with FP7 funding 9 large scale lignocelluloses biofuel demonstration projects with capacities of 40 to 80 thousand tonnes per year.

5 For nuclear sector the spending regards Euratom

6 Staff Working Paper, Technology Assessment Figure 3.2

7 1 €/kW for turnkey 100 kW systems by 2030 (expressed in 2011 prices, excluding VAT)

8 JRC calculations based on a 23% capacity factor, which is the 2011 average figure for Europe

2.4. Intelligent Energy Europe (IEE) programme

Since 2007, the innovation programme Intelligent Energy in Europe (IEE) has promoted the market uptake of technologies and tackled non-technological barriers (financial, regulatory and administrative). The programme focused on energy efficiency and renewable energy. It has, through more than 300 projects, triggered over €4 billion of related investment in all end-use sectors, including transport.

IEE has led to mainstreaming new business models that leverage private financing. An example of such business model is Energy Performance Contracting (EPC), where the initial investment in energy saving measures is re-paid by the cost savings from higher energy efficiency. IEE has so far replicated this business model in 10 Member States including some where the concept was largely unknown.

IEE has also established co-operation with financial institutions to successfully mobilise investments of around €2 billion (with €38 million EU funding) into sustainable energy through its Project Development Assistance Facilities (ELENA[9] and Mobilising Local Energy Investment). The programme has pioneered support to "energy transformation" actors such as local and regional authorities, schools, hospitals and social housing as well as addressing the needs of practitioners through training and information provision. Investments are expected to generate energy savings of more than 2000 GWh/year.

Through its Build-up Skills initiative, the programme is addressing practitioners' needs to build nearly zero-energy buildings across the EU. In the area of energy intensive industries, the CARE+ project mobilised SMEs in the chemical industry to achieve energy savings of between 10-20%.

2.5. Public-Private Partnerships and Joint Undertaking

Supported under FP7, the Fuel Cells and Hydrogen Joint Undertaking (FCH JU) has enabled the implementation of an industry-led programme of research and demonstration activities covering both transport and stationary power applications. The €380 million in grants allocated to date has brought closer to market a variety of applications (e.g. material handling vehicles, back-up power systems) while reducing costs and improving the efficiency and the lifetime of the applications.

The research oriented Public-Private Partnerships (PPPs) on energy efficiency in buildings and on factories of the future, as well as on green cars, brought together the stakeholders in each of these sectors to forge a common agenda and channel EU funding towards their objectives. From 2009 to 2012, €1.6 billion was committed by the EU, matched by a similar level of private sector investments. The PPPs have been successful in attracting strong participation of SMEs.

2.6. Improving access to debt financing - Risk Sharing Finance Facility (RSFF)

Under FP7, the RSFF is supporting the European Investment Bank (EIB) in providing some €10 billion of loan commitments (with €1 billion of EU contribution) to attract more than €20

[9] The market replication ELENA Facility was launched by the Commission and the European Investment Bank (EIB) in December 2009 to support investments in energy efficiency and renewable energy projects. Run by the EIB, KfW, CEB and EBRD, the ELENA Facility is funded through the European Commission's IEE Programme.

billion of research and innovation investments, mainly by large firms and mid-caps companies. The RSFF encourages project promoters to undertake research and innovation activities associated with a high degree of risk. From 2009 to 2012, the energy sector has accounted for 14-18% of the RSFF portfolio, including major first-of-a-kind investments in solar and wind and investments to improve energy efficiency, particularly in the automotive sector.

2.7. Regional Dimension – support from cohesion policy

Within the cohesion policy budget significant funding is dedicated to sustainable energy, with over € 10 billion planned for investment in energy efficiency and renewables in the 2007-2013 programming period. One such example is the Wave Hub project in South West England, aiming to create the world's largest test site for devices that generate electricity from the power of waves. Another example is the Green Buildings Cluster project of Lower Austria, which connects construction and building professionals with researchers to address challenges such as climate change and enables innovation through cooperation.

2.8 Assessment of EU the energy technology and innovation framework

Europe is on the right track to foster the development of energy technologies and creating the right conditions for innovation, but much remains to be done.

The rapidly evolving energy landscape requires a system approach and responsiveness to new developments. Both the evaluation of the SET plan implementation[10] and the public consultation[11] conducted in support of this Communication confirm that the SET Plan needs increased focus on energy system integration, integration of activities along the innovation chain, and increased coordination of the EIIs and EERA to support this. Further industrial supply chain developments need to increase, while a stronger coordination of actors and investments along the research and innovation chain is needed to accelerate development and market uptake.

In addition, although Member States do share common industrial and research objectives, their commitment to the SET Plan is currently suboptimal. Coordinated and/or joint investments between Member States and with the EU need to be fostered to leverage private sector investments in support of the EIIs Technology Roadmaps and the EERA Joint Programmes. Similarly, a clear commitment from industrial partners needs to be ensured including in PPPs based on a shared vision and clearly defined objectives, while research capacities under the EERA need to be more integrated to accelerate the delivery of results with stronger links to industry.

An external evaluation of the IEE programme in 2011[12] concluded that it has a crucial role in developing service innovation, knowledge and capacity building and new business models that leverage private financing for the roll-out of energy efficiency and renewable technologies to the market. Building upon this successful example, measures supporting the

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10 JRC/SETIS SET Plan Review is available at: http://setis.ec.europa.eu/set-plan-implementation/set-plan-review-2010-2012

11 Public consultation full report is available at: http://ec.europa.eu/energy/technology/consultations/20130315_technology_innovation_en.htm

12 "Ex-ante evaluation of a successor of the 'Intelligent Energy- Europe II' (2007-2013)", available at: http://ec.europa.eu/energy/intelligent/files/doc/2011_iee2_programme_ex_ante_en.pdf

market uptake of energy innovation need to be expanded to other energy policy areas and should be more strongly linked to the Structural and Cohesion Funds.

In a similar vein, the interim evaluation of the FCH JU[13] recommended a stronger focus on applied research and larger-scale demonstration activities linked to energy system needs, such as the use of hydrogen to store renewable electricity.

These highlight the need for an integrated research and innovation chain at EU level that spans from basic research to market roll-out.

3. ENERGY TECHNOLOGY AND INNOVATION STRATEGY TO 2020 AND BEYOND

The European energy technology and innovation strategy needs to accelerate innovation in cutting edge low carbon technologies and innovative solutions, and bridge the gap between research and the market. This is clearly recognised in the Commission's proposals for Horizon 2020, which bring together EU support for research and innovation (including the successors to the current FP7 and IEEII programmes and further support to the EIT) under a simplified framework. However, EU funding remains a limited part of the overall funding across Europe, and the key principles and developments need to be reflected equally in private sector and Member State investments. Implementation needs to be increasingly based on partnerships that build the necessary scale and scope, and achieve greater impact from scarce public and private resources.

3.1. Key principles

Adding value at the EU level

EU intervention needs to focus on where it can really add value. It should concentrate on large-scale efforts which go beyond what Member States can achieve alone or bilaterally, promoting innovation through regulation and financing. It should support research and innovation capacity building to accelerate developments, and generate economies of scale.

Looking at the whole energy system when setting priorities

The development of energy technologies should be seen from the perspective of delivering cost-effective energy services to final customers: light, heat, cooling, clean transport etc. Individual technological developments should be assessed for their integration and impact on the whole energy system (production, transmission, distribution and use of energy). A system approach means going beyond the existing divisions between energy sources and end uses, and should therefore exploit synergies between sectors (e.g. energy, ICT, transport, agriculture), taking advantage of cross-sectoral complementarities and spill overs, as well as looking for life-cycle based solutions that reduce the overall need for energy by reducing waste and re-using and recycling materials.

Integrating actions along the energy innovation chain and strengthen the link with energy policy

[13] Available at: http://ec.europa.eu/research/evaluations/pdf/archive/other_reports_studies_and_documents/eval_fuel_cell_hydro_report_2011.pdf

Support for innovation cycle from basic research to market deployment means supporting market-uptake measures to build capacities, proofing of concepts for next generation technologies, tackling regulatory barriers , analysing the market conditions of specific technologies and create an investment climate and horizon conducive to more innovation investment.

Pooling resources and using a portfolio of financial instruments

The energy challenge requires investments in research and innovation that are beyond the reach of a single Member State or private actor. At a time when research-driven solutions are urgently needed and public resources are under pressure, there is a need to leverage the individual investments of Member States to support industry with programmes that allow ambitious and comprehensive industrial developments, and indirectly with an increased integration of national institutional funding and research institutions Different stages of innovation and deployment require proper financing mechanisms. The exploitation of synergies with the EU Structural and Investments Funds especially through national and/or regional research and innovation strategic policy frameworks for smart specialisation[14] should be strengthened. Other programmes can also be used for financing innovation, such as the Connecting Europe Facility (smart grids and electricity highways) or financing instruments such as those proposed in the Access to Risk Finance component of Horizon 2020 or directly deployed by the European Investment Bank. Additionally, ETS financing mechanisms similar to the "NER 300" Programme could be envisaged in the future.

Keeping options open, while concentrating on the most promising technologies for post 2020

Most energy technologies have long lead-times and so investment decisions now will have repercussions well beyond 2020. As a result, the EU needs to drive the development of a spectrum of technologies which may only reach maturity beyond 2020. The energy technology and innovation strategy puts in place a framework to deliver economic and viable energy technologies and solutions both in the short and long term, for the EU and the global market. It builds on the European Commission Horizon 2020 proposal currently subject to decision under the legislative process. It will also incorporate the results of the debate on the Green Paper on the 2030 framework for climate and energy policy.

3.2 Key developments that are needed

Unlocking the full potential of energy efficiency, focusing on end use consumption

Investing in energy efficiency brings savings to consumers and allows EU industries to be less dependent on energy prices, reduce their costs and increase their competitiveness.

Buildings, with nearly 40% of final energy consumption, are a high priority for increasing the rate of energy efficient renovations for existing buildings and making new buildings nearly zero-energy ones. New building materials, designs for integrating renewables into buildings, and new concepts and business models for energy efficient building renovation, need to be developed and demonstrated. These need to be supported by convergence between national

[14] In the proposal for 2014-2020 Regional Policy, Member States or regions are required to develop such strategies

and regional regulatory approaches to reduce administrative burdens, establish standard methodologies to measure the energy performance of buildings, and enable the single market.

The development and uptake of innovations which substantially reduce the energy costs of industry must be prioritised, in particular for energy intensive industries and SMEs (e.g. the use of industrial insulation throughout Europe would reduce annual energy consumption by 4%). This includes support for developing skills to grasp energy efficiency savings in industry through training energy auditors and energy managers.

Delivering competitive solutions for a clean, sustainable, secure and efficient energy system

Innovations that *ensure the flexibility and security of the European energy system* will lower the costs of the whole energy infrastructure and prepare it for taking up much larger amounts of renewable energy. Electricity storage technologies will be important at transmission and distribution level.

Innovations are needed *to ensure the continuity of electricity supply and rationalise demand for infrastructures* through cost-effective balancing of renewable electricity, at local level through demand response and flexibility and at transmission level through innovation in long distance electricity transport to enable balancing between multiple renewable energy source locations, for example, for linking offshore wind.

Technologies that enable *active consumer participation* will allow energy efficiency improvements in networks, making more use of ICT. Innovation in distribution grids and the development of a market environment that empowers consumers, while ensuring adequate protection of the vulnerable ones, to profit from the best price and energy conditions and to produce and sell their own energy.

Whilst a number of technologies have been successfully developed and brought to the market (onshore wind and solar photovoltaic) thanks to deployment support, *an open and flexible approach to further development of a portfolio of cost-effective and sustainable energy options* is needed. Other promising renewable energy fields include floating and other deep-sea offshore wind, ocean energy, advances in concentrated solar power and novel photovoltaic applications. Further focus on research into heating and cooling technologies, hydrogen and fuel cells technologies is needed. Innovation is also required in new materials, key enabling technologies such as ICT, nanotechnology, micro and nano-electronics, photonics, biotechnology and advanced manufacturing processes routes. The International Thermonuclear Experimental Reactor (ITER)-project[15] is a core of the EU's long-term research for fusion energy.

Technological development is needed to *support safe operation of nuclear systems, development of sustainable solutions for the management of radioactive waste, and nuclear competences.* This should focus on the safety of existing nuclear plants, particularly in view of the extension of operating lifetimes, as well as the safety of future nuclear systems. Research must continue in the field of long-term solutions for the management of radioactive waste in Europe through development of geological disposal. These efforts should be accompanied by multidisciplinary research on the risks of low doses of radiation. Next generation nuclear fission reactors such as "Generation IV" systems are the potential long term nuclear energy options.

[15] developed jointly by Japan, China, India, South-Korea, Russia, the US and the EU.

Deliver sustainable alternative fuels to the European transport fuel mix, in line with the alternative fuels strategy[16] for the long-term substitution of oil as energy source for all modes of transport, .This requires targeted development and cost reduction of the fuels (in particular advanced biofuels, bio-methane and hydrogen) and transport application technologies.

Fostering innovation in real environments and through a market driven framework

A particular focus is needed on cities which use far more energy than they are able to produce. Further integration and optimisation of the energy, information and transport flows at the level of districts, cities and communities is needed This is the premise of the Smart Cities and Communities European Innovation Partnership[17]: demonstrating commercial-scale smart urban solutions based on the use of ICT in the energy and transport sectors that can deliver cost effective solutions in European urban areas.

Market uptake measures are needed in the roll-out of all innovative energy technologies to allow scaling up investments in supply chains and to support policy implementation for grids, renewable energy and energy efficiency tackling non-technological barriers, including:

- building the *capacity* of market actors and public authorities to introduce effective policies and measures, which draw technologies into the market. This includes continuous development of practitioners (e.g. skills developments for technicians, engineers);
- supporting the development and take-up of innovative *financing* solutions for renewable energy and energy efficiency, including financing for their deployment.

National and regional innovation strategies need to play a critical role in fostering innovation in real environments. They should be mobilised to support research and innovation capacities build-up and to accelerate the exploitation and dissemination of research and innovation results into the market, with particular attention to creating an innovation-friendly business environment for SMEs and regional and local industry including improving access to risk finance.

4. IMPLEMENTING THE ENERGY TECHNOLOGY AND INNOVATION STRATEGY

The SET Plan remains the core instrument to deliver on the challenges addressed above. It provides the reference point for EU, national, regional and private investments in energy research and innovation.

However, the SET Plan also needs reinforcing, to respond to the new challenges and to better consolidate research and innovation capacity and resources across Europe. For this purpose, the following changes are proposed:

- To address energy system and innovation chain integration, an *Integrated Roadmap* should be developed, under the guidance of the SET Plan Steering Group, incorporating the key principles and measures identified in this Communication. This Integrated Roadmap should consolidate the (up dated) technology roadmaps of the SET Plan while retaining the technology specificities; it should cover the entire

[16] COM(2013) 17 final
[17] COM(2012) 4701 final

research and innovation chain from basic research to demonstration and support for market roll-out; and it should identify clear roles and tasks for the various stakeholders such as the EERA, the EIIs, the EIT, relevant European PPPs and other stakeholders such as universities, investors and financiers while promoting synergies and interactions between them. The first Integrated Roadmap should be developed by the end of 2013.

- Based on the Integrated Roadmap, the Member States and the Commission should develop an *Action Plan* that lays down coordinated and/or joint investments by individual Member States, between Member States and with the EU. These investments should go beyond grant programmes and include financial engineering instruments and procurements. The Action Plan will follow a flexible approach and contain different modes of implementation such as alignment of Member States and EC funding on priorities identified in the integrated roadmap and joint investments between Member States or/and with the European Union. It should cover institutional funding and research capacities of EERA. It should be developed by mid-2014 and be regularly up dated and supported by network(s) of funding bodies.

- A robust reporting system based on the *Strategic Energy Technologies Information System (SETIS)* of the SET Plan would monitor the implementation of the Integrated Roadmap and the Action Plan. Drawing on the data supplied by Member States, reporting on progress should be made annually to allow assessment of the impact on energy policy objectives and a better orientation of EU and national support.

- A *coordination structure* should be established under the Steering Group of the SET Plan to promote investments in research and innovation on energy efficiency. This should cover the relevant EU Public and Private Partnerships in this area, the Smart Cities and Communities European Innovation Partnership and other initiatives to facilitate market rollout. This structure should be composed of the research community, industry and market actors, public authorities and financiers.

The membership, operation and mandate of the *SET Plan Steering Group* may therefore need to be strengthened to address the challenge of developing the Integrated Roadmap.

Likewise, the *European Industrial Initiatives* and associated European Technology Platforms need to adjust their mandate, structure and participation including through a stronger industrial component to update their Technology Roadmaps and to contribute to the Integrated Roadmap. Emerging technologies and new developments need to be addressed in particular storage and ocean energy linking to the Blue Growth strategy. At the same time, the *European Energy Research Alliance* needs to further integrate its research capacities and to increase the market/commercial impact of its results, in close collaboration with the European Industrial Initiatives.

In all these structures, new stakeholders need to be brought in to address non-technological innovation and the removal of regulatory, financial, market and behavioural barriers thus improving market preparedness. This includes local actors, SMEs, ICT, regulators, network operators, financiers and consumers.

The external dimension should strengthen the EU's excellence and attractiveness as a research partner. International R&D cooperation in line with the International Cooperation Strategy[18] and under Horizon 2020 should be focused on those key energy research and innovation challenges to which it can bring added value and benefits for the EU. The external dimension of energy policy, including the bilateral Energy Dialogues[19] and the Science and Technology Cooperation Agreements concluded by the Commission with third partner countries, should be implemented in a coordinated and mutually reinforcing way. The United Nations Framework Convention on Climate Change (UNFCCC), which provides an international framework for climate and energy technologies, is also an important partner. With its Technology Mechanism, the global market for technology transfer to emerging and developing countries is expected to grow

Countries like the US, Japan and China are initiating and implementing ambitious low-carbon programmes, which represent significant research and innovation cooperation opportunities for the European research sector and market opportunities for industry, for instance on smart grids, fuel cell and hydrogen, renewable energy or nuclear safety and nuclear fusion. Multilateral cooperation between the EU, US and Japan on critical raw materials for energy must continue. The potential of solar energy should be further exploited in cooperation with the Mediterranean Partner Countries.

5. CONCLUSIONS

The EU energy technology and innovation strategy is an integral part of the EU energy policy. As such, it must complement the existing regulatory measures, ensure that the EU is at the forefront of innovation in international energy markets, as well as address the challenges posed by the current economic situation. It must contribute to strengthening our energy cost-competitiveness and reliability of supply. In this communication, the Commission has set out its strategy to ensure that the EU continues to have a world-class technology and innovation sector to tackle the challenges for 2020 and beyond.

To support this approach, the Commission:

- will:
    - ensure the development, together with the SET Plan stakeholders, of an Integrated Roadmap around the priorities identified in the EU Energy technology and innovation strategy by the end of 2013.
    - define, together with the Member States, an Action Plan of joint and individual investments in support of the Integrated Roadmap by mid 2014.
    - strengthen together with the Member States the reporting system for the monitoring of the Integrated Roadmap and the Action Plan based on the Strategic Energy Technologies Information System (SETIS) of the SET Plan.
    - invite, together with the Member States in the context of the Steering Group, the European Industrial Initiatives and associated European Technology

[18] COM(2012) 497 final
[19] COM(2011) 539 final

Platforms to adjust their mandate, structure and participation to update their Technology Roadmaps and to contribute to the Integrated Roadmap.

- establish a coordination structure, under the Steering Group of the SET Plan, to promote investments in research and innovation on energy efficiency

- calls on the European Parliament and the Council to:

  – reaffirm their support to the SET Plan as part of Europe's Energy and Climate Change policies and its reinforcement to energy technology and innovation development as set out in this Communication

  – endorse the proposed key principles and developments needed for energy technology and innovation across the EU;

  – support the alignment of EU, national, regional and private resources to this integrated research and innovation approach;

- invites Member States and regions to support the implementation of the Integrated Roadmap and the Action Plan through:

  – enhanced coordination of their energy research and innovation programmes as well as through the use of EU Structural and Investment funds and of EU ETS auctioning revenues;

  – increased collaboration through joint actions and clusters on projects with a European added value;;

  – further integration of national institutional funding and research capacities through the European Energy Research Alliance.

  – put in place support for faster market roll-out of sustainable energy technologies.