

## The Strategic Energy Technology Plan: Financial Instruments

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**Abstract.** In order to achieve the 20% reduction of greenhouse gas emissions, increasing the share of renewable to 20% and saving 20% of energy consumption by 2020, the European Commission launched in 2007 The Strategic Energy Technology Plan (SET Plan), considering technology as a vital piece for the Energy Policy.

The UE intends to be on the top of the energy technologies worldwide, planning a defined roadmap up to 2020 and beyond. This plan means a new approach, never arose before at European level, which involves a great deal of cooperation among all stakeholders.

The SET Plan is being implemented with different financial instruments. Most of them were already in place before the SET Plan publication. Currently, some new instruments have been launched, increasing the portfolio of financial tools for implementing the SET Plan.

In this paper, the SET Plan's motivation is outlined. The definition and structure of the plan is presented and the process carried out to get the plan is analyzed. Special attention has been paid to the instruments for allocating fund. Finally, some conclusions are highlighted.

### 1. Background: motivation and energy policy objectives

The Treaty of Lisbon, signed on December 13<sup>th</sup> 2007 [1], establishes the following aims to the European Union policy in the field of energy:

- Ensure the functioning of the energy market.
- Ensure security of energy supply in the Union.
- Promote energy efficiency and energy saving and the development of new and renewable forms of energy.
- Promote the interconnection of energy networks.

The measures taken by the European Parliament and the Council shall not affect a Member State's right to determine the conditions for exploiting its energy

resources, its choice between different energy sources and the general structure of its energy supply.

For the development of this policy, the European Commission, after the Green Paper “A European Strategy for Sustainable, Competitive and Secure Energy” [2], and under the mandate of the European Council, published the Communication “An Energy Policy for Europe” [3]. It establishes three main Europe's energy challenges: (1) competitiveness, (2) sustainability and (3) security of supply. Furthermore, the European Parliament and Council were asked to endorse specific energy objectives for 2020.

The Council of the EU endorsed on March 2007 [4] the following objectives for 2020:

- Achieving at least a 20% reduction of greenhouse gas emissions compared to 1990 levels.
- Increasing the share of renewables in final energy consumption to 20%.
- Saving 20 % of the EU's energy consumption compared to projections for 2020.
- 10 % minimum target to be achieved by all Member States for the share of biofuels in overall EU transport petrol and diesel consumption by 2020.

### 2. Set plan: definition and structure

As a response to these objectives, the European Commission launched in 2007 the Strategic Energy Technology Plan [5], considering technology as a vital piece for the Energy Policy. The SET-Plan is the EU vehicle that can

- Enable the pooling of resources and sharing of risks to develop new technologies that offer huge potential but are currently far from market competitiveness and are beyond the means of individual countries.
- Facilitate strategic planning at both the technology

and energy system levels to ensure a common approach to problems that have a cross-border dimension, such as networks, as well as to optimise the transition towards the energy system of the future.

- Permit a better gathering and sharing of data and information to support sound energy technology policy making and guide investment decisions.
- Ensure coherence and critical mass in international cooperation efforts.

For driving these challenges, the SET-Plan proposes a new governance structure, establishing different organs with different competences and actors:

- European Community Steering Group on Strategic Energy Technologies: chaired by the Commission, is composed of high level government representatives from Member States. Its mandate is to conceive joint actions, through coordinating policies and programmes, make resources available and monitor and review progress in a systematic manner, fully geared towards reaching our common objectives.
- European Energy Technology Information System (SETIS): To provide regular and reliable information and data for effective planning to the Steering Group. It includes 'technology mapping' (state of the art, barriers and potential of technologies) and 'capacities mapping' (financial and human resources). This information system is developed by the Commission's Joint Research Centre. For an effective implementation of the SET Plan, SETIS develops sets of Key Performance Indicators for monitoring the evolution of each technology, regarding its performance and cost-effectiveness.
- European Industrial Initiatives (EIIs): to strengthen industrial energy research and innovation by mobilising the necessary critical mass of activities and actors, the EII are geared towards measurable objectives in terms of cost reduction or improved performance, establishing specific roadmaps for achieving its specific goals. Some sectors are targeted considering the added value of a Community level work. The priority initiatives are:
  - European Wind Initiative: focus on large turbines and large systems validation and demonstration (relevant to on and off-shore applications).
  - Solar Europe Initiative: focus on large-scale demonstration for photovoltaics and concentrated solar power.
  - Bio-energy Europe Initiative: focus on 'next generation' biofuels within the context of an overall bio-energy use strategy.
  - European CO<sub>2</sub> capture, transport and storage initiative: focus on the whole system requirements, including efficiency, safety and public acceptance, to prove the viability of zero emission fossil fuel power plants at industrial scale.
  - European electricity grid initiative: focus on the development of the smart electricity system, including storage, and on the creation of a European Centre to implement a research programme for the

European transmission network.

- Sustainable nuclear fission initiative: focus on the development of Generation-IV technologies.
- European Smart Cities Initiative: focus on achieving in 2020 a 40% of green house gas reduction in European cities.
- European Energy Research Alliance (EERA): composed by National Research Institutes and research teams from universities and specialised centres aiming to coordinate their efforts and work plans.

As a conclusion, the EU is providing the framework to all stakeholders to strength cooperation and collaboration. Member States are expected to support, at national level, projects in line with the EIIs roadmaps, as well as the European Commission. In addition, industry and research organizations are asked to work in accordance with the schedule foreseen under the SET Plan.

The SET Plan identifies clearly the R&D roadmaps and the required budget for its implementation. The total amount of budget needed for the implementation of the SET Plan has been estimated, by 2020, between 58,5 and 71,5 thousand million euros. Nevertheless, there is not a budget allocation dedicated for funding the implementation of the whole programme. For solving this barrier, a combination of different funding schemes is being used.

With this approach, current gaps (e.g. overlapped projects, initiatives and investments) will be filled, which is the real goal of this Plan.

### **3. EU, member states and industry energy R&D financial resources**

Before the SET Plan, the only funds planned and managed in a EU level, were those coming from the European Commission. Member States have been managing their respective funds, without any motivation or request for coordination among them. Moreover, the industry has prioritized its investments without neither joint plan within the sector nor cross-sectorial approach. Till this moment, from the basic research perspective National Research Institutes have not identified joint research areas for conducting an EU level research agenda.

Before starting the coordination among member states, EU, Industry and research organizations, in 2009, the European Commission assessed the structure of the R&D investments in the R&D priorities of the SET Plan [6]. Investments dedicated to R&D in non-nuclear SET-Plan priority technologies amounted to €2.38 billion in 2007, with a division roughly balanced across individual technologies.

In the same year, corporate R&D investments in non-nuclear SET-Plan priority technologies reached €1.66 billion, thus accounting for 69% of the total investments. The share of corporate R&D investments was elevated for

the more mature Technologies: wind energy and biofuels. In comparison, the share of corporate R&D investments was lower for PV, hydrogen and fuel cells and concentrated solar power, as well as for generation IV nuclear reactors and nuclear fusion.

Member States invested €571 million in R&D related to the non-nuclear SET-Plan priority technologies, which is equivalent to 34.5% of their total public non-nuclear energy R&D budgets. On top of the national funding, EU investments under the Sixth Framework Programme added another €157 million for the public research on those technologies.

On top of the €2.38 billion invested in non-nuclear SET-Plan priority technologies, €0.94 billion were dedicated in 2007 to nuclear SET-Plan priority technologies, with fusion research receiving high public support due to the capital investment needs of the ITER construction.

Corporate and public R&D investments in SET-Plan priority technologies largely concentrate in only few Member States. 99% of the aggregated national R&D budgets on SET-Plan priority technologies originate from eleven Member States namely France, Germany, Italy, the UK, Denmark, Spain, the Netherlands, Belgium, Sweden, Finland and Austria with the first three accounting for two thirds. R&D investments in SET-Plan priority technologies from companies located in Germany, France, the UK, Denmark, Spain and Sweden were found to account for almost 95% of the total corporate R&D investments.

#### **4. European industrial initiatives: roadmaps and investments**

The European Industrial Initiatives (EIIs) bring together the industry, the research community, the Member States and the European Commission in risk-sharing, public-private partnerships aiming at the rapid development of key energy technologies at the European level.

In 2009, the technology roadmaps of the European Industrial Initiatives [7], as well as the estimated inversion for its implementation [8], elaborated by all related stakeholders, were published by the European Commission.

All the EIIs were launched in 2010, except the EII on Smart Cities, that is expected to be endorsed at the end of 2011, in the context of the SET Plan Conference under the Polish EU Presidency.

For each Industrial Initiative the following items have been established:

- A set of objectives established as key performance indicators.

- A roadmap for achieving the fixed goals, detailing demo and R&D projects.
- The required budget for executing the proposed roadmap.

This information is provided in annex 1, together with the strategic objectives of each initiative.

##### *A. Wind Industrial Initiative*

The aim of this Initiative is to enable wind energy to take a 20% share of the final EU electricity consumption by 2020 by improving the competitiveness of wind energy technologies, to enable the exploitation of the offshore resources and deep waters potential, and facilitating grid integration of the wind power.

##### *B. European Industrial Initiative on Solar Energy - Photovoltaics*

The strategic objective of this initiative is to improve the competitiveness and ensure the sustainability of the technology and to facilitate its large-scale penetration in urban areas and as free-field production units, as well as its integration into the electricity grid.

The solar photovoltaic sector aims to establish photovoltaics (PV) as a clean, competitive and sustainable energy technology providing up to 12% of European electricity demand by 2020.

##### *C. European Industrial Initiative on Solar Energy – Concentrated Solar Power*

The strategic objective of this initiative is to demonstrate the competitiveness and readiness for mass deployment of advanced concentrating solar power (CSP) plants, through scaling-up of the most promising technologies to pre-commercial or commercial level.

The concentrated solar sector aims to contribute around 3% of European electricity supply by 2020 with a potential of at least 10% by 2030.

##### *D. European Industrial Initiative on Bioenergy*

The strategic objective of this initiative is to address the technical-economic barriers to the further development and accelerated commercial deployment of bioenergy conversion technologies for widespread

sustainable exploitation of biomass resources.

The bioenergy sectors aims to ensure at least 14% bioenergy in the EU energy mix by 2020, and at the same time to guarantee GHG emission savings of 60% for bio-fuels and bio-liquids.

##### *E. European Industrial Initiative on Carbon Capture and Storage*

The strategic objective of this initiative is to demonstrate the commercial viability of carbon capture and storage

(CCS) technologies in an economic environment driven by the emissions trading scheme. In particular, to enable the cost competitive deployment of CCS technologies in coal-fired power plants by 2020-2025 and to further develop the technologies to allow for their subsequent wide-spread use in all carbon intensive industrial sectors.

The CCS sector aims to enable European fossil fuel power plants to have near to zero CO<sub>2</sub> emissions by 2020.

#### *F. European Industrial Initiative on Smart Grids*

The strategic objective of this initiative is to transmit and distribute up to 35% of electricity from dispersed and concentrated renewable sources by 2020 and a completely decarbonised electricity production by 2050; to integrate national networks into a market-based truly pan-European network, to guarantee a high quality of electricity supply to all customers and to engage them as active participants in energy efficiency; and to anticipate new developments such as the electrification of transport. The CCS sector aims to enable European fossil fuel power plants to have near to zero CO<sub>2</sub> emissions by 2020.

The industrial objective is to substantially reduce capital and operational expenditure for the operation of the networks while fulfilling the objectives of a high-quality, low-carbon, pan-European, market based electricity system.

*G. European Industrial Initiative on Sustainable Nuclear Energy* The strategic objective of the Initiative is to achieve a vast increase in the sustainability of nuclear energy through demonstrating the technical, industrial and economic viability of Generation-IV fast neutron reactors (FNRs), thereby ensuring that nuclear energy can remain a long-term contributor to the low carbon economy and building on the safety, reliability and competitiveness of current reactors.

The objective of the sector is to enable the commercial deployment of Generation-IV FNRs from 2040, while in the meantime maintaining at least a 30% share of EU electricity from currently available reactors with an expansion towards the cogeneration of process heat for industrial applications when such markets develop.

#### *G. European Industrial Initiative on Smart Cities*

The strategic objective of this initiative is to demonstrate the feasibility of rapidly progressing towards European energy and climate objectives at a local level while proving to citizens that their quality of life and local economies can be improved through investments in energy efficiency and reduction of carbon emissions. This Initiative will foster the dissemination throughout Europe of the most efficient models and strategies to progress towards a low carbon future.

This Initiative will support cities and regions in taking ambitious and pioneering measures to progress by 2020 towards a 40% reduction of greenhouse gas emissions

through sustainable use and production of energy. This will require systemic approaches and organisational innovation, encompassing energy efficiency, low carbon technologies and the smart management of supply and demand. In particular, measures on buildings, local energy networks and transport would be the main components of the Initiative.

## **5. European instruments for allocating funds**

Even if the EU only manages one quarter of the public investments on R&D related to the SET Plan priorities, the SET Plan serves as a framework to coordinate and leverage the investments coming from member states, industry and RTD performers.

The funding instruments subject to coordination, which can contribute to the SET Plan goals, are detailed below.

### 1) Member States R&D funding instruments

Member states are the only responsible of managing and controlling their R&D programmes, independently of one another. From the launching of the SET-Plan on, member states are encouraged to align their national and regional R&D programmes in the direction of the SET Plan, respecting national sovereignty.

Under this framework, all the public funding administrations, at national and regional level, are invited to finance the activities agreed under the EIIs roadmaps. Nevertheless, all of them remain responsible for establishing the funding schemes and participation rules they consider the most appropriated, without any scope or schedule limitation.

The European Commission has promoted the creation of seven "EII teams" addressing the seven EIIs, for facilitating the coordination between the different stakeholders. These EII teams are composed by representatives from the member states interested in the specific initiative, the European Commission and the industry. Industry is represented by delegates from European technology platforms and, in some cases, also from European industrial associations.

Member states play a significant role in these groups, identifying and coordinating their national funding instruments within this European framework.

### 2) FP7

The 7<sup>th</sup> Framework Programme for Research and Technological Development (FP7) [9] lasts for seven years, from 2007 to 2013, and has a total budget of over € 50 billion. It is the key tool of the EU for funding R&D projects. The Budget is spent on grants to research actors all over Europe and beyond, in order to co-finance

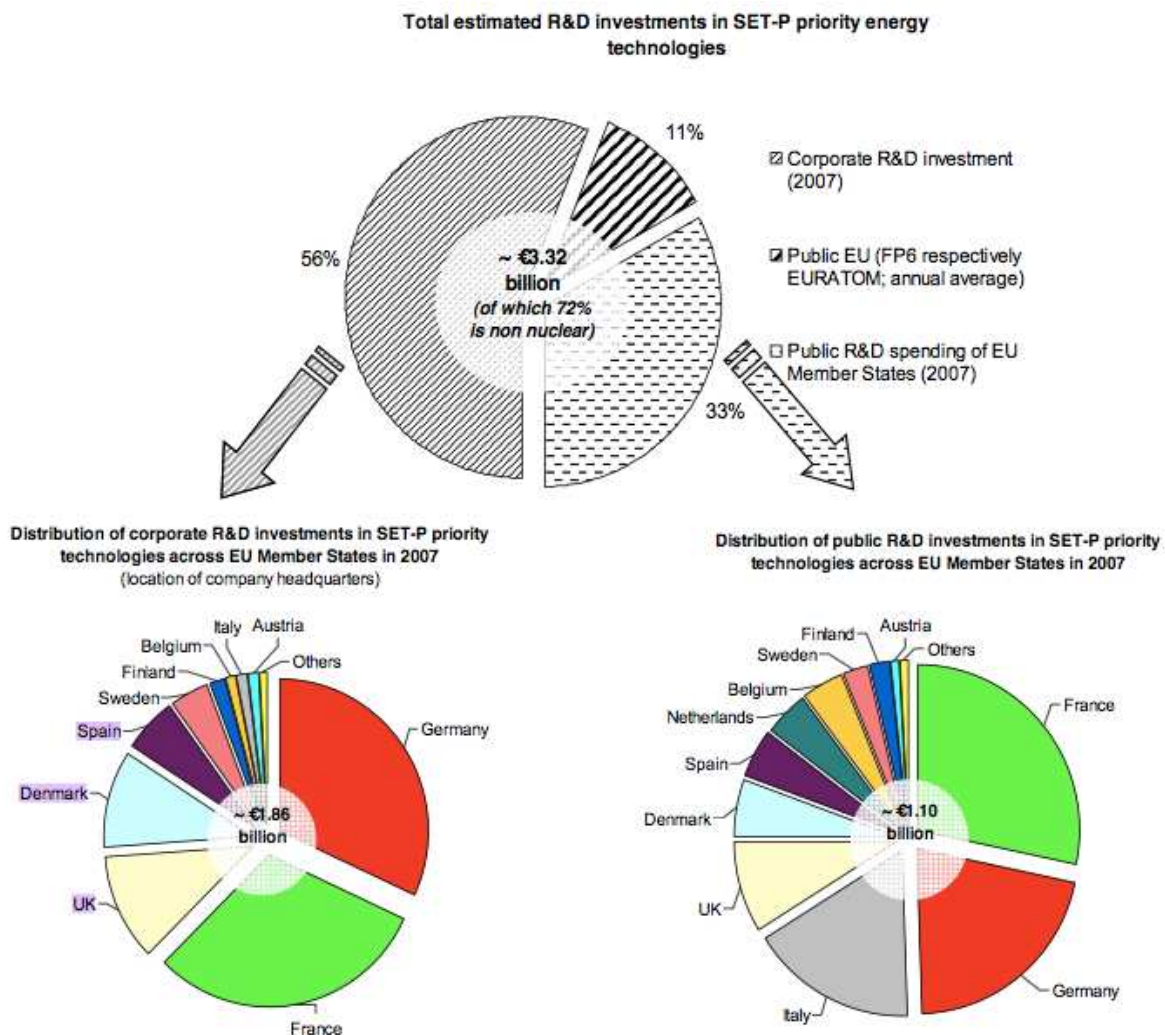
research, technological development and demonstration projects. Grants are determined on the basis of calls for proposals and a peer review processes, which are highly competitive.

It is structured in Four Specific Programmes. Cooperation is the core Specific Program, accounting with 2/3 of the global budget, and it funds collaborative research projects in ten key thematic areas. One of these thematic areas is Energy, with a budget of 2.300 M€. The calls for proposals, published in a yearly basis, have a top-down

Currently, the FP7 is the main instrument of the European Commission for implementing the SET Plan. Since the endorsement of the SET Plan, the FP7 proposed topics are defined looking forward to the accomplishment of the EII implementation plans. In addition, participants are requested to justify how their proposals contribute to the objectives proposed by the EIIs.

### 3) FCH - JTI

Joint Technology Initiatives are a specific kind of Public



approach. Furthermore, every call contains a Work

Private Partnership, being a new element of the FP7

Programme detailing the topics to be funded.

regarding previous FPs. five fields have been established.

The Energy Work Programme is managed by two Directorates General of the European Commission: DG Energy, who finance close to market projects, usually with a predominant demo component and DG RTD, who finance long term research projects, with a predominant research component.

The hydrogen and fuel cells is the only one related to energy (FCH JTI) [10]. The JTIs take the legal form of a Joint Undertaking and they are envisaged to develop the Strategic Research Agenda of the concerned EU Technology Platform.

The JTI FCH provides a pre-defined budget of 940 M€ for a 7 years horizon (2008-2013), raising confidence of public and private investors and allowing a long term planning. Under this formula, industry is stimulated to contribute with substantial additional funding (50%).

This technology was also awarded within the internal reflection in the Commission as one of the most important field to be developed under the Set Plan. However, the Joint Technology Initiative that addresses to fuel cells and hydrogen was officially endorsed before the Set Plan. Therefore, the FCH-JTI works very close to the EIIs so as to find potential common interest but not under the Set Plan governing board.

#### 4) Energy Intelligent for Europe

The Intelligent Energy – Europe programme is run by the Executive Agency for Competitiveness and Innovation (EACI) on behalf of the European Commission, and seeks to bridge the gap between EU policies and how they impact on the ground. It is integrated in the Competitiveness and Innovation Framework Programme [11] and it funds projects aiming to overcome non-technical barriers for the implementation of energy technologies.

The Programs has a budget of 730 M€ for seven years (2007-2013) for co-funding projects till 50%. It is focused on four main areas:

- Energy efficiency in buildings, industry and products
- Renewable energy sources, with a focus on electricity, biofuels, heating and cooling and small-scale applications
- Energy in transport, mainly in alternative fuels, clean vehicles and energy efficiency.
- Integrated initiatives: bio-business, energy services, intelligent energy education, product standards, European networking for local action, combined heat and power, sustainable energy communities and creation of local and regional energy agencies.

Till this moment, any specific action has been taken in order to align this program with the EIIs roadmaps. At this first stage, the SET Plan is focused on the development and demonstration of new energy technology. Once the projects under the SET Plan will produce its first results, it would be suitable to consider this program to bring the outcomes to the market, and adapt, appropriately, the regulations and standards.

#### 5) European Energy Programme for Recovery

In December 2009 and in March 2010, the European Commission took the decision of funding several energy related projects in order to face the European economic and financial crisis while contributing to meet the energy and climate change objectives [12].

The total EU contribution raises the 3.98 billion euros and finances 12 projects in the electricity infrastructures, 31 in gas infrastructures, 9 wind offshore projects and 6 CCS projects. These projects are 50% co-founded by the European Commission, except the CCS that is 80% co-founded.

The identification of the projects was driven by the EU energy policy orientations set out in SET Plan, among other policies.

#### 6) European Economic Recovery Plan

In November 2008, the European Commission launched the European Economic Recovery Plan [13], with a budget of 3.2 billion euros, in order to face the economic crisis. One of the included measures was the creation of four Public Private Partnerships.. These PPPs are focused on (1) Green Cars (2) Energy Efficient Buildings, (3) Factories of the Future and (4) Internet of the Future.

The PPP on Energy Efficient Buildings has a budget envelope of 1 billion euros, 50% coming from the European Commission.

The current instrument to implement these PPPs is the FP7, that has made a reserve of funds in its different areas to finance projects related to the PPPs challenges. The FP7 work programmes already contain dedicated calls for the implementation of the PPPs. It is expected that the PPP calls, e.g. Energy Efficient Buildings or Green Cars, will be aligned with the SET Plan priorities, specially the Smart Cities EII ones.

#### 7) NER300

New Entrants Revenue (NER300) is a financing instrument managed jointly by the European Commission, the European Investment Bank and the Member States [14]. It contains the provision to set aside 300 million allowances (rights to emit one tonne of carbon dioxide) in the New Entrants' Reserve of the European Emissions Trading Scheme for subsidising installations of innovative renewable energy technology (RES) and carbon capture and storage (CCS). The allowances will be sold on the carbon market and the money rose - which could be as much as 4.5 bn EUR if each allowance is sold for 15 EUR - will be made available to projects as they operate.

This expected budget is going to be expended by means of two calls. The first one closed on February 2011 and accounted on 200 millions of allowances. Normally, the second call will be published at the end 2012, involving 100 millions of allowances plus the funds remaining from the first call.

Some of the EIIs roadmaps consider the NER300 as the most suitable funding instrument for some of its identified demonstration projects.

#### 8) Structural Funds

Structural Funds are a financial instrument to address economics and social imbalances at EU level, contributing to three main objectives: convergence, regional competitiveness and employment and EU territorial cooperation. This is called the EU Regional Policy

The Structural Funds play a substantial role to help all regions build research and innovation capacities corresponding to their situation and priorities. Between 2000 and 2006, approximately € 13 billion – around 6% of the EU Structural Funds – were spent on research infrastructures and networks, innovative business start-ups and the modernisation of SMEs.

The current trend is higher, being the promotion of innovation and R&D a main priority for the EU Cohesion Policy Programs. In the period 2007-2013, regional funds will provide € 86,4 billion, almost 25% of its total.

The main objective of these funds, concerning R&D, is to capacitate and to provide the infrastructures and resources needed for carrying out excellent research.

Member states, as end-users of these funds, in cooperation with the European Commission, should also consider these resources for building their R&D capabilities ready to contribute to the SET Plan implementation.

#### 9) European Investment Bank

In 2009, the European Investment Bank (EIB) signed loans for the energy sector for €14.2bn (of which € 4.6bn were for renewable energy projects), a 40% increase over 2008. In addition to standard loans, the EIB provides 5 instruments which could support SET Plan activities: (i) Structured Finance Facility (SFF) and Risk Sharing Finance Facility (RSFF); (ii) Investments in Equity Funds; (iii) NER300; (iv) European PPP Expertise Centre (EPEC) and (v) Joint Assistance to Support Projects in the European Regions (JASPERS).

## 6. Conclusions

The SET Plan is a new way of working at EU-level, based on the coordination of public and private funding mechanisms.

It is needed to highlight that the SET Plan, by the moment, doesn't mean any additional money for the energy R&D field. Till now, the work has focused on the evaluation of what is needed and how much does it cost, in order to achieve the 2020 targets. No dedicated budget or funding instrument has been designed specifically for it. Therefore, now it starts the complex task of organizing the existing funds and instruments, which are heterogeneous and managed by a wide number of different European, national and regional administrations.

The most recent actions of the European Commission related to R&D on energy, has shown a lack of clear coordination according with the SET Plan. It can be seen, for example, in the NER300 call for proposals, published in November 2010, with an estimated budget bigger than 4 billion euros, in which there is no reference at all to the SET Plan.

The European Commission, in its role of manager and implementer of the EU policies, shall transmit a clear message to the member states, showing coherence with the SET Plan in its own actions.

In parallel, member states need an internal discussion for boosting its national research towards the SET Plan. Decisions are needed at very high level, as well as cooperation procedures between different national funding institutions. Besides, member states should have an open approach, internalizing the need of cooperating with their European partners.

In the current economic crisis, industry is expecting a strong commitment from the public administrations in the long term. Being the responsible of executing the EIIs roadmaps, they have to take the risk, even if it might be reduced with public support. The SET Plan is a huge opportunity for industry. However, in accordance with the Lisbon Strategy targets, the share of private investments is expected to highly increase, and the energy field is not an exception

Finally, the RTD performers are stimulated to coordinate each other. The EERA provides a good framework for this purpose, but an enrichment of its participants, as well as a clarification of its procedures, are needed.

In summary, it is needed a sound, stable and effective set of financial mechanisms that ensure the immediate mobilisation of the necessary resources for R&D and demonstration projects.

The SET Plan has just started. Although the complexity of the process, all the stakeholders are fully committed with the SET Plan. This fact guarantees the success of the programme, whether the decisions are taken on time. Currently, it is essential to move forward, giving visibility to the SET Plan first results, while gaining credibility.

The outcomes of the SET Plan will keep the high competitiveness of the EU energy industry in a very exigent global market. Furthermore, from the climate and energy policies perspective, the SET Plan is one of the most significant ways for achieving the environmental and competitiveness challenges.

Even if there is still some room for improvement, there are very positive signals at all levels. The efforts needed for implementing the SET Plan are worth.

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