EUROPEAN PHOTOVOLTAIC ACTIONS AND PROGRAMMES-2011

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ABSTRACT: Europe's ambitious combination of a new Directive, targeted financing and well focused EU programmes is designed to deliver simplified legal frameworks, more attractive financial support schemes, and more competitive PV systems. The significant growth of the photovoltaic electricity production in Europe opens new challenges in terms of building the necessary infrastructures and adopting the required standards and protocols. It is unlikely for Europe to be price leader in the photovoltaic sector. But Europe can progress confirming and reinforcing its role as technology and innovation leader, as technology leadership will contribute to maintain companies in Europe. The Solar Europe Industrial Initiative is an opportunity for the European companies to increase their innovation base and improve their competitiveness.

Keywords: Photovoltaic R&D and Innovation, and Demonstration Programmes; Nanotechnology; Dissemination Strategy and Market Transformation.

1 INTRODUCTION

Photovoltaics continues to be one of the fastest growing sectors of the economy, creating additional economic value, generating growth and providing jobs. In Europe, in 2010, the photovoltaic (PV) sector surpassed any other renewable electricity sector, in terms of installed power capacity. In that year, more than 13 GW of PV installations have been connected to the European grid [1]. This figure attests the leading market role of Europe, as it represents more than 80% of the yearly world installed capacity. Most of the photovoltaic power capacity has been installed in Germany (7,4 GW), Italy (2,3 GW), Czech Republic (1,5 GW) and France (0,7 GW). These figures show that the European market remains quite heterogeneous, even if less than before. The cumulated PV capacity installed in Europe by the end of the year 2010 is higher than 29 GW.

From the supply side point of view, Europe is a net importer of photovoltaic devices and the trend will likely continue as the recent rapid growth of PV production capacity in Asia brings new challenges to EU players. However, Europe maintains its predominant role as manufacturing equipment supplier and European know-how in the current wafer-Silicon based photovoltaic remains very competitive. It should be said that it is unlikely for Europe to become price leader in the photovoltaic sector. But Europe can further progress confirming and reinforcing its role as technology and innovation leader, as technology leadership will help to maintain companies in Europe.

While solar electricity is still not competitive with conventional power generation, its cost is closer to the electricity tariffs charged to consumers. This is especially relevant because when the PV installation is sited at the consumers' premises, then the cost of PV electricity is compared to the tariff, not to the cost of power generation. The gap between the best PV electricity prices, in the sunniest locations, and the highest tariffs has been narrowing. On the one hand, support schemes that bridge this gap have been causing rapid growth in sales of photovoltaic modules, especially in Germany, and Italy. On the other hand, support schemes have been substantially revised almost everywhere. Nevertheless, the price of PV modules has witnessed a downward trend in recent years and is expected to decline further in the years to come. This should allow absorbing future reductions of feed-in tariffs, provided that they are well planned and soundly shaped. This is why the PV sector is expected to provide a significant contribution to the European energy policy strategy.

In this paper, we first describe the European framework which is in place to ensure significant development of renewables and photovoltaics in particular. We also provide insights on the Commission's Communication on renewable energy that highlights current progress, the state of the implementation of the RES Directive [2] and the National Renewable Energy Action Plans and flags up areas for action on financing matters. The Commission wishes renewable energy to be developed as cost effectively as possible. To that end, it will continue to work with Member States on the implementation of the RES Directive to facilitate the convergence of national support schemes that ensure the best conditions for the development of renewable energy (e.g. schemes following best practice, avoiding over-compensation and retroactive changes). Then, we present an update of the state of the 7th Framework Programme for Research of the European Union (FP7) in terms of call results, projects selected, and breakthroughs, and discuss the investments in the various photovoltaic areas. In the same context, we seize the opportunity to present the lessons learned from the workshop *Photovoltaics and nanotechnology: from innovation to industry* [3], for the possible identification of future research needs. We discuss, then, the activities carried out under the second Intelligent Energy Europe (IEE) Programme aiming at transforming the PV market. We also provide an update on the state of the NER300 initiative, which represents another funding opportunity for European PV projects.

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Finally, we illustrate the Solar European Industrial Initiative of the SET-Plan and describe how it is being implemented.

2 EUROPEAN ENERGY FRAMEWORK AND LEGAL INSTRUMENTS

2.1 Renewable Energy: Progressing towards 2020

On 31 January 2011, the European Commission presented its Communication *Renewable Energy: Progressing towards the 2020 target* [4]. This provided a chance to review the state of play of the legal framework for the development of renewable energy in Europe and indeed, the extent of the development. The Communication recalls that despite having a supportive policy framework for renewable energy since 1997, overall growth in developing renewable energy has been slow, at least as shares of electricity consumption or transport fuel consumption. The overall nominal target of a 12% share of gross inland consumption by 2010 was not met[α]. Moreover the *indicative* sectorial targets established by legislation [5, 6] were also missed[β]. So whilst there has been growth, with a significant increase in absolute production quantities, expectations have not always been met.

In this context, it becomes important the entry into force of the Directive 2009/28/EC [2]. The Directive sets legally binding targets for all Member States, covering all energy consumption (i.e. including the heating sector for the first time), to achieve a 20% share by 2020. It requires reforms and improvements to governments' administrative regimes, grid operation and development, training and product certification regime and other measures to improve the environment for the development of renewable energy. A key requirement of the Directive is the elaboration of national renewable energy action plans (NREAPs) by each Member State. These plans provide detailed roadmaps for the achievement of the targets and represent a new wealth of information for industry and other stakeholders [7]. Overall, EU plans imply that we will exceed the 20% 2020 target. For PV they indicate that capacity should surpass 80 GW by 2020 (Fig. 1). The growth of the renewable electricity production, in particular, signals a major industrial change. The renewable share of electricity is expected to rise from 16,6% (2008) to 34% by 2020; wind power capacity to rise to 213 GW. The improvements and changes needed for the electricity grid to respond to these developments are now occurring. ENTSO-E and the European Commission in its energy infrastructure package are planning how to absorb all this energy.

The mentioned 2011 Communication on renewable energy also flags up the financing needs that this growth engenders. Annual capital expenditure needs to double (to EUR 70 billion/year) across the EU for the growth projections to be met. Such expenditure, combined with the necessary grid reinforcements, make the development of energy infrastructure a significant expenditure item for the next decade. Addressing this at a time of major fiscal constraint will not be easy. For this reason, the Commission highlighted the need to keep a close eye on national support schemes, to follow best practices and encourage convergence and consistency across Member State regimes. The move towards more market friendly instruments (such as feed in premiums rather than feed in tariffs) is encouraged, as both technologies and markets mature. However, it is clear that the competitiveness of the energy (in particular the electricity) markets need to improve as well if PV and other renewables are to compete on a level playing field.

Bad practices, including retroactive changes to support schemes, have already been roundly criticised by the Commission. The entire legal framework for renewables needs to provide regulatory certainty (or reduce the uncertainty) to encourage investment and technological development. Reneging on support or any other matter contributes nothing to the growth of the sector.

A positive element that emerges is that manufacturing costs have declined significantly, particularly for PV. So whilst we need to monitor costs and to optimise support schemes to ensure they drive down costs and still promote growth, the industry is showing that it can respond, continue to drive down costs and increase the competitiveness of PV across the board. Furthermore, the Member States are following up the Directive with detailed plans. The Commission scrutinizes the implementation of these plans, included the measures put into place to stay on the trajectory towards the 2020 targets. This is something that Member States are of course required to monitor and report on as well. The European Commission will produce its progress report next year, on the basis of the Member States' reports.

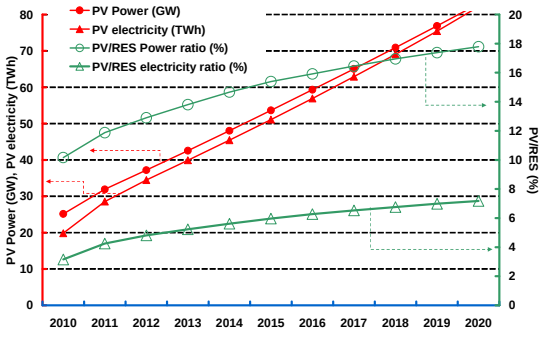

Fig 1. PV sectorial targets estimates based on the NREAPs notified to the European Commission by the 27 Member States.

2.2 Energy Roadmap 2050

The growth of renewable energy – the expectation that it will soon provide a third of our electricity and 10% of our transport needs – has also triggered discussion of "beyond 2020". The European Commission has published an overall "low carbon economy" roadmap to 2050, as well as a transport sector -specific 2050 paper.

[α] Judging from the 2009 data of 9,4%.

[β] The 2010 electricity target is 21% compared to the 2008 result of 16,6%; the 2010 transport target is 5,75% compared to 2008 3,5%.

A communication outlining a 2050 energy roadmap, presenting different pathways to the decarbonisation of the energy sector, will be published by the end of 2011. Nevertheless, different studies and intuitions of different stakeholders have already flagged up how decarbonisation can begin. The association of the European electricity industry recognises that renewable energy could generate 40% of Europe's electricity by 2050; other studies suggest this figure could be 60%, 80% or nearly 100%.

The policy drivers established by the 2008 Energy and Climate package – reducing greenhouse gas emissions, increasing security of supply and improving the competitiveness of the energy sector – continue to work. The need to achieve our objectives in these areas is still strong, despite the current economic circumstances. The policy development for preparing the right regulatory, industrial and technological framework and the right legal instruments for the post 2020 environment will continue. Given its current position, its potential for further development and cost reduction, mass deployment and increased efficiency, the photovoltaic industry will continue to be an ever more important part of Europe's energy sector.

3. PV RTD AND DEMONSTRATION PROGRAMME

The 7th Framework Programme, FP7 (2007-2013) has a significantly increased budget compared to the previous programme, and runs for seven years. Calls for proposals based on topics identified in the work programme are being launched on an annual basis. Less emphasis has been given to the development of traditional wafer-based silicon photovoltaics, which is the focus of increasing R&D investment by companies and national programmes. Material development for longer-term applications, concentration PV and manufacturing process development have attracted relevant European funding. Furthermore, significant funding has been also made available for thin-film technology and for the development and demonstration of new concepts and new approaches for construction elements based on photovoltaic.

Six calls for proposals have been already launched for the years from 2007 to 2012. The photovoltaic projects granted under the 2007, 2008 and 2009 calls have been described previously [8]. The projects which received grants under FP7 2010 call are described in the following.

The FP7 2010 call topic addressing *Further development of very thin wafer based c-Si photovoltaics* has resulted in two projects (i.e. *20plμs* and *SUGAR*) which are currently running, with a total EU contribution of EUR 8,6 million. *20plμs*, a 3-year project coordinated by Universitaet Konstanz, Germany, is expected to bring a significant contribution into the development of silicon solar cells substantially thinner than present-day ones. The project will cover the overall process chain, from wafer to module to pilot production. Also *SUGAR*, a 3-year project coordinated by IMEC, Belgium, proposes an innovative methodology to produce solar cells by using a very limited amount of silicon. The methodology is based on two steps: the fabrication of the solar wafer, and the processing of this material, till to the module level. For the fabrication of the ultra-thin wafer, a metal with a high thermal expansion coefficient is deposited on the silicon substrate at high temperature; the system is then cooled down, and the difference in thermal expansion induces a mechanical stress in silicon which gives rise to a crack propagating parallel to the surface. This way, a silicon layer (around 50 μm in thickness) is detached from the parent substrate.

The FP7 2010 call topic on *Future Emerging Technologies* (FET) has resulted in three projects (i.e. *MOLESOL*, *PEPDIODE* and *R2M-Si*) which are currently running, with a total EU contribution of EUR 8,0 million. *MOLESOL*, a 3-year project coordinated by IMEC, Belgium, aims at developing highly efficient molecular-wire charge transfer platforms to be used in a novel generation of thin-film dye-sensitized solar cells, fabricated via organic chemistry routes. This concept is expected to lead to stable cells with enhanced conversion efficiency, because the short molecular wires compatible with exciton diffusion length ensure the reduction of the critical length for collection of the charge generated in the dye monolayer. *PEPDIODE*, a 4-year project coordinated by the Karlsruher Institut fuer Technologie, Germany, aims at synthesizing several peptides, and subsequently at screening variants thereof, to be used in a novel type of solar cell based on biomimetic principles. *R2M-Si*, a 3-year project coordinated by the Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung, Germany, develops and implements the crystalline silicon thin-film lift-off approach, where thin c-Si layers are stripped from a silicon wafer. The project aims at using lift-off films in a nearly handling-free approach, through the following steps: continuous separation of a very thin (<10 μm) c-Si foil from the circumference of a monocrystalline silicon ingot; attachment to a high-temperature stable substrate of large area (e.g., graphite, sintered silicon, or ceramics) which also works as module back side; high-temperature re-organisation of the silicon foil followed by in-situ epitaxial thickening, including pn-junction formation; processing of solar cells and formation of integrated interconnected modules. As a deliverable, a mini-module with efficiency higher than 18% will be manufactured.

The EU-India topics (i.e. *Development of novel materials, device structures and fabrication methods suitable for thin film solar cells and TCOs including organic photovoltaics* and *Development of new concentrator modules and field performance evaluation of Concentrated PV systems*), launched at the same time of the FET call, resulted in the selection of three projects (i.e. *AGATHA*, *ESCORT* and *LARGECELLS*) which are currently running, with an overall EU contribution of EUR 4,7 million. *AGATHA*, a 3-year project coordinated by CEA, France, aims at realizing an advanced light trapping design by combining micro-texturing of glass by hot embossing with nano-texturing of the top TCO layer by etching. To demonstrate the efficiency of this optical trapping design, the modulated texture concept will be implemented in thin film technologies based on a-Si:H, μc-Si:H as well as CIGS. The objective is to reduce the active material thickness (from 250 nm to 150 nm for a-Si:H, from 1,5 μm to 1 μm for μc-Si:H, and from 2,5 μm to 800 nm for CIGS), while increasing the short-circuit current by 15%. *ESCORT*, a 3-year project coordinated by CNR, Italy, will exploit the joint leadership of top European and Indian academic and industrial institutions to foster the wide-spread uptake of dye-sensitized solar

cell technology, by improving over the current state of the art by innovative materials and processes. *LARGECELLS*, a 3-year project coordinated by Universitaet Bayreuth, will develop large-area, thin-film solar cells based on polymers as well as solid-state organic-inorganic (hybrid) systems. The relevant novel materials (e.g., charge transport polymers, semiconductor surfactants/compatibilizers and inorganic nanoparticles) will be synthesized, and the compounds with the best potential will be scaled-up for the purpose of the newest fabrication methods such as roll-to-roll processing. Moreover, the devices will be tested in outdoor conditions in India and under accelerated ageing conditions in Israel, to better understand the degradation mechanism. Finally, the knowledge gained will be exploited to design novel materials suitable for higher efficiency and long-term stability.

Finally, the work programme 2010 for the Specific Programme "Capacities" launched the call topic *INFRA-2010-1.1.22: Research Infrastructures for Solar Energy: Photovoltaic Power*, aimed at integrating the key research infrastructures in Europe for all aspects of photovoltaic research. This call topic has resulted in the selection of a proposal currently under negotiation with an estimated EU contribution of about EUR 9,0 million.

The work programme for the FP7 2011 calls was published on 20 July 2010. A EU-Japan Coordinated Call addressing *Ultra-high efficiency concentration photovoltaics (CPV) cells, modules and systems* was published, with a submission deadline on 25 November 2010. One project (i.e. *NGCPV*) has been selected and is already running. *NGCPV*, coordinated by Universidad Politecnica de Madrid, Spain, has been granted an EU contribution of EUR 5,0 million for a duration of 42 months. Through a collaborative research between seven European and nine Japanese leading research centres in the CPV field, the project pursues the improvement of present concentration cells, modules and system efficiency. A special effort will be devoted to the development of multi-junction cells (by making use of e.g. inverted and bifacial growth, and incorporation of quantum nanostructures), in view of approaching the 50% efficiency goal at the cell level and the 35% one at the module level (by utilising advanced optics such as Fresnel-Kohler concentrators). As a mean of field demonstration, the project envisages the construction of a 50 kW concentration plant.

Within the same work programme 2011, two topics for collaborative projects with a predominant demonstration component were also published, namely: *Productivity and cost optimization issues for the manufacturing of photovoltaic systems based on concentration*, and *Development and demonstration of standardized building components based on photovoltaics.* The submission deadline for these two topics was 7 April 2011. Two proposals on each topic have been retained for negotiation – currently under way - for a total of about EUR 24,5 million of EU contribution.

Finally, one joint call between the Theme "Energy" and the Theme on "Nanosciences, Nanotechnologies, Materials and New Production Technologies" (NMP) addressed the topic *Development and up-scaling of innovative photovoltaic cell processes and architectures to pilot-line scale for industrial application.* Its submission deadline was 16 November 2010. Three projects have been retained for negotiation - currently underway - for an overall estimated EU contribution of EUR 24,5 million.

Figure 2 summarizes the EU investments supporting PV RD&D from 2003 to 2011, broken down by field of activity.

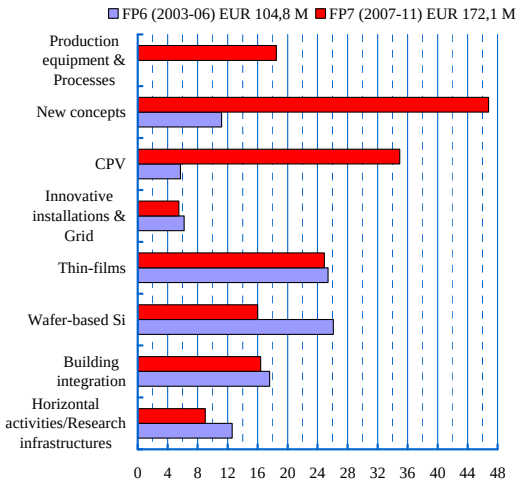

Fig. 2 Investment in PV, 2003-2011 (Euro million)

The FP7 2012 calls for proposals have been published on 20 July 2011. Two main PV topics are addressed: 1. *Reliable, cost-effective, highly performing PV systems* (call: FP7-ENERGY-2012-1 - deadline: 25/10/2011) and 2. *Demonstration of smart multi-functional PV modules* (call: FP7-ENERGY-2012-2 - deadline: 08/03/2012).

4. PHOTOVOLTAICS AND NANOTECHNOLOGY: FROM INNOVATION TO INDUSTRY

A workshop dedicated to "*Photovoltaics and nanotechnology: from innovation to industry*" was organized in September 2010, to specifically address the impact of the nanotechnologies and the opportunity offered to the European PV industry in this area [3]. By discussing the portfolio of the PV projects running under the EU Programmes, the nanotechnology and the PV communities identified areas of collaboration, gained contacts and explored ideas for possible industrial partnerships. During the workshop, the development of materials and structures which offer improved light conversion efficiencies and lower cost was particularly emphasized. The novel processes, based on nanostructured materials and nanotechnology, which have been developed at research scale, shall now be transferred to PV industrial applications. To support the swift transfer from laboratory to industrial scale, the Commission launched the joint call between the Energy and the NMP Themes of FP7 with the FP7 2011 work programme, already detailed before. Another result of the workshop has been the identification of a number of clusters, which are grouping the portfolio of PV projects.

As a follow-up of the first event, a second workshop on "*Nanotechnology innovation for photovoltaics*", has been organised in conjunction with the Conference NANOTEX 2011 (9-16 July 2011, Thessaloniki, Greece). This second workshop has focussed on

nanotechnology innovative ideas and methods applied to PV, also to contribute to set-up a roadmap for next generation PV. Information on the clusters, workshops and related events, as well as reports and proceedings, have been posted on the EU PV Clusters' website [9].

5. INTELLIGENT ENERGY – EUROPE

The Intelligent Energy – Europe (IEE) programme helps to achieve the EU's 2020 targets by supporting collaborative actions in which EU organizations from different countries cooperate to reduce non-technological barriers hindering the growth of sustainable energy markets. IEE projects contribute to the development and implementation of EU policies and legal frameworks, and help create more favorable market conditions for the uptake of renewable energy technologies, including photovoltaics.

Following the first IEE programme (2003 to 2006), the second IEE programme (2007-2013) which has a budget of EUR 730 million has launched five annual calls for proposals and two more calls have yet to be launched.

In the framework of the first four calls, a number of projects on photovoltaic are being funded. Some of them have been described previously [8]. As an update, *PVs in BLOOM* (www.pvsinbloom.eu), mobilized a total investment of approximately EUR 37 million for the installation of PV plants on marginal or degraded land (landfills, quarries, abandoned industrial areas) in six EU countries. The project *PV LEGAL* (http://www.pvlegal.eu/) aims at reducing bureaucratic barriers holding back the development of photovoltaic energy installations throughout Europe. One of the results of the project has been a database, launched in May 2010, describing the administrative processes that need to be fulfilled to install a PV system in a number of EU countries (http://www.pvlegal.eu/database.html). This database has become a unique source of information for the PV community.

PV PARITY is a new photovoltaic project selected under the IEE-2 2010 call for proposals. The project, started in June 2011 and coordinated by WIP, Germany, aims at providing relevant EU policy makers with a clear understanding of the necessary measures to accompany solar PV to competitiveness with conventional electricity sources. The project will develop strategies for supporting PV after grid parity is reached, by presenting a cost/benefit analysis of the integration of PV systems in the markets and the grid, analyzing the critical points of the current support schemes, and finally developing new proposals of incentives for PV installations.

An important field of delivery of the IEE programme is on *Building skills and capacities.* IEE continues to fund a range of projects on capacity building, training and certification of installers of small scale RES systems in buildings, including photovoltaics. Relevant projects supported in past calls, like *QUALICERT* (www.qualicert-project.eu), *Install+RES* (http://www.resinstaller.eu/), *PVTRIN* (http://pvtrin.gr/) have been described previously [8].

In this context it is worth to mention the new IEE initiative *BUILD UP Skills* which supports the training and qualification of craftsmen and on-site construction workers and systems installers on *sustainable energy solutions in buildings*. *BUILD UP Skills* addresses both energy efficiency and integration of renewable energy technologies (including PV) in buildings. 21 projects (for a total funding of EUR 7,5 million) have been selected from the 41 applications received following the IEE-2 2011 Call for proposals. Under this initiative, the building industry, the public authorities and the vocational training sector of 21 European countries are now committed to establishing national roadmaps for qualifying their craftsmen on high energy performance solutions for the building sector. National platforms will be established to determine skill needs and training gaps for sustainable energy (including PV) in the building sector and elaborate strategic recommendations for the necessary qualification measures.

The remaining EU countries are expected to join the initiative in 2012. In addition in 2012 and 2013, following on from these national qualification strategies, IEE funding will be devoted to setting up or upgrading training schemes for sustainable enrgy installers and craftsmen throughout Europe.

The next IEE call will be published in early 2012.

Since 2010, a series of IEE funded initiatives have been launched with the aim of mobilizing investments in sustainable energy by local & regional public authorities. Those which are managed by investment banks are named *ELENA* (European Local ENergy Assistance).

The European Commission and the European Investment Bank (EIB) established the first such initiative EIB-ELENA as a technical assistance facility in 2010. Under this initiative, funds can be provided to public authorities to cover part of the costs of preparing, implementing and financing large scale (i.e. over EUR 50 million) investment programmes, to make local sustainable energy projects ready for funding by investment banks.

In 2011, the European Commission and the KfW bank established a similar initiative, the KfW-ELENA facility, offering a complementary approach which aims to mobilize smaller investment projects from small and medium sized municipalities through cooperation with local financial intermediaries.

Also in 2011, a pilot technical assistance initiative *MLEI* (Mobilising Local Energy Investments) was launched within the annual IEE Call. Unlike the ELENA facilities, which are managed directly by the Banks, the *MLEI* initiative is managed like other IEE projects by the EACI. All of these facilities have opened up new PV investment opportunities.

Further information on the IEE programme, on-going IEE projects and future calls, are available at: http://ec.europa.eu/energy/intelligent/index_en.html.

6. NER300

A further funding initiative which is worthwhile to mention within this paper is the NER 300 programme, which aims to fund at least eight CCS and 34 innovative renewable energy demonstration projects. The programme will be funded from the sale of 300 million emission allowances held in the New Entrants Reserve (NER) of the EU Emissions Trading System (ETS). At the current carbon price, these allowances are worth about EUR 4 billion. In addition, it is expected to

leverage around the same amount from private or other sources, as project sponsors must also bring funding.

A first call for proposals was launched in November 2010. Project sponsors submitted their applications to their respective Member State authorities which had to check their eligibility and submit the projects they wished to support to the European Investment Bank (EIB). The EIB started financial and technical due diligence assessments, and aims to finalise the appraisal of submitted projects by 9 February 2012.

Based on recommendations from the EIB, the Commission will consult the EU Climate Change Committee, in which all Member States are represented, check that Member States still support the projects they recommended, and prepare and issue award decisions.
At least one project, and up to a maximum of three, will be funded per Member State.
The Commission intends to issue award decisions in the second half of 2012. A total of 13 CCS projects and 65 renewable energy projects are under assessment at EIB, included 4 photovoltaic projects [10].

7. EUROPEAN SOLAR INDUSTRIAL INITIATIVE OF THE SET PLAN

The European Industrial Initiatives (EIIs) have been conceived as large scale programmes aiming at the rapid development of key energy technologies. They bring together the industry, the research community, the Member States and the Commission and have their origin in the Strategic Energy Technology Plan (SET-Plan) of the European Union [11]. The Solar European Industrial Initiative (SEII), in particular, was launched in June 2010 to contribute to reach very ambitious objectives in terms of solar electricity share of the European electricity consumption by 2020. It deals with both PV and concentrating solar power (CSP).

The SEII 2010-2012 Implementation Plan for PV identified RD&D needs for about EUR 1,2 billion to be invested in new production technology, in the integration of PV into the grid as well as into the built environment, aiming at achieving cost reduction and enabling large-scale deployment.

The current focus of the initiative is the definition of an ERA-NET proposal, dedicated to the implementation of the SEII priorities.

The *SEII-Team* is the plenary body composed of representatives of fourteen countries, industry, EERA-PV and EERA-CSP and Commission. The ERA-NET will complement existing mechanisms of trans-national cooperation, offering the opportunity to participants to explore the potential and actual benefits of variable geometry arrangements between funding bodies supporting both private and public sector RD&D in the fields of PV and CSP. The activities funded by the ERA-NET will have to be coordinated with funding prospects at national level in other schemes (e.g. NER300) avoiding double funding, while allowing synergies and complementarities. The ERA-NET will primarily involve the launching of joint calls (starting as of the end of 2012).

CONCLUSIONS AND FUTURE PERSPECTIVES

The Commission wishes renewable energy and photovoltaics to be developed as cost effectively as possible and continues to work with Member States on the implementation of the RES Directive..

At the same time, continuous technological development and demonstration is necessary to further reduce costs and increase performances of the solar photovoltaic devices. Innovative manufacturing processes should further reduce both the consumption of scarce resources (feedstock materials, chemicals, energy, and water) and by-product streams. It is unlikely for Europe to be price leader in the photovoltaic sector. But Europe can progress confirming and reinforcing its role as technology and innovation leader, as technology leadership will help in maintaining companies in Europe. The SEII offers an opportunity to accelerate the development and demonstration activities of European companies, to increase their innovation base, and to improve their competitiveness.

The significant growth of the photovoltaic electricity production in Europe opens new challenges in terms of building the necessary infrastructures and adopting the required standards and protocols.

Meanwhile, the EU action in the sector will continue to pursue an increasingly effective mix of policy measures, technological development and demonstration programmes as well as market transformation programmes.

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