

EUROPEAN PHOTOVOLTAIC ACTIONS AND PROGRAMMES-2012

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ABSTRACT: The last calls of the EU 7th Framework Programme for research have been already published. About EUR 195 million have been invested in research and demonstration projects on photovoltaics with the first five calls of the Programme. The actions to transform the photovoltaic market are carried out with the second Intelligent Energy Europe Programme. Horizon 2020 is the next framework programme for research and innovation for the 2014-2020 period. On the basis of the Commission proposals, the European Parliament and Council are negotiating the terms for the adoption of the legislative acts. The Commission wishes renewable energy to be developed as cost effectively as possible and works with Member States on the implementation of the Directive on renewables to facilitate the convergence of national support schemes, with schemes following best practice, avoiding over-compensation and retroactive changes. The June 2012 communication on renewables proposes the elements to start discussing the regulatory, industrial and technological configuration and legal instruments which are necessary for the post 2020 environment. The continuous growth of the photovoltaic electricity production in Europe justifies further consideration, particularly with regard to whether the center of gravity of the photovoltaic industry has already moved from technology development and demonstration to market deployment.

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

1 INTRODUCTION

More than 29 GW of PV systems were newly connected to the grid worldwide in 2011, up from about 17 GW in 2010. In the same year, Europe was confirmed as the predominant area of global PV demand, hosting 75% of the overall new capacity. Italy was the largest market for the year with 9,3 GW newly connected to the grid, followed by Germany (7,5 GW) and France (1,6 GW). The cumulated photovoltaic capacity installed in Europe by end of the year 2011 is estimated at more than 51 GW, from about 30 GW the year before [1]. In 2011, China was the most active market outside Europe, with 2,2 GW installed, followed by USA with 1,9 GW [2]. The significant EU domestic imbalance between demand and supply of photovoltaic modules persisted in 2011, with less than 30% of the demand satisfied domestically. The imbalance is much lower for inverters of PV systems and almost invisible for the EPC/installation services, which are supplied almost entirely by EU companies [3]. These considerations are important because, with falling module prices, balance of system costs become increasingly relevant. For instance, balance of system costs are now more than module costs in some commercial and ground-mount systems.

The feed-in tariffs support schemes for photovoltaics, first introduced in Europe, have permitted the industry to grow and step up to become a mainstream power generation technology. During the last few years, we have recorded substantial changes to the industry structure and, especially, an accelerated price reduction of the technology. This has led to continued rushes on installations, as investors have tried to make the most of the difference between feed-in tariffs and the cost of

photovoltaic electricity. The growth of the photovoltaic market was unanticipated by National authorities, despite the application of a number of complex schemes, which were intended to take market dynamics into account. It appears now that the combined effect of reductions of the support schemes, the introduction of caps, and restricted access to finance will limit the growth of the photovoltaic installations in Europe. In the coming years, Asia (in particular China and Japan) and USA are likely to assume an increasing share of the photovoltaic demand.

The predictability and consistency of the current prices with the scale of the sector justify further consideration, particularly with regard to whether the center of gravity of the photovoltaic industry has already moved from technology development and demonstration to market deployment. The shaping of future national support instruments might benefit from the conclusions of such considerations.

In this paper, we first describe the European policy framework and envisage its development for preparing the right regulatory, industrial and technological configuration and legal instruments for the post 2020 environment. In particular, we discuss the new Commission Communication "Renewable Energy: a major player in the European energy market" [4]. The Commission wishes renewable energy to be developed as cost effectively as possible and will continue to work with Member States on the implementation of the RES Directive [5] to facilitate the convergence of national support schemes. The best conditions for the development of renewable energy should be ensured, with schemes following best practice, avoiding over-compensation and retroactive changes. It seems to us that a strong sense of direction towards 2030 is needed soon,

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to support long-term investment decisions and to enable markets to integrate higher shares of renewables.

Second, we present the results of the 7th Framework programme (FP7), highlighting the newly selected projects and breakthroughs, and we discuss the investments operated in the various strands of photovoltaic activities. It is worth recalling that FP7 is ending and the last calls of the programme have been already published. The next framework programme for research and innovation for the 2014-2020 period, Horizon 2020, is already in an advanced phase of preparation.

Third, we discuss 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 status of the NER300 initiative, which represents another funding opportunity for European PV projects.

Finally, we describe the implementation of the Solar European Industrial Initiative of the SET-Plan.

2 EUROPEAN ENERGY FRAMEWORK AND LEGAL INSTRUMENTS

2.1 Energy Roadmap 2050

The growth of renewable energy – the expectation that it will soon provide more than a third of our electricity and 10% of our transport needs – has triggered discussion of "beyond 2020". In 2011 the European Commission published an overall "low carbon economy" roadmap to 2050, a transport sector -specific 2050 White Paper and a Communication outlining a 2050 energy roadmap, presenting different pathways to the decarbonisation of the energy sector. Various studies and contributions from different stakeholders have also flagged up how decarbonisation can begin. Indeed, the association of the European electricity industry recognizes 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 Commission's Energy Roadmap 2050 envisages between 60 and 97% for electricity, or between 55% and 75% for energy consumption overall.

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 – all remain valid. The need to achieve our objectives in these areas is still strong, despite current economic circumstances. Indeed it is important to recall the IEA's findings that delays in climate change mitigation would *raise* costs significantly. Policy development, 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.

2.2 Renewable Energy: a major player in the European energy market

Following up the Energy Roadmap 2050, the Commission published a renewable energy-specific Communication in June 2012. The intent was to give

clear signals to industry about the longer term perspectives for renewable energy. The Communication started with the findings of the Energy Roadmap 2050: whatever decarbonisation pathway is followed, however we aim to improve our security of supply, strong growth of renewable energy is a "no regrets" policy. Another clear message from the Roadmap 2050 was that under current policies, we will miss our objectives; so it is clear that a strong new policy regime for post 2020 must be established. The Communication also explored key issues that still need to be addressed on the way to 2020: the single market, renewables support and trading, and renewables in the Mediterranean.

The work on the creation of the single European electricity market is still on-going; and is promised for 2014. A competitive and open market is important for new entrants, namely renewable energy producers. A technology neutral electricity system management framework – with grid codes and guidelines, infrastructure development which no longer favours incumbents and conventional electricity generation – is an urgent necessity. With such a framework, the transformation of Europe's electricity industry can be accelerated, bringing in new technologies, new market players, greater distributed generation, and demand management. All this will become increasingly possible as the market becomes more competitive and dynamic.

The cost of renewables support is also an important issue that needs urgent attention. This is in particular the case for PV, because it is in PV that the market growth has taken governments by surprise and caused major increases in expenditure on support. The expectation of the Commission is that by creating a competitive market and correcting other market failures, renewable energy will be able to compete favourably with traditional energy forms. As the scale of the industry continues to grow, costs will continue to fall, so support for renewables can continue to be reduced and eventually phased out.

The reforms to renewable energy support schemes, which have taken place during the last two years, have shown that their cost effectiveness and the incentives for further reducing costs can be much improved, that the market distortions resulting from differences in the national schemes can be reduced, and that the sometimes uncoordinated nature of the reforms can also be improved. It is for this reason that the Commission announced plans to produce guidance on support schemes, aiming to ensure that stable predictable frameworks are created, and that the on-going growth of renewables occurs with support, as necessary, but that this support does not create either huge deficits or unacceptable increases in electricity prices.

Another feature of the market which is helping to ensure that renewables growth occurs in a cost effective manner is the increase in "trade" in renewables. The Commission points out that it makes sense to exploit renewables where it is most cost effective to do so, rather than just in the domestic markets of those Member States that are concerned with achieving their 2020 targets. The renewables energy Directive created "cooperation mechanisms" to facilitate such trade, but these have not yet been extensively used. The Commission therefore plans to produce guidance on their use.

The further element which could help to ensure that renewable energy will become a major player in the EU

energy market involves would be to improve energy relations and trade between the EU and the southern Mediterranean countries. The scope for renewable energy growth in North Africa is vast, but new regulatory and infrastructure measures must be developed and put in place and a market regime created. A number of European Commission initiatives are in place to assist with the development of energy market framework conditions in these countries. In addition, the renewable energy Directive's "cooperation mechanisms" provide for importing renewable energy from third countries and counting it towards a Member State's target. This incentive for renewable energy development and trade could be strengthened, and the Commission is therefore working on guidance on this matter too.

In addition to these four areas on which the Commission will provide more guidance, the Communication highlighted the importance of giving clear policy signals about the longer term (post 2020) prospects for renewables. It emphasised that, as already indicated in the Energy Roadmap 2050, a strong policy framework will still be needed if renewable energy growth is not to slump after 2020. A range of policy options is highlighted, including emissions reductions, renewables diversification and technology innovation, and a broader EU harmonised approach, and work on the future policy framework must start now. Interactions with other policy areas - in particular international climate change policy - are of course an important consideration in this policy discussion.

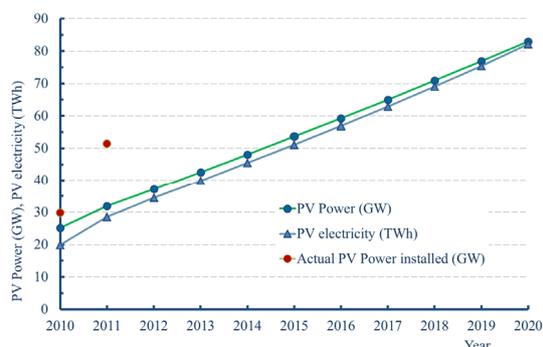


Fig. 1 PV sectorial targets estimates based on NREAPs notified to the European Commission by the 27 Member States and reported power installed for two years.

2.3 Directive 2012/19/EU on waste electrical and electronic equipment (WEEE).

Following a recast procedure, the new WEEE Directive seeks to increase the amount of waste electrical and electronic equipment that is recycled [6]. The Directive maintains the current collection target of 4 kg/capita/Member State until 2015. From 2016 it introduces a collection target of 45 % of electronic equipment sold that will apply and, as a second step from 2019, a target of 65 % of equipment sold, or 85 % of electronic waste generated. These targets apply as a per capita average of all WEEE in each Member State together; they do not necessarily have to be achieved by each sector individually.

Photovoltaic panels are within the scope of the Directive, as of its entry into force date of 13 Aug 2012. Member States will have to amend their existing legislation on WEEE and align it with the new

Directive and the new targets by 14 February 2014, at the latest. Producers are obliged to register their sales of new equipment with national registers in each Member State, and are obliged to comply with their waste and financing obligations in each Member State.

The Commission will as soon as possible adopt an implementing act in order to harmonize the details of the registration procedures.

3. PV RTD AND DEMONSTRATION PROGRAMME

3.1 The 7th Framework Programme

The 7th Framework Programme for Research of the EU, FP7 (2007-2013), received a higher budget than the previous programme, and ran for seven years. Calls for proposals based on topics identified in the work programme have been published on an annual basis. Seven calls for proposals have been published for the years from 2007 to 2013, included the last 2013 calls. Material development for wafer-based silicon devices, photovoltaics based on solar concentration, and manufacturing process development have attracted relevant European funding. Significant funding has been also made available for thin-film technology and for the development and demonstration of new concepts and new approaches for building construction elements based on photovoltaic (Figure 2).

The photovoltaic projects granted under the 2007, 2008 and 2009, 2010 calls have been described previously [7]. The projects which received grants under the FP7 2011 call are described below.

The EU-Japan Coordinated Call addressing *Ultra-high efficiency concentration photovoltaics (CPV) cells, modules and systems* has resulted in the project *NGCPV*, 42-month duration for an EU contribution of EUR 5,0 million. *NGCPV*, coordinated by Universidad Politecnica de Madrid, Spain, pursues the improvement of present concentration cells, modules and system efficiency, and envisages the construction of a 50 kW concentration plant as a mean of field demonstration. A special effort is being devoted to the development of multi-junction cells by making use of e.g. inverted and bifacial growth, and incorporation of quantum nanostructures. Targeted efficiencies are 50% at the cell level and 35% at the module level.

The FP7 2011 call topic on *Productivity and cost optimization issues for the manufacturing of photovoltaic systems based on concentration* has resulted in the selection of two project proposals, *CPV4ALL* and *ECOSOLE*. While we are completing this paper, the *CPV4ALL* grant agreement has not been signed yet. Voestalpine Automotive GMBH coordinates the project which is focused on demonstrating and validating, at industrial scale, the production technology for the components and the assembly technology for the photovoltaic modules and system based on solar concentration. The project total cost is EUR 12,6 million and the EU grant is about EUR 7,3 million. The project *ECOSOLE* is focused on the realization of innovative photovoltaic generator based on solar concentration and the demonstration of new and more efficient methods for large scale, low cost manufacturing of related modules and systems. The project, coordinated by Becar Srl (Beggelli Group), has a total eligible cost of about EUR 12 million and an EU grant of almost EUR 7 million.

The FP7 2011 call topic on *Development and demonstration of standardized building components based on photovoltaics* has resulted in the selection of two project proposals, *BFIRST* and *CONSTRUCT PV*. The project *BFIRST* deals with design, development and demonstration of a portfolio of innovative photovoltaic products for building integration, based on cell encapsulation within fibre-reinforced composite materials. The aim is to expand the portfolio of photovoltaic products which are currently available, with new standardized solutions developed to a pre-industrial stage. The project, coordinated by TecNALIA, has a total cost of about EUR 5,4 million and receives an EU grant of EUR 3,3 million. The grant agreement concerning the project proposal *CONSTRUCT PV* has not been signed yet. The proposal aims at developing and demonstrating customizable, efficient, and low cost building integrated photovoltaic solution for opaque surfaces of buildings. The proposal, coordinated by ZUEB, foresees a total cost of about EUR 11,7 million and an EU grant request of EUR 6,9 million.

Finally, three projects have received a grant under the joint call between the Theme "Energy" and the Theme on "Nanosciences, Nanotechnologies, Materials and New Production Technologies" (NMP), which addressed the topic *Development and up-scaling of innovative photovoltaic cell processes and architectures to pilot-line scale for industrial application*.

The project *FAST TRACK*, with an EU contribution of EUR 9,3 million, coordinated by the Forschungszentrum Juelich GmbH in Germany, focuses on bringing the next-generation thin-film silicon technology to the market, using newly developed state-of-the-art knowledge to solve the complex puzzle of achieving at the same time strong light in-coupling (high current) and good electrical properties (open-circuit voltage and fill factor). The target of the project is to achieve solar cells with 14% stable efficiency, leading to the demonstration of reliable production size prototype modules of 12% level. The project *R2R-CIGS*, with an EU contribution of EUR 7 million, coordinated by the Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek – TNO, in the Netherlands, aims to develop efficient flexible solar modules by implementing innovative cost-effective processes so that production costs below 0,5 EUR/W could be achieved in large volume factories with annual capacity of 500 MW in the future. The project *SCALENANO*, with an EU contribution of EUR 7,5 million, coordinated by Fundacio Institut de Recerca de l'Energia de Catalunya, in Spain, will exploit the potential of chalcogenide based thin film photovoltaic technologies, for the development and scale-up of new processes based on nano-structured materials for the production of high efficiency and low cost photovoltaic devices and modules compatible with mass production requirements.

The work programme for the FP7 2012 calls was published on 20 July 2011. Two topics for collaborative projects with a predominant demonstration component were published, namely: 1. *Reliable, cost-effective, highly performing PV systems* (deadline: 25/10/2011) and 2. *Demonstration of smart multi-functional PV modules* (deadline: 08/03/2012). The evaluation of the proposals received under both topics has been completed. Two proposals under the first topic have been retained for negotiations, for an estimated total contribution of about

EUR 7,6 million. Three proposals under the second topic have been retained for negotiation, for an estimated total contribution of about EUR 9 million.

In addition, the FP7 2012 call topic on *Future Emerging Technologies* (FET), with deadline on 25/10/2011, has also resulted in the selection of two PV proposals which have been retained for negotiation – currently underway – for an overall EU contribution of about EUR 5,0 million.

Furthermore, the FP7 2012 topic *ERA-NET on Solar Electricity: Implementation of the Solar Energy Industry Initiative* (deadline: 28.02.2012) has resulted in the selection of one proposal, currently under negotiation, which will be granted an EU contribution of about EUR 2,0 million (see also Sect. 6).

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

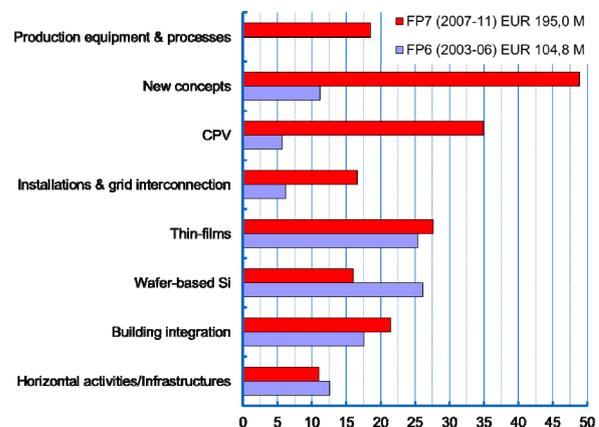


Fig. 2 Investment in PV, 2003-2011 (Euro million)

The FP7 2013 calls for proposals have been published on 10 July 2012. Three main PV topics are addressed: 1. *High efficiency c-Si photovoltaics modules* (call: FP7-ENERGY-2013-1; topic ENERGY.2013.2.1.1 - deadline: 28/11/2012), 2. *Support to key activities of the European Photovoltaics Technology Platform (TP PV)* (call: FP7-ENERGY-2013-IRP; topic ENERGY.2013.2.1.2 - deadline: 08/01/2013), and 3. *Integrated research programme in the field of photovoltaics* (call: FP7-ENERGY-2013-IRP; topic ENERGY.2013.10.1.5 - deadline: 08/01/2013).

3.2 Horizon 2020 - The Framework Programme for the 2014-2020 period

Horizon 2020 is the next framework programme for research and innovation for the 2014-2020 period. The European Parliament and Council are negotiating the terms for the adoption of the legislative acts on the basis of the Commission proposals [8].

The cost of solar energy, including photovoltaics should be halved by 2020 compared to 2010 levels. This would require long term research on novel concepts and systems and the demonstration and testing of mass production with a view to large-scale deployment. Horizon 2020 is expected to continue the EU support for the development of efficient, reliable and cost-competitive solar energy systems along these lines.

4. 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 with the aim to reduce non-technological market barriers. 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 six annual calls for proposals. The last IEE II call will be launched most probably in December 2012.

In the framework of the first five calls of IEE II, a number of projects on photovoltaic are being funded. Some of them have been described previously [6], like *PVs in BLOOM* (www.pvsinbloom.eu), and *PV LEGAL* (www.pvlegal.eu).

Under *PV LEGAL* – ended in February 2012 – a comprehensive database describing the administrative processes necessary to install a PV system in a number of EU countries (<http://www.pvlegal.eu/database.html>) was developed. This database has become a unique source of information for the PV community, and under the successor *PV GRID* (www.pvgrid.eu, started in May 2012) this database will be enlarged to cover almost all of the EU PV market. Moreover, building on the findings of its predecessor, *PV GRID*'s main goal is to trigger processes which will reduce regulatory and normative barriers towards large-scale integration of PV and other intermittent RES-e generation technologies into the distribution grid of 16 EU countries.

PV PARITY (www.pvparity.eu) is another IEE photovoltaic project, which has started in 2011. The project aims at providing EU policy makers with a clear definition of the competitiveness of photovoltaics, as well an understanding of the necessary measures to accompany solar PV to competitiveness with conventional electricity sources. On this basis, the project will identify and promote measures complementing or replacing the existing support schemes for photovoltaic and ultimately boosting a steady expansion of PV markets in the EU while bringing the highest possible benefits to society and to the energy system.

An important field of delivery of the IEE programme is on Building skills and capacities. A number of projects on capacity building, training and certification of installers of small scale RES systems, including *PV QUALICERT* (www.qualicert-project.eu), *Install+RES* (www.resinstaller.eu) and *PVTRIN* (www.pvtrin.eu) have been described previously [7]. Such projects provide experience which is useful to the establishment of the PV installer certification schemes, which are required by the Renewable Energy Directive (Art 14) to be in place in all EU Member States by 31 Dec 2012.

In this context it is worth to mention also the recent IEE initiative *BUILD UP Skills* (www.buildupskills.eu) 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 in buildings. 30 projects (for a total funding of approx. EUR

10 million) have been selected from the applications received following the IEE II 2011 and 2012 calls for proposals. Under this initiative, the building industry, the public authorities and the vocational training sector of 30 European countries are now working on the development and endorsement of national roadmaps for qualifying their craftsmen on high energy performance solutions for the building sector, with the final aim to elaborate strategic recommendations for the necessary qualification measures in the sector.

Following on from these national qualification strategies, IEE funding will be devoted to setting up or upgrading training schemes for sustainable energy installers and craftsmen throughout Europe. Since 2010, IEE has given a special focus to mobilizing investments in sustainable energy by local and regional public authorities through its ELENA (European Local Energy Assistance) Facility. The European Commission and the European Investment Bank (EIB) established the first EIB-ELENA to help public authorities to prepare, implement and finance large scale (i.e. over EUR 50 million) investment programmes. In 2011, ELENA Facility was extended towards smaller investment projects, with the KfW-ELENA and CEB-ELENA. A new extension of the Facility with the EBRD is under development, to address sustainable energy investment projects in the new Member States of the EU. A complementary initiative MLEI (Mobilising Local Energy Investments) was launched within the annual 2011 IEE Call. MLEI is managed by the EACI, and provides the project development support for small scale projects. All of these facilities have opened up new PV investment opportunities.

For the next Multiannual Financial Framework (2014-2020), the Commission has proposed that IEE III, the successor to IEE II, will continue under Horizon 2020. IEE III should address three main areas: Policy implementation at EU, national and local level; Capacity-building, addressing public acceptance, knowledge transfer and skills improvement; and Financing to mobilise investments and make energy efficiency and renewable energy projects bankable.

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

5. NER300

The NER 300 programme is funded from the sale of 300 million emission allowances held in the New Entrants Reserve (NER) of the EU Emissions Trading System (ETS). A first call for proposals was launched in November 2010, based on the sale of a first tranche of 200 million allowances. Under this call, some three carbon capture and storage (CCS) demonstration projects and up to 16 innovative renewable energy (RES) demonstration projects could be co-funded. Project sponsors submitted their applications to their respective National authorities which checked their eligibility and submitted the projects they wished to support to the European Investment Bank (EIB). The EIB finalised the appraisal of the projects by early February 2012. The Commission will adopt the award decision by end 2012, following the confirmation of the support by the Member States. Notably two photovoltaic projects are reported in

the list of projects which are candidates for award decision [9].

6. 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 and they have their origin in the Strategic Energy Technology Plan (SET-Plan) of the European Union [10]. The Solar European Industrial Initiative (SEII), in particular, was launched in June 2010 to contribute to reach ambitious objectives in terms of solar electricity share of the European electricity consumption by 2020, and deals with both PV and concentrating solar power (CSP). The *SEII-Team* is the plenary body composed of representatives of fifteen countries, industry, EERA-PV and EERA-CSP and the European Commission.

With regard to the PV sector, in early 2012 the SEII Team has identified seven priority project clusters: I. Solar glass and encapsulation materials; II. Si feedstock, crystallization and wafering; III. High efficiency PV modules based on next generation crystalline silicon solar cells; IV. Innovative processes for inorganic thin-film cells and modules: manufacturing demonstration; V. Dedicated modules for BIPV: design and manufacturing; VI. Concentrator technology: development of components and demonstration of systems; VII. Grid integration and large-scale deployment of PV.

The seven project clusters will be a key part of the joint programming activities of the ERA-NET which is called "SOLAR-ERA.NET". Eighteen organisations (funding bodies and research program managers) from fourteen countries participate in the SOLAR-ERA.NET which should start to be operative by the end of 2012.

The SEII 2013-2015 Implementation Plan for PV is currently being drafted in order to replace the previous 2010-2012 Plan.

The "Materials Roadmap Enabling Low Carbon Energy Technologies" was completed as Commission staff working paper [11]. The Roadmap complements the technology roadmaps developed in the context of the SET-Plan by identifying the materials research and innovation activities which are relevant to advance energy technologies. The Materials Roadmap for Photovoltaic Energy, which is part of the general paper, proposes activities on material R&D issues, industrial piloting of new materials and identifies needs of research infrastructures.

CONCLUSIONS AND FUTURE PERSPECTIVES

EU action in the photovoltaic sector continues to pursue an increasingly effective mix of policy measures, technological development and demonstration programmes as well as market transformation programmes. The successful deployment of renewable technologies, particularly PV, raised questions about the most cost-effective way of promotion. The policy debate mainly focuses on how national support instruments for RES electricity should be improved and to which extent they can be coordinated at a European level. The Commission wishes renewable energy and photovoltaics

to be developed as cost effectively as possible and continues to work with the Member States on the implementation of the RES Directive, as well as on starting the discussion of the post-2020 policy framework. This action is to couple with the tenacious pursuing of innovative technology patterns, if Europe's global leadership in renewable energy is to continue. Photovoltaics will play a key role in a sustainable, decarbonised and competitive energy system after 2020, as one of the "no-regrets" options.

References

- [1] Photovoltaic Barometer, Euroobserver-Systèmes Solaires, Le Journal du photovoltaïque, n.7 (2012).
- [2] EPIA, Global Market Outlook for Photovoltaics until 2016 (May 2012).
- [3] IMS Research, The European PV Industry, Presentation given at the Intersolar Europe Conference, Munich, 11-14 June 2012.
- [4] Renewable Energy: a major player in the European energy market, COM/2012/0271 final.
- [5] Directive 2009/28/EC on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.
- [6] Directive 2012/19/EU, Official Journal of the European Union, 24.7.2012, L 197/38, page 38.
- [7] P Menna, R Gambi, T Howes, W Gillett, G Tondi, F Belloni, S Fantechi, M Getsiou, P De Bonis, *European Photovoltaic Actions and Programmes-2011*, Proceedings of 26th EUPVSEC, Hamburg (2011) pp 4500-5.
- [8] Horizon 2020 - The Framework Programme for Research and Innovation, COM(2011) 808 final.
- [9] NER300 - Moving towards a low carbon economy and boosting innovation, growth and employment across the EU, Commission Staff working document, SWD(2012) 224 final, 12.7.2012.
- [10] A European strategic energy technology plan (SET Plan) - Towards a low carbon future COM(2007) 723 final.
- [11] Materials Roadmap Enabling Low Carbon Energy Technologies, Commission Staff working paper, SEC(2011) 1609 final, 13.12.2011.