2015

GLOBAL MARKET OUTLOOK FOR PHOTOVOLTAICS UNTIL 2015

EPIA

European Photovoltaic Industry Association

2015

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Disclaimer: Please note that all historical figures provided in this brochure are valid at the time of publication and will be revised when new and proven figures are available. All forecast figures are based on EPIA knowledge at the time of publication. Please also note cumulative forecast figures for individual countries only have been rounded.

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INTRODUCTION

Over the past decade, the photovoltaic (PV) market has experienced unprecedented growth. In particular in the last year, the photovoltaic market has reached a cumulative installed capacity of roughly 40 GW world-wide, with an annual added capacity of 16.6 GW. The photovoltaic power is well on the way to becoming a fully competitive part of the electricity system in the European Union (EU) and an increasingly important part of the energy mix around the Globe. But much of the progress in recent years has been very heterogeneous, varying from country to country, due to several factors, the most important being different national regulations and incentive schemes as well as varying availability of financing facilities.

These are just some of the findings in EPIA's Global Market Outlook for Photovoltaics until 2015, a key publication for the PV industry. Based on an internal analysis of market data from industry members, national associations, government agencies and electric utilities, the figures presented in this edition were discussed among the world's principal actors in the photovoltaic industry during the 6th EPIA Market Workshop, held in Paris in March 2011.

For years, EPIA has put a great deal of effort into observing and analysing PV markets. Thanks to its intimate contact with key players in the industry, national PV associations and its deep knowledge of PV policies and support schemes, EPIA market figures are a credible and authoritative source of short-term market forecasts as well as long-term scenarios. With the massive growth of the PV market, data reliability is becoming a crucial issue: industry players, electric utilities and policy makers must count on reliable data to orientate their decisions, launch investments or plan updates on legislation. EPIA advocates the availability of quick, transparent and reliable market information and, therefore, encourages the adoption of effective monitoring systems.

A doubling of the market in 2010

The PV industry experienced significant growth in 2010. Capacity additions grew from 7.2 gigawatts (GW) installed in 2009 to 16.6 GW in 2010. **The total installed capacity in the world now amounts to around 40 GW, producing some 50 terawatt-hours (TWh) of electrical power every year.**

This major increase was linked to the rapid growth of the German and Italian markets. With 7.4 GW installed in Germany in just one year, the country continues to dominate the PV market world-wide. Italy installed 2.3 GW, starting to exploit some of the potential of its huge solar resources. Other countries also saw significant growth. The Czech Republic experienced a burst to 1.5 GW in 2010 that is, however, unlikely to be sustained in 2011. Japan and the USA almost reached the gigawatt mark with 990 and 900 megawatts (MW) respectively, installed last year. France reached over 700 MW, while Spain regained some ground by installing 370 MW after two years of strongly adverse conditions. Belgium connected more than 420 MW of PV capacity to the grid in 2010. **The entire European Union installed slightly more than 13 GW of PV capacity in 2010 while the rest of the world accounted for over 3 GW.**

For a couple of years, the PV market growth has been driven by rapid decrease in prices accelerated by support schemes. The most mature market today, Germany, where the lowest prices for PV systems can be observed, will continue to decrease its Feed-in Tariffs (FiTs) to follow the declining PV prices. However, the official targets for PV in the National Renewable Action Plan in Germany leave room for additional installations, with an annual market of more than 3 GW over the next 10 years.

In Italy, the past year has seen a lot of inaccurate information and speculation about the country's market volume. This clearly pushed authorities into reacting with emergency measures that risked the development of PV in the country. The situation in 2011 may have been clarified by the time of publication, but the prospects for 2012 and beyond remain unclear and depend mainly on the policy decisions of these days.

A desirable solution to a sustainable future

The crisis in Japan has re-opened the debate on the world's future energy mix and security of energy supply. In this context, PV is more than ever part of a global renewable solution. Some scenarios have demonstrated that renewables could meet up to 100% of the EU energy demand by 2050. Switching to PV is not just a realistic option for tomorrow's energy mix; it is also a desirable solution for society as a whole.

PV markets are stronger than ever, and PV now appears on the energy map of several countries as a real alternative to conventional electricity sources. For example in Spain, up to 4% of the electricity demand was provided by PV during the summer. In several countries, grid parity for residential systems will be reached in the coming years. In some specific cases, in countries or regions with very high electricity prices, PV could soon become competitive with net-metering only.

Adequate support policies that have been driving the markets so far, such as the FiTs, must continue and be adapted to the cost curve of PV. The PV industry also supports well-designed support schemes that simplify the authorization processes and moreover limit the cost for electricity consumers, while ensuring the development of the market and industry.

A Paradigm Shift in progress

The evolution of the PV market in recent years has been heavily linked to the confidence and vision of smart policy makers in supporting the development of the technology. In only one year, the installed capacity in Europe almost doubled and, at the current pace, Europe could increase the proportion of its electricity generated from PV by one percent every two years.

2

METHODOLOGY AND SCENARIOS

With strong price decreases of PV technology in recent years and increased electricity prices across Europe, PV markets are approaching this key measure of competitiveness known as grid parity.

Grid parity refers to the moment in time when the savings in electricity cost and/or the revenues generated by selling electricity on the market are equal to or higher than the long-term cost of installing and financing a PV system. While this situation will appear at different points in time in every EU country, for now the market is still driven by incentives.

This means PV market deployment still depends on the political framework of each country. Although support mechanisms for renewables are encouraged by the European Commission, they are defined in national laws. The introduction, modification or phasing out of such schemes constitutes a significant element of our forecasts and scenarios as they have profound consequences on national PV markets and industries.

In March 2011, EPIA completed an extensive data collection exercise among a highly representative sample of the PV industry, electric utilities, national associations and energy agencies. Based on the cross-checking of data and the consolidation of complementary market projection methods, EPIA has derived two scenarios for the future development of the PV industry:

The **Moderate scenario**: This scenario assumes a "business-as-usual" market behaviour with no major reinforcement of existing support mechanisms, but takes into account a reasonable continuation of current FiTs aligned with PV systems prices.

The **Policy-Driven scenario**: This scenario assumes the continuation or introduction of support mechanisms, namely FiTs, accompanied by a strong political will to consider PV as a major power source in the coming years. This must be complemented by a removal of non-necessary administrative barriers and the streamlining of grid connection procedures.

Under these two scenarios, this report analyses, on a country-by-country basis: the historical development of the PV market; existing support policies, their attractiveness and expected developments; administrative procedures in place; national renewable energy objectives; and the potential for PV.

Installations and connections

EPIA's methodology includes only the systems connected to the grid and not those that have been installed but not yet connected. Therefore, the cumulative installed capacity refers to installations that can make a real contribution to meeting the energy demand. This also reflects the regulatory point of view as FiTs are paid only to systems that are connected and produce electricity.

The difference between installations and systems connected to the grid can be quite significant in some cases. With many projects being installed in November and December 2010 due to expected FiT changes, choosing one methodology over the other can modify the year-to-year PV market figures considerably. Consider the case of Belgium: from a connection point of view, almost 200 MW of systems installed in 2009 were connected only in 2010. In our methodology, therefore, the market progressed from 285 MW connected in 2009 to 424 MW in 2010. From an installation point of view, however, the market decreased from 480 MW to just 223 MW, due to a sharp decrease in Flanders.

Including off-grid installations

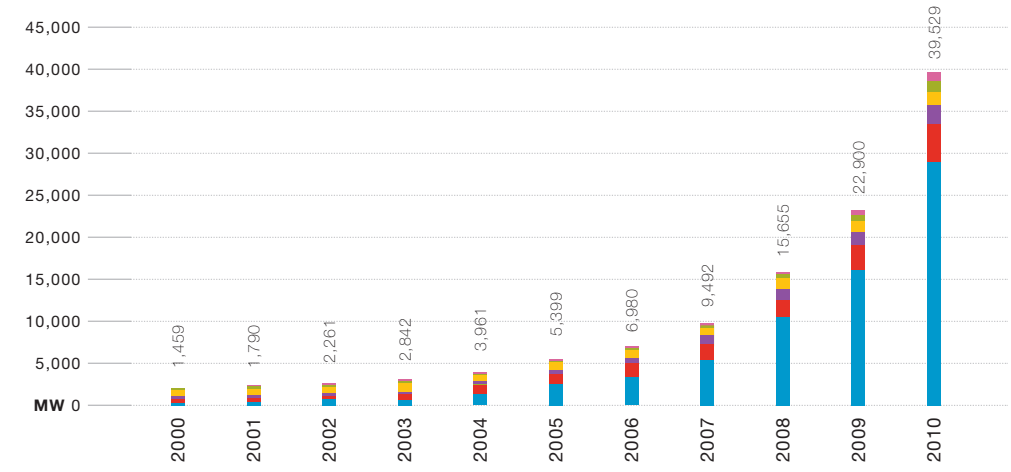
Long before PV became a reliable source of power connected to the grid, it was largely used to provide electricity in remote areas that lay out of the reach of electricity grids. While off-grid systems in the EU only account for around 1% of the installed PV capacity (with slightly more than 130 MW), they represent a significant power source in many other countries. For this reason, off-grid systems are also taken into account in the total installed capacity. In the USA, off-grid systems represented 10% of the overall market in 2009. In Australia and South Korea, dozens of megawatts of off-grid capacity are installed every year and are accordingly taken into account in the total installed capacity in those countries.

3

MARKET EVOLUTION

3.1. Historical PV market development

From the first PV applications in space to the GW systems planned today, more than 40 years have passed. Over the last decade, PV technology has acquired the potential to become a major source of power generation for the world. That robust and continuous growth is expected to continue in the years ahead. **At the end of 2008, the world's cumulative installed PV capacity was approaching 16 GW. One year later it was 23 GW. In 2010, almost 40 GW are installed globally and produce some 50 TWh of electricity every year.**



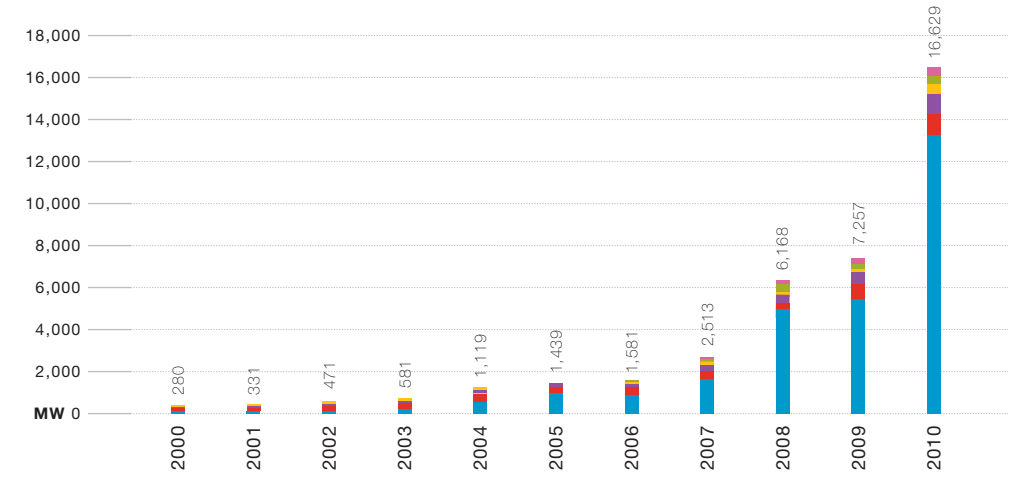
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
China	19	30	45	55	64	68	80	100	145	373	893
APEC	38	43	49	57	66	80	112	170	466	718	1,191
Rest of the world	758	814	894	971	1,000	1,010	1,128	1,190	1,303	1,427	1,844
North America	146	177	222	287	379	496	645	856	1,205	1,744	2,727
Japan	318	452	637	860	1,132	1,422	1,708	1,919	2,149	2,632	3,622
EU	181	275	414	613	1,319	2,324	3,307	5,257	10,387	16,006	29,252
Total	**1,459**	**1,790**	**2,261**	**2,842**	**3,961**	**5,399**	**6,980**	**9,492**	**15,655**	**22,900**	**39,529**

Figure 1 - Evolution of global cumulative installed capacity - 2000-2010

In terms of global cumulative installed capacity, the EU leads the way with almost 30 GW installed as of 2010. This represents about 75% of the world's total cumulative PV capacity (up from 70% in 2009). **Japan (3.6 GW) and the USA (2.5 GW)** are some way behind, while **China** has already entered the Top 10 of the world's PV markets and **should reach its first GW in 2011.** China is expected to become a major player in the coming years, and the size of its domestic market so far is only a small indication of its potential.

In terms of market, the EU has developed from an annual market of less than 1 GW in 2003 to a market of over 13 GW in 2010. After the growth seen in 2009, despite difficult financial and economic circumstances, 2010 was expected to show a major acceleration. With a 130% Compound Annual Growth Rate (CAGR), almost matching the 145% growth seen from 2007 to 2008, the PV market has again exceeded all expectations. While Germany remains the leader, with Italy following, many other markets have started to show significant development.

The EU's share of the global market has remained constant for several years. While Japan was for a long time the clear leader, the EU took prime position when Germany's market started to grow under the influence of well-designed FiTs. Since then, the EU has retained leadership without much challenge from other markets. Outside the EU, only Japan and the USA have more than 1 GW of installed PV capacity. While China could reach that threshold quickly, medium-sized markets will take several years to reach the same level of development. This will possibly rebalance the PV market between the EU and the rest of the world to reflect more closely the patterns in electricity consumption.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
China	0	11	15	10	9	4	12	20	45	228	520
APEC	5	5	7	8	10	13	33	59	300	258	473
Rest of the world	88	56	80	77	29	10	118	63	115	130	417
North America	23	31	46	65	92	117	149	212	349	539	983
Japan	112	135	185	223	272	290	287	210	230	483	990
EU	52	94	139	199	707	1,005	983	1,950	5,130	5,619	13,246
Total	**280**	**331**	**471**	**581**	**1,119**	**1,439**	**1,581**	**2,513**	**6,168**	**7,257**	**16,629**

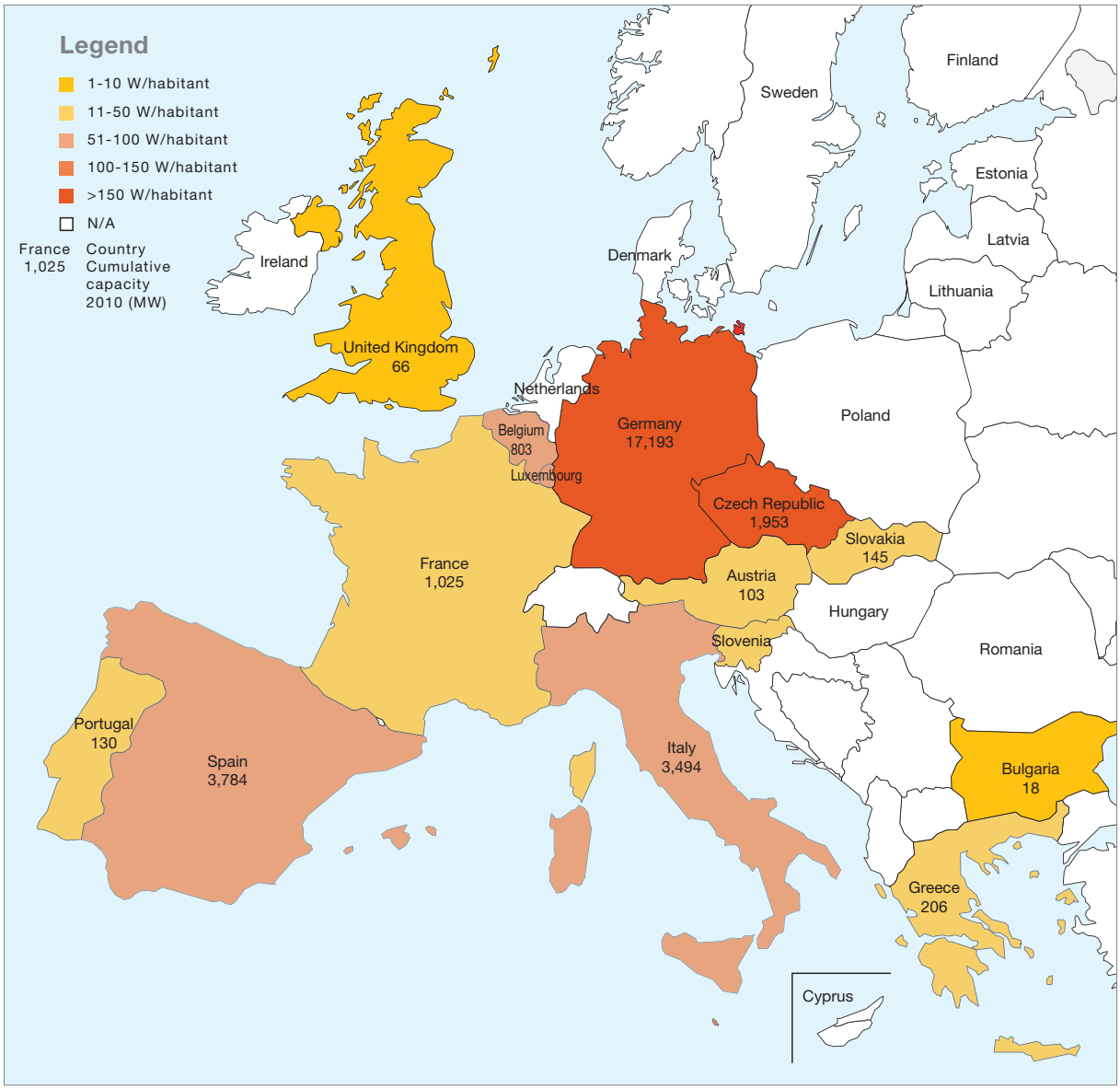
Figure 2 - Evolution of global annual PV market - 2000-2010

The regional balance shows **three main zones developing markets for PV** in contrasting ways. **The EU leads the way, followed by the Asia-Pacific (APEC) region**, following the pace of economic development and wealth. In addition to Japan and China, the APEC region includes South Korea (with a reduced market in 2009 and 2010 compared to 2008), Australia (with more than 300 MW installed in one year), Taiwan and Thailand (where more than 2.5 GW of projects may be built in the coming years)[1]. **North America appears as the third region**, with Canada developing steadily alongside the USA, a huge market with tremendous potential for growth.

Outside these three regions, the Middle East and North Africa (MENA) region represents untapped potential for the medium term. PV also shows great potential in South America and Africa, where electricity demand will grow significantly in the coming years.

1 Given their annual market size and cumulative installed capacity, Japan and China are presented separately from the rest of the APEC region in this document.

3.1.a. EU PV Power Map and world-wide figures



	Market 2009 (MW)	Cumulative 2009 (MW)	Market 2010 (MW)	Cumulative 2010 (MW)	W/habitant
EU					
Austria	20	53	50	103	12.6
Belgium	285	379	424	803	73
Bulgaria	6	7	11	18	2.4
Czech Republic	398	463	1,490	1,953	191.5
France	219	306	719	1,025	15.5
Germany	3,806	9,785	7,408	17,193	211
Greece	36	56	150	206	19.3
Italy	717	1,173	2,321	3,494	60.2
Portugal	55	114	16	130	11.5
Slovakia	0	0	145	145	26.4
Spain	17	3,415	369	3,784	80.5
United Kingdom	10	21	45	66	1.1
Rest of the EU	50	235	98	333	

	Market 2009 (MW)	Cumulative 2009 (MW)	Market 2010 (MW)	Cumulative 2010 (MW)	W/habitant
Japan	483	2,632	990	3,622	28.8
North America					
Canada	62	95	105	200	5.9
USA	477	1,650	878	2,528	8
APEC					
Australia	79	184	320	504	1.6
South Korea	167	524	131	655	13.4
Taiwan	12	10	12	22	1
Thailand	0	0	10	10	0.2
China	228	373	520	893	0.7
Rest of the world					
Brazil	0	0	0	0	0
India	30	102	0	102	0.1
Mexico	0	0	0	0	0
Rest of the world	100	1,325	417	1,742	

Figure 3 - EU PV power map and world-wide figures

3.2. The EU market in 2010 and the forecast to 2015

3.2.a. Current situation in the EU

In 2010, the EU was the world's largest PV market. **With more than 13 GW installed in 2010, its total installed PV capacity surged from 16 to almost 30 GW.** Germany continued to represent more than 50% of it with 7,408 MW installed in 2010, followed by Italy (2,321 MW) and the Czech Republic (1,490 MW). France grew rapidly in 2010, installing 719 MW. After a disastrous 2009, the Spanish market recovered partially, despite adverse conditions, to reach 369 MW. In addition, medium-sized markets progressed in the right direction, with Belgium connecting 424 MW, Greece 150 MW and Slovakia 145 MW. The United Kingdom started to develop in 2010, and while its potential for 2011 may be less than initially expected, it remains one of the most promising markets in the EU in the short term. Other smaller countries appeared on the map or continued their growth, but their relative size (Slovenia, Bulgaria) or overly restrictive local regulations (Austria, Portugal, Switzerland) made them less important for the development of the PV market as a whole.

An unbalanced market in the EU

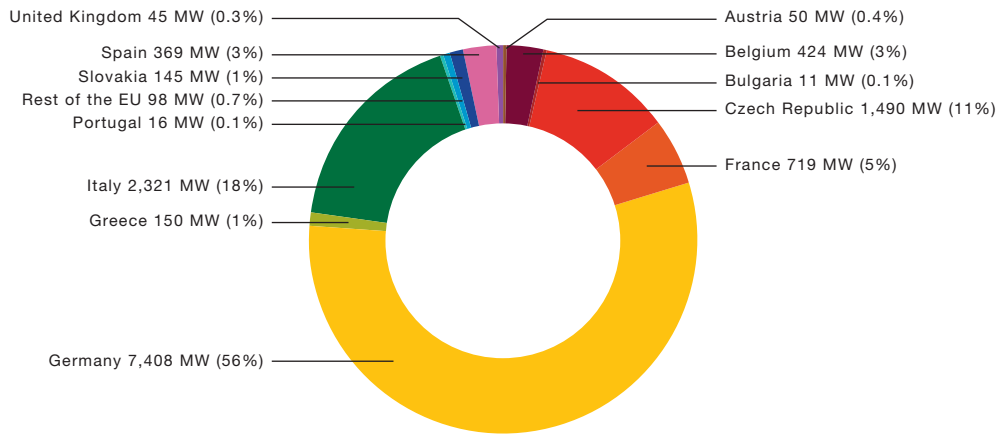


Figure 4 - 2010 EU market share (MW, %)

Germany's 2010 PV market overshadows other European markets. Only Italy, with more than 2.3 GW total capacity, is in the same league. The Czech Republic, however, puts the total PV installed capacity per habitant of the country at the same level than Germany (191 W per habitant in Czech Republic and 211 W per habitant in Germany) at the end of 2010. Given its size, the French PV market remains disappointing while Spain's market competes with Belgium's for fifth place. In total 13.3 GW were installed in the EU in 2010.

3.2.b. Market segmentation in the EU

Part of the wealth of the European PV market is due to its unique market segmentation: **from small residential systems to large ground-mounted installations, PV technologies allow variants for all geographies.**

PV can be deployed in different locations and attract all investors' interest. In some cases, the lack of sustainable support mechanisms, combined with stop and go policies, has prevented balanced market segmentation and homogeneous geographical development. It takes time to build business confidence in PV technology and raise public awareness of its capabilities. As the German example has shown, small and medium-sized installations are driven by private customers for whom confidence in the technology is essential. The examples of Spain and the Czech Republic, both dominated by large players and ground-mounted installations, provide contrast: the clear imbalance between segments has led to a lack of awareness among the population and policy makers.

In the EU, many countries are promoting one or the other market segment according to national specificities and legislation on the use of agricultural land.

Small residential installations can be seen as a possible salvation in countries where the market has collapsed: Spain and the Czech Republic could experience a market rebirth, at least to a certain extent, in this globally untapped market. In France, the moratorium on PV imposed at the end of 2010 spared residential building-integrated photovoltaic (BIPV) systems. The future of small installations therefore remains bright, with the BIPV segment progressing well in both Italy and France.

One million PV installations world-wide. In 2010, PV installations reached the one million mark, thanks to small residential installations. The rapid growth of the residential sector in Germany accounted for much of reaching this target.

Major differences can be observed in the market landscape. For example, while the Czech Republic's fewer than 13,000 installations reached almost 2 GW of PV capacity, in Flanders 96,000 installations accounted for only 700 MW.

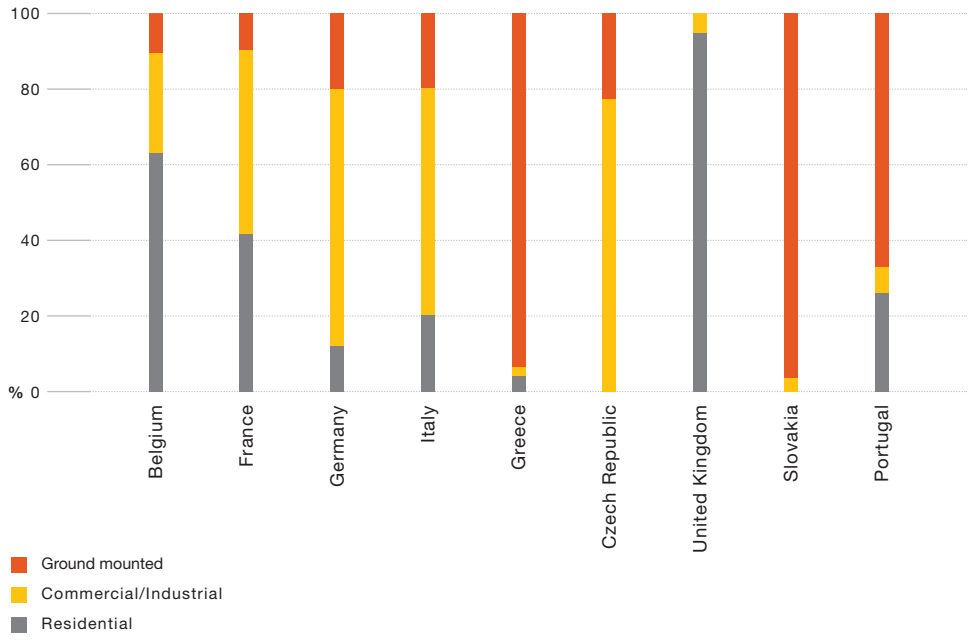


Figure 5 - EU PV market segmentation

The figure above represents estimates for market segmentation. Today no standard classification of market segments exists and the numbers collected in different countries often depend on the way their tariffs are structured.

3.2.c. PV electricity production in the EU

With a production capacity of 30 GW installed in the EU, PV generates today over 35 TWh of electricity. While countries like Belgium produce a mere 900 kWh per kW of installed capacity every year, in 2010 Spain produced more than 6.3 TWh of PV electricity in the summer with about 3.5 GW installed capacity (the latest installations contributed only marginally to the production in 2010). Italy produced 1.7 TWh last year and France around 0.6 TWh. **The largest producer remains Germany with 12 TWh produced in 2010.**

Based on these numbers, the production from existing power plants should amount in a complete year to about 35 TWh for the entire continent. This represents 1.2% of the EU's electricity demand. In the Policy-Driven scenario, around 15 to 20 TWh could be produced additionally each year until 2015, adding 0.5 or 0.6% of PV to the generation mix in the EU every year.

If this rate continues, by 2020 more than 6% of total demand could be provided by PV, as forecast by the Accelerated Growth scenario of the EPIA SET For 2020 Report[2]. To reach the 12% target forecast by the Paradigm Shift scenario (see below the chapter on 2020 European PV targets) by the same date would require an additional 1% of PV in the total electricity production mix every year until 2020. In terms of energy produced (based on expected growth in energy demand) this represents around 40 TWh of additional PV production each year for the next 10 years. This would mean an average yearly market for PV of 35 GW, in comparison with the current annual market of 13 GW.

3.2.d. The leading renewable energy technology

In 2010, PV was the leading renewable energy technology in terms of capacity growth in Europe. **With 13.3 GW installed in 2010, compared with 9.3 GW for wind, PV was second only to gas power plants.** The total installations for gas amounted to between 15.7 GW and 28 GW, according to the source considered. The truth looks probably to be in between, around 18 to 22 GW, depending on the methodology and sources. This represents a major increase in comparison with 2009, but it also shows that even if PV reached high levels of installations in 2010, the road to a carbon-free power generation mix is still a long way off.

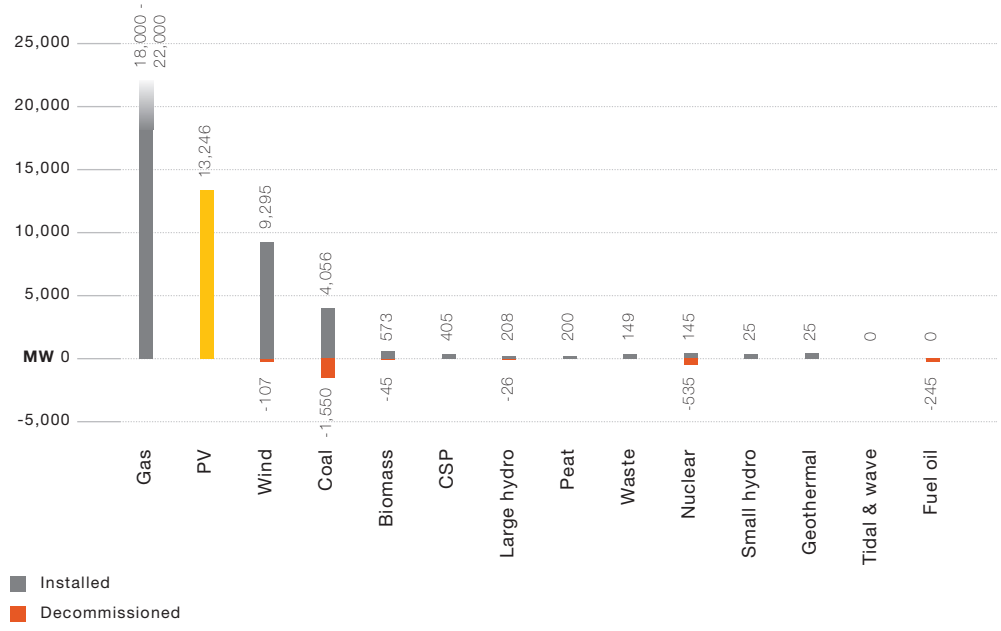


Figure 6- Power generation capacities added in 2010 in EU 27

It is possible to question whether that increase in gas installations is linked to the increase in the use of variable electricity sources such as PV and wind. Today, however, investments in the electricity sector are driven more by strong financial business cases than network stability considerations. We therefore consider that there is a global trend currently pushing investors to redirect investments into gas and renewables rather than coal and nuclear.

In addition, the number of coal power plant projects cancelled in 2010 results directly from the increase in investments in renewables, reducing the need for any additional capacities that are insufficiently flexible to integrate in tomorrow's power generation mix. The other renewables are also progressing, but without reaching the high levels that PV and wind reach.

3.2.e. Scenarios by country

The countries below represent the EU PV markets with the highest potential today mainly thanks to regulatory frameworks that have fostered their development. Both the Moderate and Policy-Driven scenarios as well as the intermediate target for 2015 of National Renewable Energy Action Plans (NREAPs) have been considered.

- **Germany**

In 2010 Germany was again the country setting the global PV pace with 7.4 GW installed and a national target of 51 GW for 2020. With the lowest PV system prices on the market and FiTs also among the lowest (an average €0.26 per kWh produced), Germany continues to attract investors.

The debate on the reduction of Feed-in Tariffs in 2010 resulted in a twofold decrease: by 13% on 1st July and 3% on 1st October. A further decrease in January 2011 reduced Germany's FiTs to much lower levels in comparison with other EU countries. The "corridor" concept, which allows the adaptation of the level of FiTs according to market growth, will continue to be applied. This may lead to a further 3 to 15% decrease in FiTs in mid-2011. The 2012 cut will range from 1.5% to 24% depending on market growth.

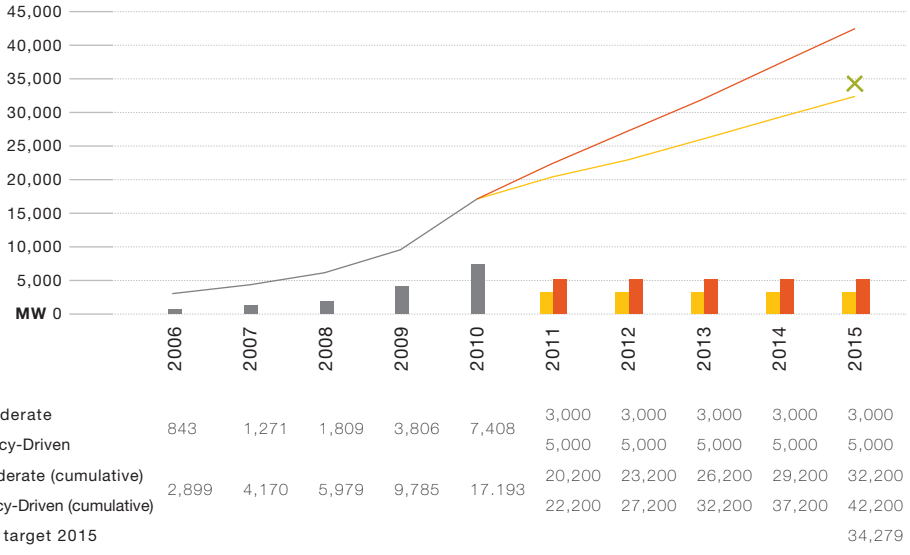


Figure 7 - Germany

With more than 17 GW of PV systems connected to the grid, Germany is now considering self-consumption as a way to decrease the cost of FiTs for electricity consumers and smooth the integration of PV systems into the grid. With an additional incentive up to €0.08 per kWh above the FiT, applied on the amount of electricity that is self consumed, this new complementary measure makes the scheme attractive and may help people modify their behaviour as consumers. Incentives are tuned to favour high self-consumption percentages (more than 30% of the total consumption gives right to the higher premium).

The decision in 2010 to halt the FiT for ground-mounted installations on agricultural land has not significantly changed the balanced market segmentation in the country, where almost all segments are represented, except BIPV systems.

After a slow start of the market during the first quarter (Q1) of 2011 mainly due to winter conditions and the long debate on support schemes in Germany, the market could take-off rapidly in Q2 and after, pushing the market in 2011 towards 3 to 5 GW.

• Italy

2010 was a year of massive growth for the Italian PV market. The final numbers are yet subject to interpretation, and the future of the PV market remains unclear; The Italian government's decision to put in place a new regime for installations connected after 31st May 2011 has created significant market uncertainty. The reason was to keep the costs borne by electricity consumers financing the FiTs below a to-be-defined threshold, in a context where the decreases in FiTs, foreseen for the year 2011 and 2012 by the Third Conto Energia, appear insufficient if related to the cost decline of PV.

Amid confusion about effective numbers, the market has been estimated to reach as high as 6 GW of installations. **As of end 2010, however, only 2.3 GW had been effectively connected to the grid.**

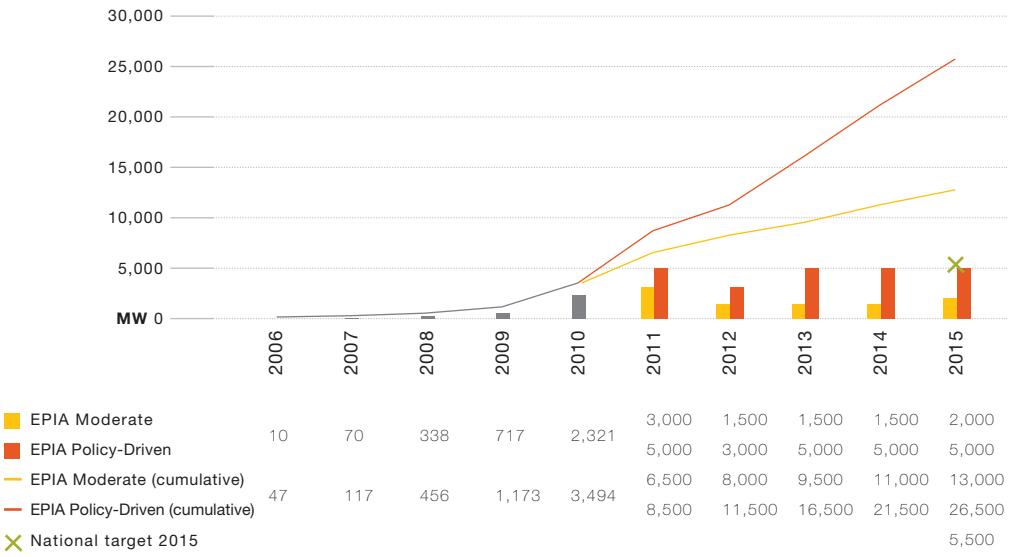


Figure 8 - Italy

In 2011, the total amount of installations is expected to range from 3 to 5 GW. Between 2 and 3 GW of projects installed during 2010 will probably be connected before June 2011 (following the "Salva Alcoa" decree). Around 800 MW are foreseen to be installed under the Third Conto Energia until 31st May 2011. It is difficult to predict what additional capacity will be connected under the Forth Conto Energia applicable from June 2011 onwards.

The numbers for the years 2012 to 2015 are unpredictable. The government may want to channel the future annual PV capacity additions to some 2 GW, but it remains to be clarified as to whether this goal would be achieved through caps or targets, the latter requiring well-designed, corridor-based regulations.

• Czech Republic

With 1,490 MW connected last year, the Czech Republic was the third largest PV market world-wide in 2010, mainly driven by an overly generous FiT scheme. This unsustainable growth has triggered a strong reaction from the Czech government and grid operators.

In addition, in February 2010, the publicly owned Czech transmission system operator CEPS asked the main distribution operators to stop permitting all new renewable energy plants due to the potential risk of grid instability. This moratorium was still in place at the beginning of 2011 despite many promises and will not be abolished until a vote for improved legislation takes place in September 2011. In October 2010, the legislation was amended to suppress all FiTs for ground-mounted systems on agricultural land and for systems above 30 kW from 1st March 2011. In November 2010, the Parliament removed the possibility of exemption from income tax for five years for all producers of renewable electricity. It introduced a 26% retroactive tax on benefits generated by all PV installations over 30 kW, applicable to systems installed in 2009 and 2010 and payable in 2011, 2012 and 2013.

A new revision of FiTs is foreseen for 2012. In parallel, the new legislation under preparation, which is likely to impose an obligation of remote supervisory control for installations of over 100 kW, strengthens the permit procedure for systems over 1 MW, sets a FiT ceiling at CZK6,000 (€248) per MW and creates new requirements for the recycling of PV panels.

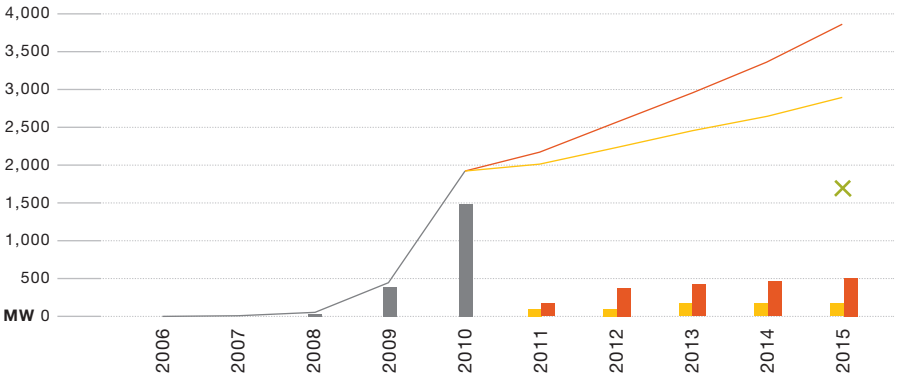


Figure 9 - Czech Republic

In terms of volumes for the coming years, the Czech Renewable Energy Action Plan has set a limit for PV at 1,695 MW by 2020, which may already have been surpassed today. EPIA therefore expects the market to stagnate at around 200 MW in the coming years. A 3.9 GW cumulative installed capacity by 2015 is envisaged under a Policy-Driven scenario if grid stability concerns are lifted but this prospect remains far from the current reality.

The Czech situation represents an example of what should be avoided, with FiTs allowing for a too high rate of return on investment, thus leading to unsustainable market development over several years. It also highlights that the PV industry should be able to take part in the debate about grid stability issues, notably at the distribution level.

• France

With **719 MW connected to the grid last year**, the French PV market has finally shown the progress many have been expecting for several years (around 100 MW of the total came from 2009 installations that were connected in 2010). This good news was tempered by a series of changes in the regulatory framework and the brutal decision to halt installations. As seen in other countries, the high profitability resulted in many PV projects being submitted following the French authorities' declared intention to reduce FiTs. The sudden boom led the Prime Minister to declare in December 2010 a three-month moratorium on demands for new PV installations above 3 kW and a suspension of projects awaiting grid connection.

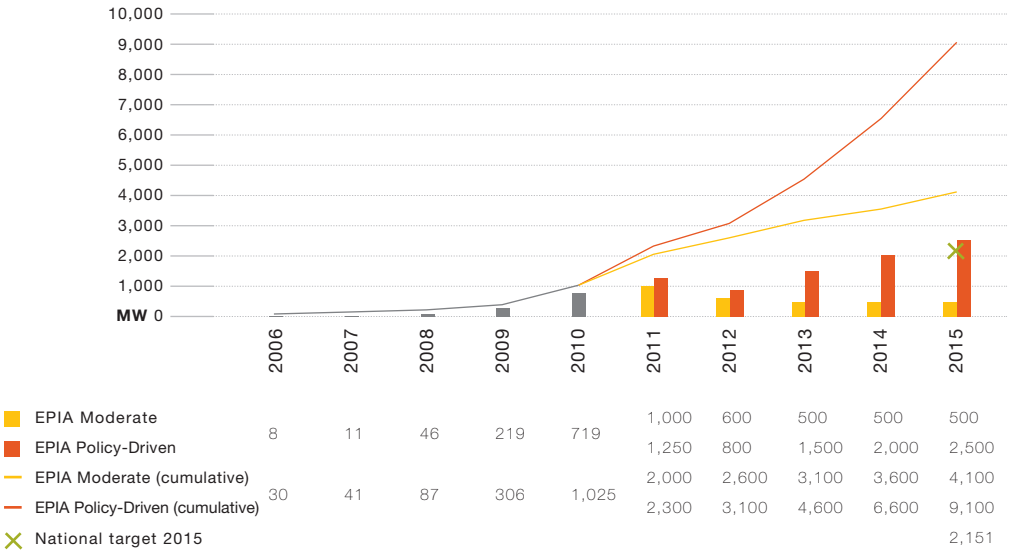


Figure 10 - France

A series of consultations with different French PV stakeholders were conducted during this three-month period. On 5th March 2011, two decrees were published in the French Official Journal - the first repealing the current regulatory framework and the second setting up new conditions for the purchase of electricity produced by PV systems.

Under this new regime, systems of up to 100 kW will receive a significantly reduced FiT (down by 20%), which differs according to the type of building, the type of integration and the size of the system. For systems of over 100 kW on buildings and for ground-mounted installations, tendering mechanisms will be set up, with conditions that should be defined by mid-2011.

Moreover, a very strict "cap/corridor" system has been put in place with annual objectives per market segment: 100 MW for residential BIPV systems and 100 MW for non-residential BIPV. The mechanism used to adapt quarterly volumes is so strong, however, that it is hard to believe these objectives will be surpassed. For systems larger than 100 kW, a tendering system has been put in place with a 300 MW yearly cap.

All these recent developments have led EPIA to forecast an annual market of 500 MW by 2015 under the Moderate scenario, which is higher than the NREAP objective. Given the number of projects submitted before the moratorium, the market might still be large in 2011, at around 1.25 GW. This number reflects projects already granted, while new projects this year may be limited to only 200 MW.

The current uncertainties about the calendar and the conditions under which calls for tenders will be conducted may, however, further limit the number of large systems and ground-mounted installations in 2011.

Progress will be reviewed in mid-2012, which could result in an increase in the annual objective to 800 MW. In the meantime, 2012 presidential and parliamentary elections might also influence the development of PV in France. EPIA therefore considers that under a Policy-Driven scenario, the annual market could reach up to 2.5 GW by 2015, representing a cumulative capacity of 9.1 GW.

In the coming years, the French market will probably continue to be characterised by the particular importance given to BIPV applications. As recently pointed out by the debate on local job creation, public authorities will also seek additional solutions in order to favour the development of the PV industry in France.

• Belgium

The Belgian market's division into three regions is only one of the country's specificities; it is also the only successful market in the EU that uses Green Certificates instead of FiTs. In Flanders, the Green Certificate scheme can be compared to a FiT, but in Brussels and Wallonia, the price of these certificates is defined by an exchange market. In addition a net-metering scheme and tax rebate exist for residential installations at the national (or federal) level.

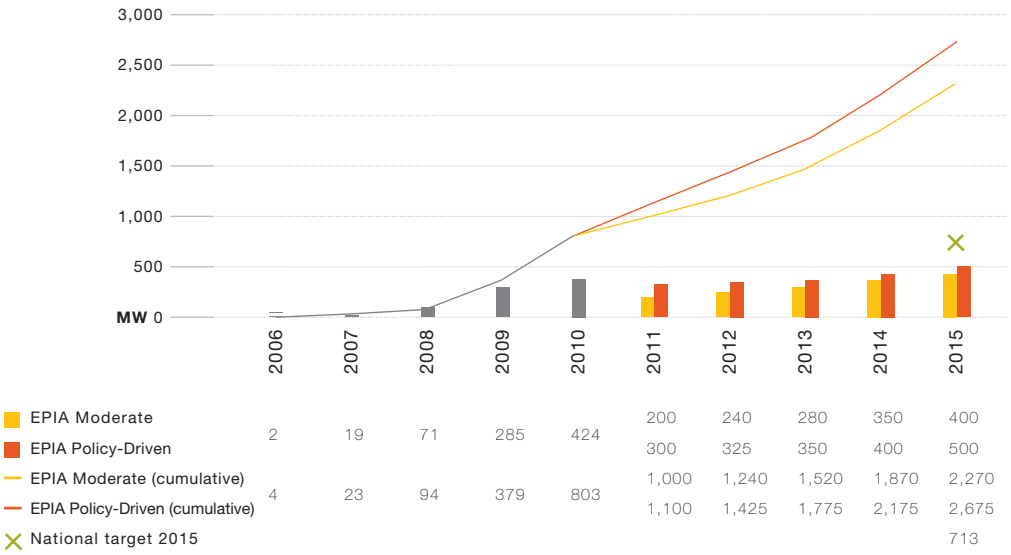


Figure 11 - Belgium

While Flemish PV development has spread in all market segments, the Walloon market remains largely residential as a consequence of political choices made so far. Changes in 2010 brought the market in Flanders down to a more reasonable level. While the numbers show an increase in 2010 compared to 2009, a large part of installations made in 2009 in Flanders were connected only in 2010, artificially inflating the 2010 market figures. The country now has **more than 800 MW of installed capacity**, with slightly more than 700 MW in Flanders, 90 MW in Wallonia and the rest in the region of Brussels.

The market from 2011 onwards should remain at around 200 to 300 MW. While development in Flanders is likely to accelerate without policy changes, the potential in Brussels and particularly Wallonia will depend on the future of support schemes. Some of these may well be adapted during 2011.

• Spain

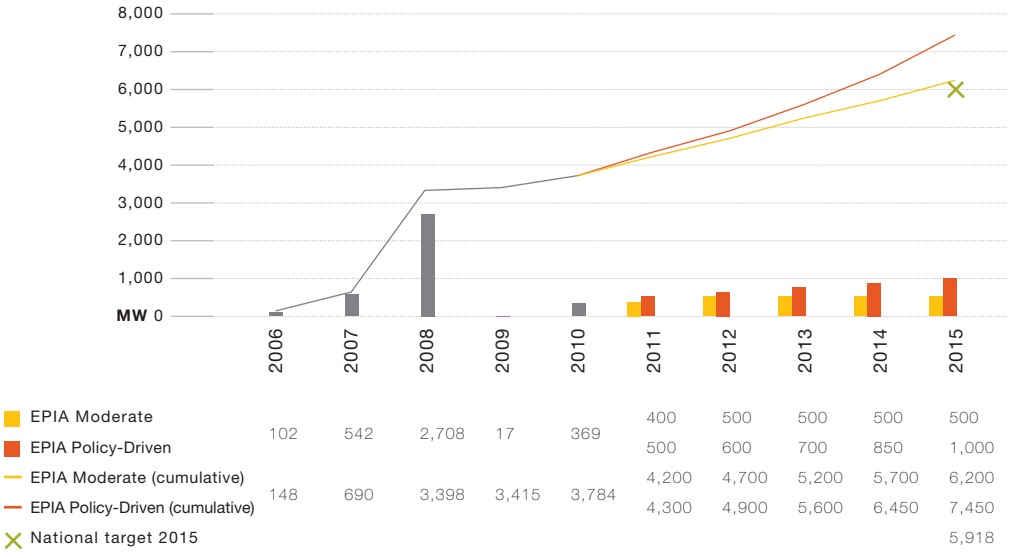


Figure 12 - Spain

After a hectic year in 2009 (123 MW of PV modules were traded this year, out of which only 17 MW were actually installed and connected to the grid) with strong adverse lobbying and possible retroactive legislation measures, **about 370 MW were installed in 2010** (286 MW traded this year) out of the total of 500 MW permitted by the cap.

The situation of PV in Spain is very specific. With limited possibilities for the export or import of electricity, the power sector faces a situation of theoretical overcapacity. In recent years, several tens of GWs of wind power and gas power plants have been installed, alongside almost 4 GW of PV. **Today, PV supplies about 4% of the electricity demand in summer and 1% in winter**, reaching as high as 15% in summer for some regions such as Extremadura and Castilla-La-Mancha.

This puts a serious constraint on the future market in Spain if policies remain unchanged. The recently published NREAP sets a target of 8.7 GW of PV installed capacity by 2020, which translates into an annual market of 300 to 400 MW to 2016, enforced by the 500 MW cap.

Under the current regulation (Royal Decree 1565/2010 and Royal Decree-Law 14/2010) the future remains unclear, establishing important tariff reductions, especially for the ground-mounted installations segment. The new system basically allows for the development of a roof-top PV market only. The major setback, however, has been the introduction of a limit (for the next three years) on the number of hours for which the producer will receive the full tariff. This limit affects retroactively all plants installed under the previous royal decree. The number of hours depends on whether the PV modules are using a tracking system or not. From 2014 onwards, this limit will be set according to geographical location.

If the cap is reviewed the potential of PV in Spain remains quite high, even in the coming years, but this will depend on political choices. One step in that direction could be the development of a "net-metering" scheme, probably out of the annual cap.

- **Greece**

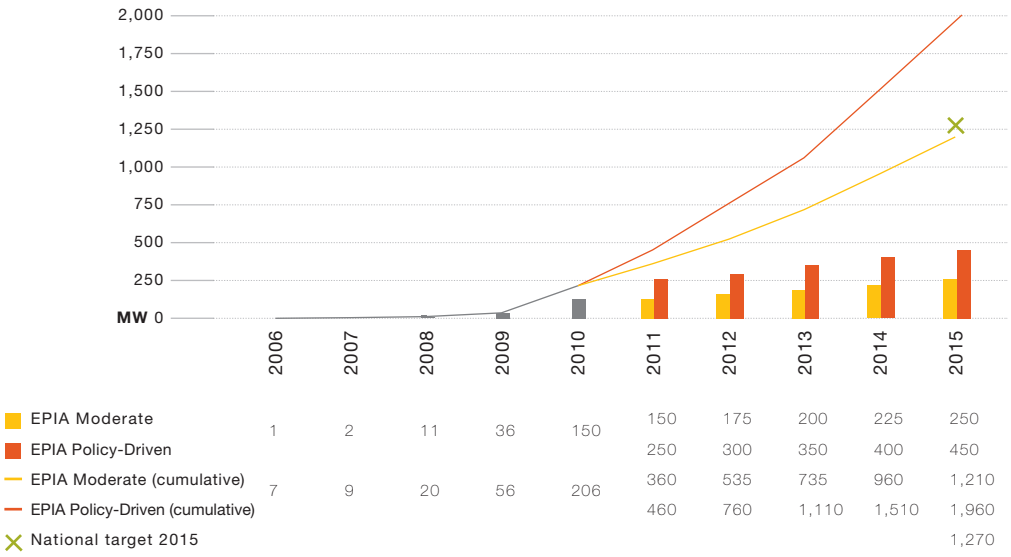
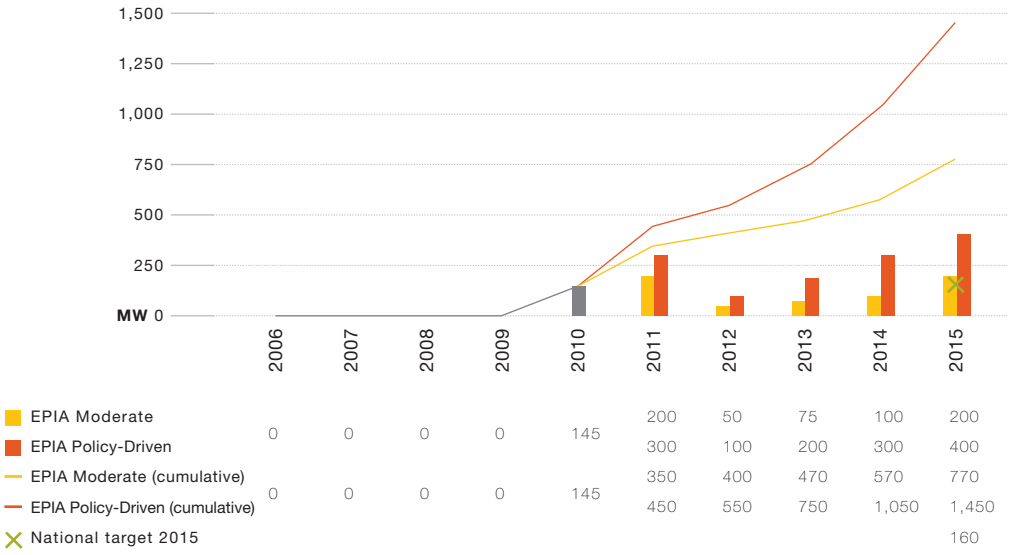


Figure 13 - Greece

Despite a generous FiT, until recently the market in Greece has been constrained by heavy administrative procedures. 2010 saw a major improvement in that field leading to long-awaited market development last year, with **150 MW installed and connected to the grid**. Five years after the introduction of FiTs, the Greek market is progressively taking off and the annual installations for the year 2011 may be around 250 MW. The government set a target of 2.2 GW installed capacity by the year 2020 (through the EU-mandated NREAP) and an intermediate target of 1.27 GW by the year 2015. The residential segment is gaining market share and from 4% in 2010 it will probably represent 10% of the market in 2011. The FiT level is quite high but this could be explained by the need to compensate the complex administrative procedures and high bank interest rates. The main specificity of the Greek PV sector is the existence of local manufacturers who contribute to job creation in the country and, to a certain extent, the willingness of the main power utility company to invest in PV (it is planning a new 200 MW plant).

• Slovakia

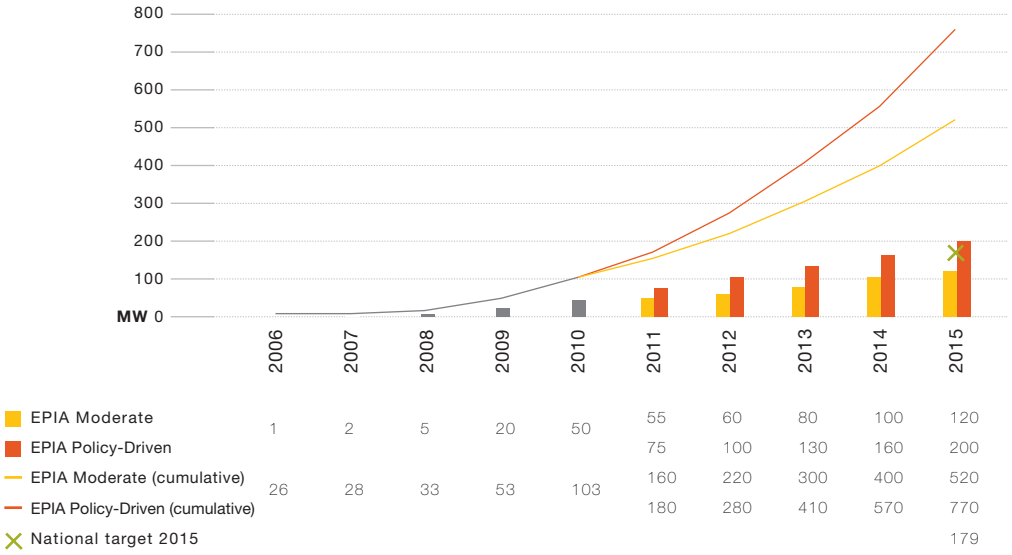


	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
EPIA Moderate	0	0	0	0	145	200	50	75	100	200
EPIA Policy-Driven						300	100	200	300	400
EPIA Moderate (cumulative)	0	0	0	0	145	350	400	470	570	770
EPIA Policy-Driven (cumulative)						450	550	750	1,050	1,450
National target 2015										160

Figure 14 - Slovakia

The market in Slovakia experienced unexpected growth in 2010 that could continue in 2011, with a market estimated at between 200 and 300 MW. Recent changes in legislation, however, including a significant reduction in the FiT to €0.26/kWh and the removal of support to systems above 100 kW from mid-2011, are likely to alter market growth from 2012 onwards.

• Austria



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
EPIA Moderate	1	2	5	20	50	55	60	80	100	120
EPIA Policy-Driven						75	100	130	160	200
EPIA Moderate (cumulative)	26	28	33	53	103	160	220	300	400	520
EPIA Policy-Driven (cumulative)						180	280	410	570	770
National target 2015										179

Figure 15 - Austria

Despite its well-developed PV industry, Austria remains an untapped market. For years, it has been limited by fixed annual budget caps. Various support measures exist at national and regional levels, the main being the national FiT, which is granted for 13 years. It is constrained by a cap on annual expenses, however, that cannot exceed €2.1 million. Through the Climate and Energy Fund some projects are financed each year at country level using bidding procedures. Some grants are also allocated for both on- and off-grid applications.

In spite of its high potential, the market will remain small unless the cap is lifted soon. This alone could ensure a strong PV development in Austria.

• United Kingdom (UK)

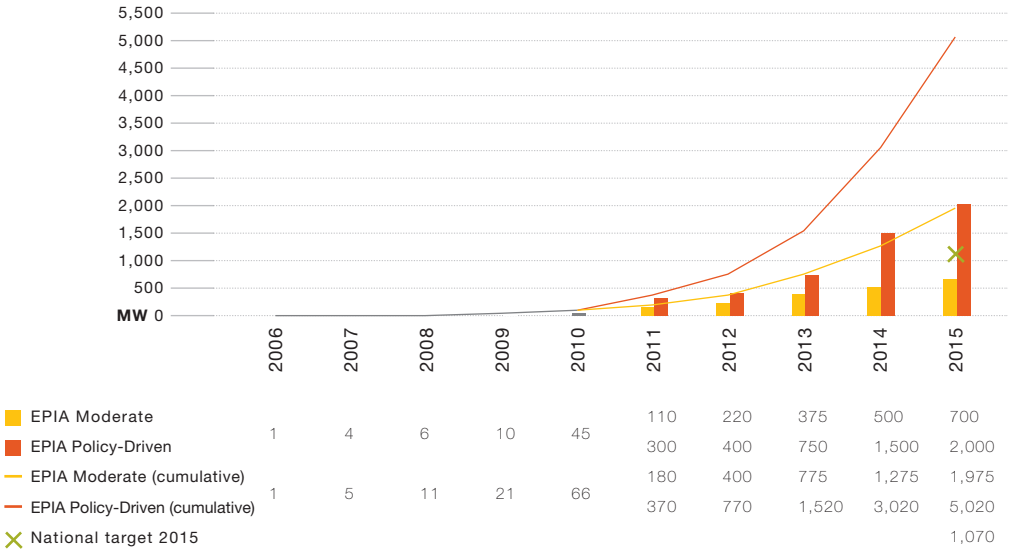


Figure 16 - United Kingdom

The market growth observed in 2009 was confirmed in 2010, with 45 MW installed last year, in line with EPIA's Policy-Driven scenario. However, the UK government has decided to review the new FiTs introduced in 2010 earlier than expected for PV installations over 50 kW. The new proposed rates (£0.19 per kWh for 50 kW to 150 kW systems, £0.15 per kWh for 150 kW to 250 kW systems, and £0.085 per kWh for 250 kW to 5 MW systems and stand-alone installations) that are under public consultation until 6th May 2011 are significantly lower than before. They could be effective from 1st August 2011.

The residential rooftop market, which makes up 95% of installations today, will remain unaffected. The domestic segment will therefore continue to be, together with social housing, a main driver of the UK market, with strong development already observed in the first months of 2011.

In parallel, a separate comprehensive review of FiTs is now under way, with the aim of improving the efficiency of the system and delivering £40 million of savings in 2014-2015. Tariff levels are supposed to remain unchanged until April 2012.

EPIA expected the yearly market to grow steadily in the coming years, reaching between 700 MW in a Moderate scenario and 2 GW in a Policy-Driven scenario by 2015. The new policies could affect these scenarios and delay the market take-off in the UK.

• Portugal

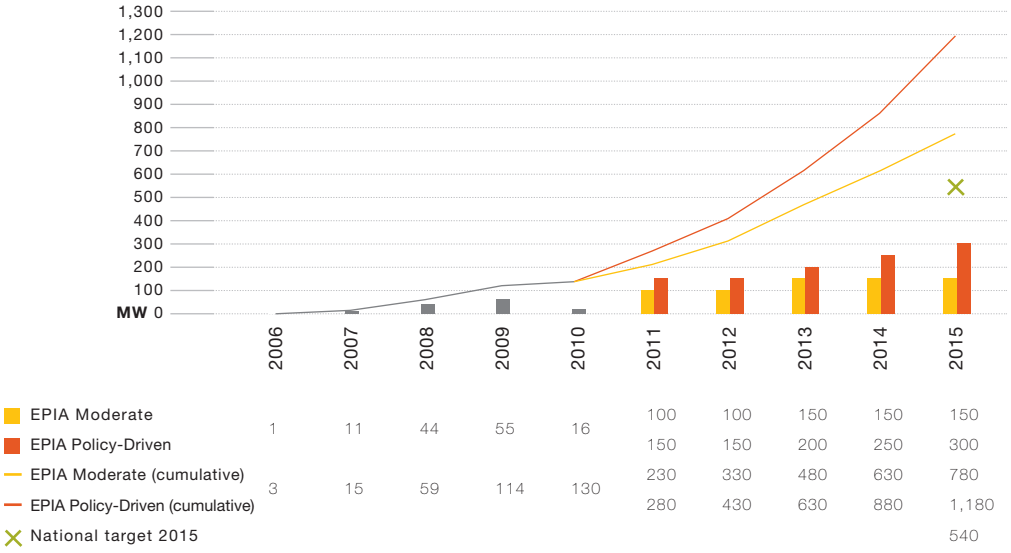


Figure 17 - Portugal

Although Portugal is one the sunniest EU countries, its PV market has remained low for years, constrained by policies in place. **PV cumulative capacity is just below 130 MW and only 16 MW were installed in 2010**, less than half the size of the market in 2009. Moreover, all installations last year were based on projects approved during 2009.

Some changes are in sight, as the current legislation (in place since October 2010 for very small residential systems and since March 2011 for medium-sized systems) is finally providing a stable regulatory environment. The introduction of a FiT for 15 years should increase investors' confidence, although the FiT will be subject to a decrease of 7% every year. Here also, a system of multiple caps, with a cap of 20 MW a year for small systems and 50 MW a year for medium-sized systems, will limit any further market growth. Additionally, the government announced in November 2010 a call for tender to finance up to 75 PV plants of 2 MW capacity each, and 5 Concentrator Photovoltaics (CPV) plants of 1 MW, making a total additional capacity of 155 MW. A new call for tender may be published in 2013, but its size is still uncertain. Officially, the government is taking this approach in order to integrate PV into the existing grid where it is most needed, and where it does not represent a major challenge in terms of network integration.

• Bulgaria

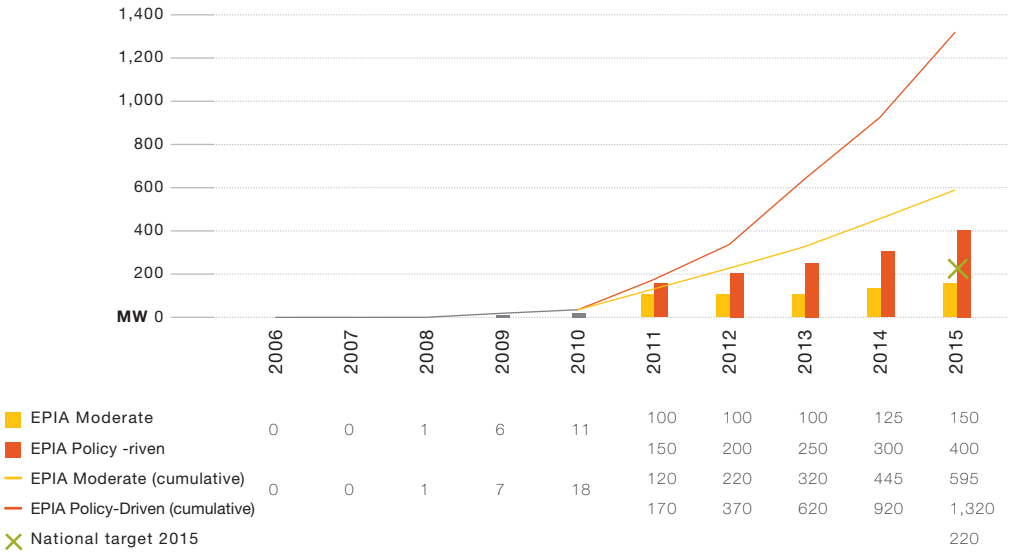


Figure 18 - Bulgaria

The Bulgarian market has yet to develop. A new *"Renewable Energy Act",* to be approved in the first half of 2011, could provide favourable conditions for PV investments and this may allow the market take-off. If this happens, the high level of the FiT could trigger up to 200 MW of installations this year. Such a rapid growth could harm future development, however, as has been seen in several countries previously.

As of April 2011, the FiT level may be fixed for the next 25 years, a major change from the current rule which foresees annual decreases for existing projects. Also, the procedure for funding rooftop applications between 30 kW and 1 MW could be simplified. As in the Czech Republic, the regulator intends to establish annual caps for the amount of new renewable energy capacity permitted to be connected to the grid, based on the estimated capacity of the electricity network to integrate it. Moreover, a grid connection fee could be introduced.

In summary, the PV market in Bulgaria is biding its time. It has good potential which remains to be developed.

• Rest of the EU

As more markets develop, the remaining countries are mainly composed of northern and eastern EU Member States where the PV market is either low or non-existent.

Slovenia installed 27 MW in 2010, which is a good market level for a population of 1.9 million. Other markets remain either small or are unlikely to add much to the EU PV market in the future. Of these, Poland, Romania and Hungary remain untapped.

In the North, although grid parity has almost been reached in Denmark without using incentives (by using the existing net-metering scheme instead), the prospects of a huge PV market developing are at least a decade away.

3.2.f. EU forecasts for PV until 2015

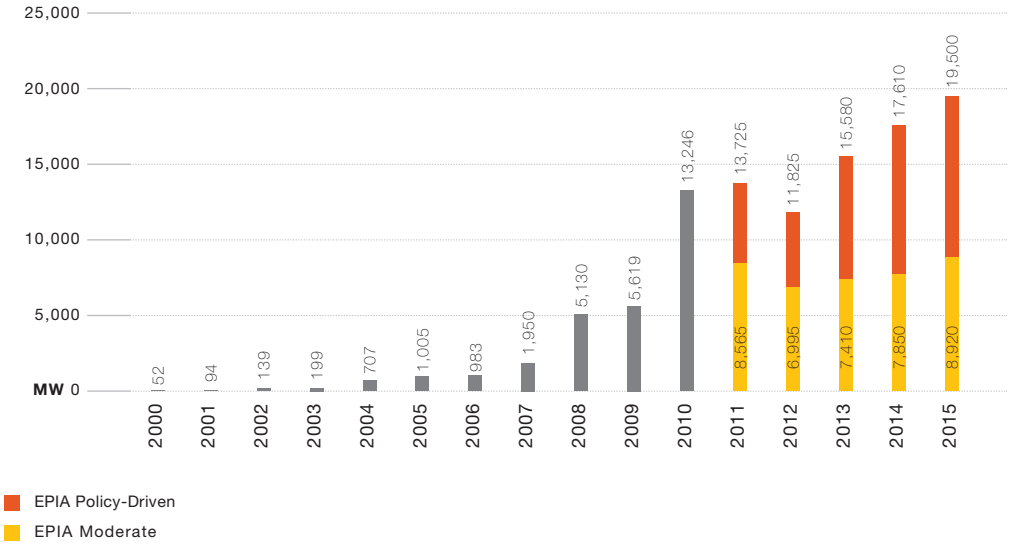


Figure 19 - European annual market scenarios - Moderate and Policy-Driven

The major growth experienced by the EU market last year is unlikely to be reproduced in the coming years. This can be explained most easily by the opposition to PV in many countries, including some of the most promising markets.

EPIA expects the market to at best stabilise in the EU in 2011 and 2012 before recovering in 2013.

3.2.g. Reaching 2020 targets

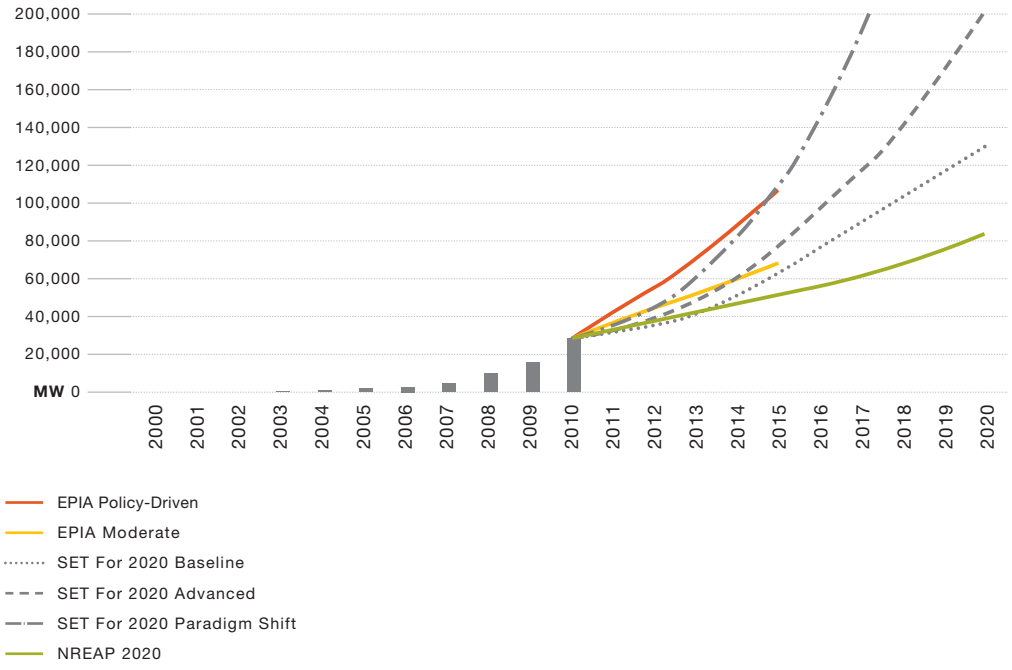


Figure 20 - Market forecasts compared to 'SET For 2020' targets and NREAPS

2010 was the year of the National Renewable Energy Action Plans (NREAPs) in Europe. Although the NREAPs have imposed to the Member States to think about the share of renewables in their national energy portfolio, compared to the PV industry targets, they do not constitute a real lever for wide market deployment. So far the total installed capacity expected from the NREAPs in the EU amounts to 84.38 GW.

The following table compares the cumulative installed capacity at the end of 2010 in the most advanced EU PV markets, the market level in 2009 and 2010 and the necessary yearly market to reach the 2020 target (linear projection).

	Cumulative installed capacity in 2010 (MW)	NREAP target for 2020 (MW)	Necessary market until 2020 (MW)	Target reached in	Market 2009 (MW)	Market 2010 (MW)
Austria	103	322	22	2013-2014	20	50
Belgium	803	1,340	60	2012-2013	285	424
Bulgaria	18	303	29	2013-2014	6	11
Czech Republic	1,953	1,695	N/A	2010	398	1,490
France	1,025	4,860	385	2013-2015	219	719
Germany	17,193	51,753	3,460	2017-2020	3,806	7,408
Greece	206	2,200	200	2017-2020	36	150
Italy	3,494	8,000	440	2011-2012	717	2,321
Portugal	130	1,000	84	2016-2020	55	16
Slovakia	145	300	16	2011	0	145
Spain	3,784	8,367	460	2016-2020	17	369
United Kingdom	66	2,680	260	2014-2015	10	45
Rest of the EU	333	1,561	125	by 2020	50	98

Table 1 - EU cumulative installed capacity and annual market compared to NREAP targets

The SET For 2020 Report, released by EPIA in 2009, identifies three possible PV deployment scenarios by 2020 that represent the real potential of the technology.

The **Baseline scenario** envisages a business-as-usual case with 4% of the electricity demand in the EU provided by PV in 2020.

The **Advanced scenario** with PV meeting 6% of the demand, is based on the maximum PV growth in the EU that is possible without major changes to the electrical infrastructure.

A third case, where the assumption is that all barriers are lifted and specific boundary conditions are met, is called the **Paradigm Shift scenario.** This foresees PV supplying up to 12% of the EU electricity demand by 2020.

EPIA has compared the PV market forecasts until 2015 against these three scenarios with the following results:

- The Moderate scenario for PV until 2015 looks to be aligned with the 4% target (SET For 2020's Baseline scenario). This represents an improvement from previous EPIA forecasts which estimated that growth under the Moderate scenario would not quite reach the 4% target by 2020. Thus, it looks reasonable to expect that 4% penetration for PV could be reached even in the low growth case.
- The Policy-Driven scenario for PV until 2015 lies quite close to the Paradigm Shift scenario for 2020. However, the growth required after 2015 to reach 390 GW in the EU by 2020 would have to be stronger than the growth forecast for 2014 and 2015. While the Advanced scenario of reaching 6% by 2020 looks coherent and easily reachable from the Policy-Driven scenario until 2015, to reach 12% would require a real Paradigm Shift in the way PV is supported and incentivised, even after grid parity is reached in many countries and market segments.

In addition, NREAPs have downplayed the possible future of the PV market for different reasons: apart from Germany and Greece, market evolution could easily overtake the action plans. Future expectations largely reflect the current balance of installations, with Germany dominating the market.

In the EU forecasts, the NREAPs targets for 2015 have been taken into account. The extent to which they have underestimated the market developments in 2009 and 2010 has rapidly become obvious.

EPIA believes today that the potential for 2020 is at least twice as high as the levels foreseen in the NREAPs, pushing towards 200 GW capacity or even more in the EU by 2020. The coming revisions of the action plans will have to take into account the very fast increases in installations over the last year.

3.2.h. Support schemes in the EU

	Political Support Environment	General Political support situation
Austria	Some lack of visibility on PV policies. Existing cap limits the market growth.	
Belgium	Some lack of visibility on PV policies. Risk of political reaction if market surges again. Improving administrative process.	
Bulgaria	Complete lack of visibility on PV policies, combined with strong adverse lobbying from conventional stakeholders. Heavy and slow administrative process.	
Czech Republic	Clear FiT evolution in 2011. Strong adverse lobbying from conventional stakeholders, including grid manager. Retroactive law passed in 2010. Grid operator is blocking any new permits.	
Denmark	No FiT but net-metering and high electricity prices: grid parity for residential systems is virtually reached.	
France	Clear FiT evolution in 2011. Strong adverse lobbying from conventional stakeholders. Temporary revision of the FiT in 2011 leading to a complex scheme. End of moratorium. Heavy and slow administrative processes keeping prices artificially high.	
Germany	Clear FiT evolution in 2011. Intermediate measure taken to avoid market to surge again. Willingness to control market within defined ranges. The simple and lean administrative framework can be bettered.	
Greece	Clear FiT evolution in 2011. Risk of late political reaction if market surges. Improving administrative process framework but long road to reduce costs and lead time.	
Italy	Clear FiT evolution in early 2011, no visibility from June 2011. Willingness to limit development to control cost. Improving administrative process but long road to reduce costs and lead time.	
Netherlands	FiT (paid by taxpayers) was cancelled.	
Portugal	Clear FiT evolution in 2011 for small market segments. Improving administrative process. Existing cap limits the market growth.	
Slovakia	Some lack of visibility on PV policies, combined with adverse lobbying from conventional stakeholders, including grid manager. FiT reduced in 2011. Risk of late political reaction as market has surged.	
Slovenia	Clear FiT evolution in 2011. Improving administrative process.	
Spain	Clear FiT evolution in 2011. Issues to be solved regarding market segmentation within the cap. Risk of retroactive law reduced. Heavy and slow administrative process.	
United Kingdom	Unclear FiT evolution in 2011. Strong political reaction in 2011 led to new scheme not favorable to all segments.	

Table 2 - EU support schemes assessment

3.3. World market in 2010 and evolution until 2015

3.3.a. Global situation

While the EU has dominated the world market for years and may continue to do so, the rest of the world has clearly the biggest potential for growth. PV makes economic as well as environmental sense and is a sustainable solution to the energy needs of the "Sunbelt" countries around the Equator. In these countries, PV can already compete with diesel generators for peak power generation without policy support. Driven by local and global energy demand, the fastest PV growth is expected to continue in China and India, followed by South-East Asia, Latin America and the MENA countries. **The PV potential of the Sunbelt countries could range from 60 to 250 GW by 2020, and from 260 to 1,100 GW in 2030, representing 27% to 58% of the forecast global installed PV capacity by then.**

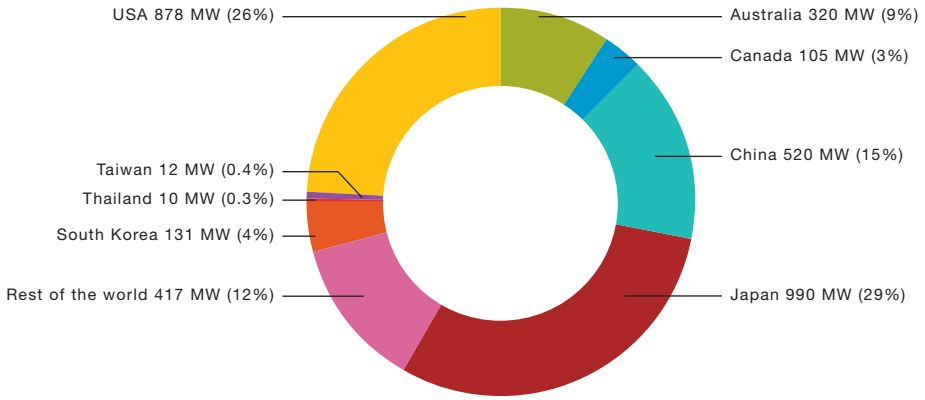


Figure 21 - 2010 market share outside EU (MW, %)

While small in comparison to the EU, the rest of the world accounts for a 3 GW market for PV. Japan and the USA approached the gigawatt mark in 2010 and are expected to continue growing in 2011 (although the situation in Japan could alter or delay the PV market). Australia and Canada are expanding fast, while China remains difficult to estimate as it continues to develop.

The total installed capacity shows greater contrasts. The development of the market elsewhere in recent years has not yet caught up with the existing installations in Japan and the USA.

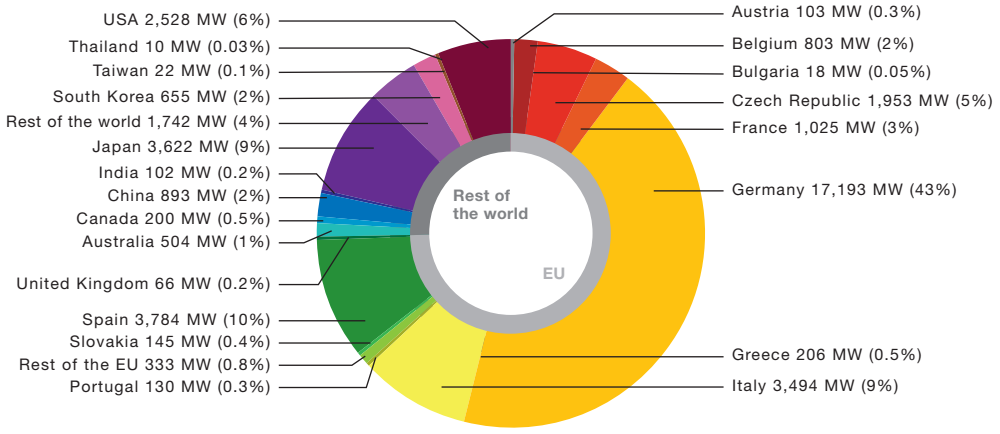


Figure 22 - 2010 global cumulative installed capacity share (MW, %)

3.3.b. Scenarios by country

- **USA**

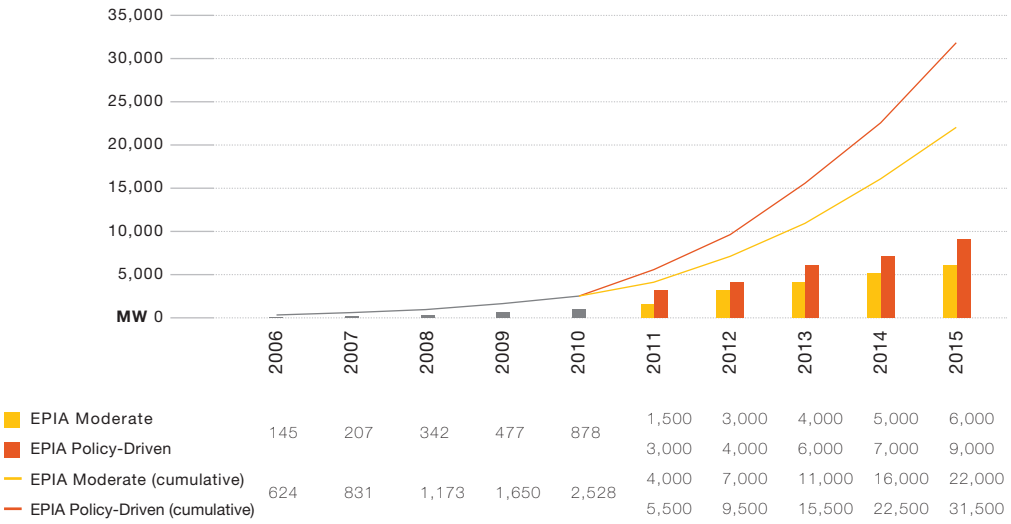


Figure 23 - USA

California leads the US PV market with 60% of the total installations. The market as a whole shows a renewed dynamism that could trigger major growth in the coming years.

Given the very high solar irradiation and the high electricity prices in some states (such as California), PV will become competitive relatively rapidly. Already a long pipeline of projects, representing up to 15 GW, currently await decisions before they can go ahead. As in other countries, even if only some of these are actually implemented, they would still contribute to a major increase in the market.

The US market is noteworthy for its widespread use of tracking systems. The market is regulated by bidding procedures which award very competitive projects. These projects can achieve costs of $0.12 per kWh or less. At the federal level various tax rebate systems are in place, though these could be at risk after the last congressional elections shifted the balance of power in Washington. Depending on the system size, different policy strategies apply. Systems below 1 MW - the large majority of PV applications in the USA (outside California) - can benefit from a net-metering system.

• Canada

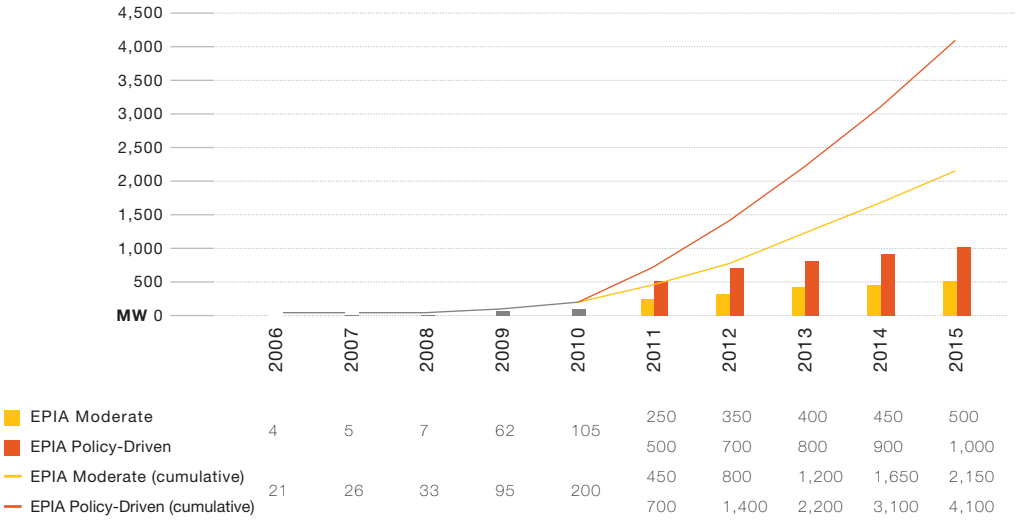


Figure 24 - Canada

Despite limited solar irradiation compared to the USA, Canada has continued the increasing PV uptake observed in 2009. **An additional 105 MW capacity was connected to the grid in 2010**. The province of Ontario is clearly driving the market due to a relatively generous FiT. The province made some noise in 2010 by introducing a local-supplier obligation that requires developers to source at least 60% of their products and resources from Ontario-based goods and labour. Japan requested consultations with Canada through the World Trade Organisation (WTO) regarding Canada's measures relating to domestic content requirements in the FiT program .

Around 200 MW are already foreseen for installation in 2011, all located in Ontario. EPIA considers that the Canadian market could reach **up to 4.1 GW cumulative installed capacity by 2015** under a Policy-Driven scenario.

• Japan

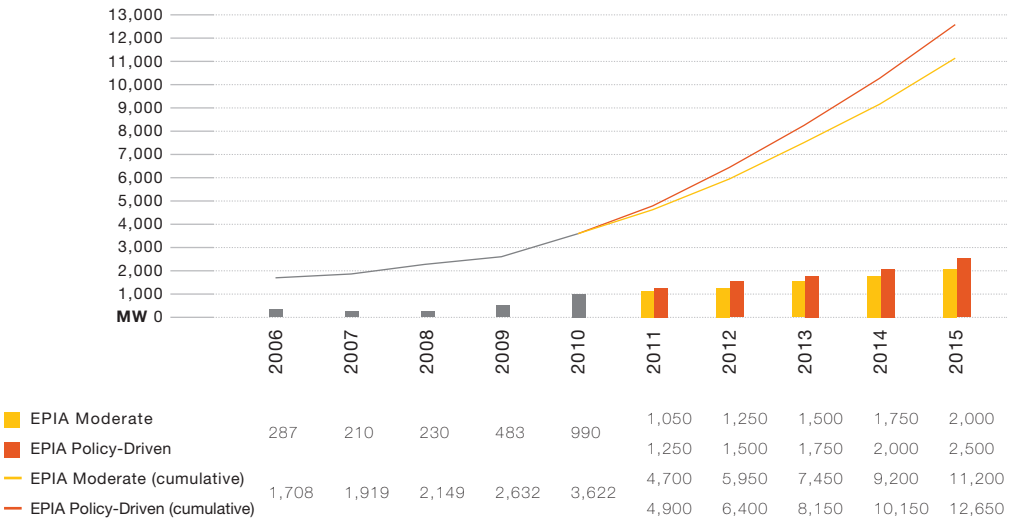


Figure 25 - Japan

Before the dramatic events of March 2011, the Japanese PV market was progressing rapidly, with **990 MW installed in 2010** and positive forecasts for the years to come. The 28 GW target defined for 2020 looked reasonable and achievable with a manageable increase in market volumes. As well as the residential systems that represented more than 95% of the market, ground-mounted installations were also expected to grow.

EPIA believes that the lack of power generation following the destruction of many power plants will push forward PV development in the coming months and years. The rising electricity demand for air conditioning during summer could also favour PV as a preferred energy source in order to solve the current lack of power generation capacity in the short and medium term.

The growth will certainly resume afterwards, whatever the outcome of the current events, meaning that Japan will continue to be one of the leading PV countries world-wide.

• Australia

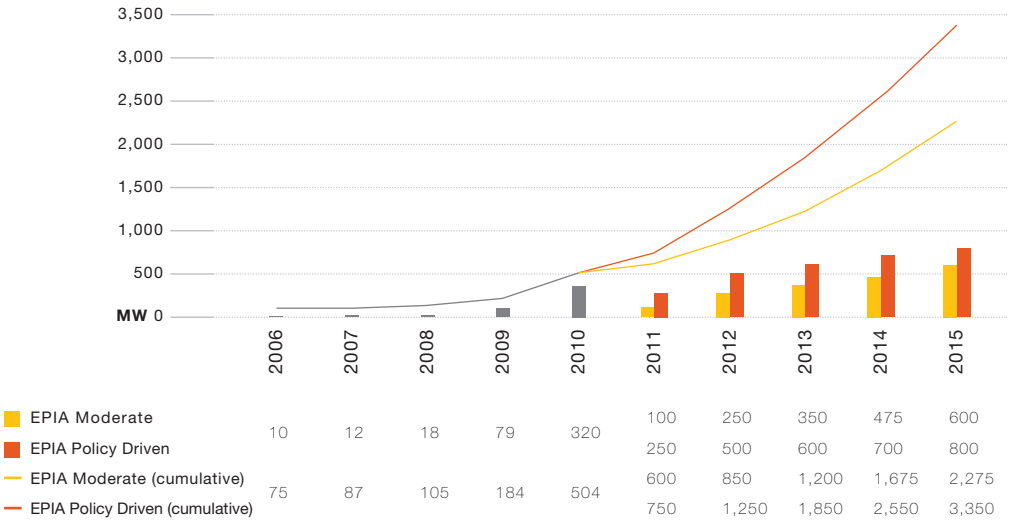


Figure 26 - Australia

Australia's wide range of state-level support schemes make it a complex market. It is also a highly volatile one, as tariffs are often modified, but this support has resulted in a **PV market of 320 MW in 2010**.

In the coming years, PV policies will strongly depend on the plans of the newly-elected Liberal and National Party Coalition government in New South Wales (NSW). This state has dominated market development to-date, and the new government has set out a multi-faceted plan including a Gross FiT for PV installations and a Solar Summit. The latter will aim to establish a sustainable future for the NSW solar industry for small and large-scale installations. The Australian market is supported by state-level incentives and is largely dominated by residential and commercial systems. Though participation in this market is complex, the long-term trends point clearly towards a growing emphasis of PV technology.

• China

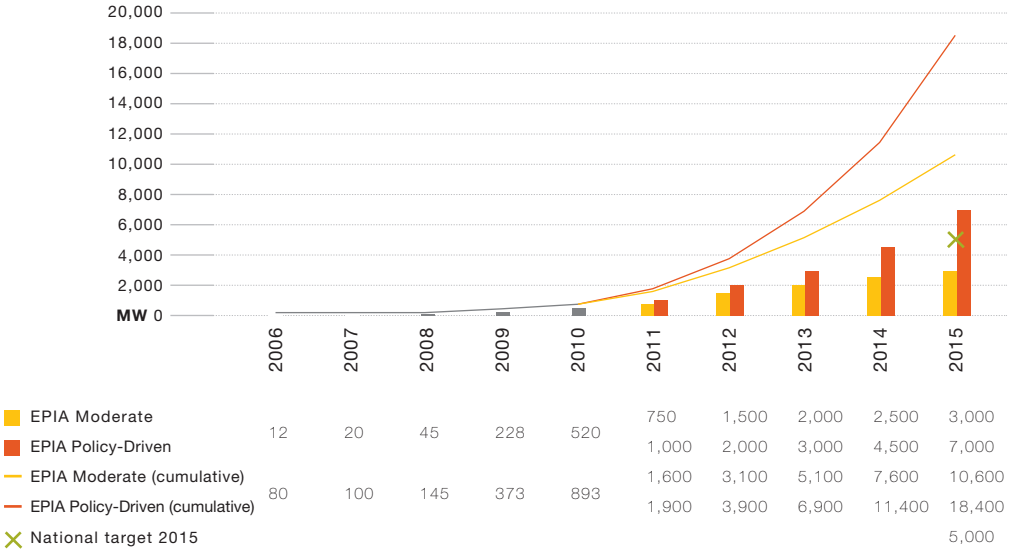


Figure 27 - China

China's domestic PV market took off in 2010, the first full year of the country's principal national program, "Golden Sun". The 520 MW capacity installed last year brought cumulative capacity to 893 MW. Unfortunately, the anticipated national PV FiT was dropped indefinitely as PV generation cost is currently still deemed too high. At national level, two rounds of biddings have taken place to date, with the first round (after 54 MW of project cancellations) awarding 576 MW in projects. The government tightened the reins in the second round in November 2010 (272 MW approved) to ensure fewer project defaults. It also punishes firms that do not complete their projects on time by not allowing them to participate in future rounds. At provincial level, other programs have been launched (Ordos 2 GW project, 280 MW by the National Development and Reform Commission for desert-based projects) and several provinces (Zhejiang, Shandong, Jiangsu) have introduced their own FiTs.

In 2011, China could officially become a gigawatt market. This is driven by the various national and provincial programs, as well as the fact that China has again, in its annual National People's Congress (NPC) earlier this month, reiterated the strategic importance of renewables in its 12th Five Year Plan (2011-2015). EPIA expects total PV installations to grow by between 750 MW and 1 GW in 2011. The NPC also sets 5 GW as an official minimum PV target by 2015, with a longer-term target of 20 to 30 GW by 2020. EPIA considers that this target could easily be exceeded if the right market conditions and regulatory frameworks are in place.

• India

India's National Solar Mission (NSM) was launched in January 2010 in order to achieve the government's target of generating 22 GW (20 GW on-grid; 2 GW off-grid) of solar power by 2022. It has had something of a slow start, particularly regarding its on-grid projects. Phase One of the NSM (until 2013) has seen 804 MW of solar projects being approved to date, only one-third (or 282 MW) of which are using PV technology. PV features more prominently in several states (Gujarat, Rajasthan, Punjab, West Bengal, etc.) that have taken positive steps and introduced their own solar programs as well as FiTs. The current frontrunner is Gujarat, which aims to generate 1 GW by 2012 and 3 GW by 2015. Another boon is the recent introduction of solar-specific Renewable Purchase Obligations (RPOs) from 0.25% (until 2013) and 3% (by 2022), which could potentially generate 32 GW by the end of 2022. This will be complemented by solar specific Renewable Energy Certificates (RECs) to allow solar plants to sell their RECs to electric utilities in order to meet their solar RPO, which will further drive demand for solar.

• Rest of Asia

The solar irradiation in South-East Asia creates an enormous potential for PV in the region. Moreover, part of global PV production is moving there, supported by favourable governmental frameworks. Thailand's support program has been very successful and contributed to a huge flow of applications for a total of 397 PV projects (1,600 MW) by October 2010. Since then this number has increased even more, pushing the government to constrain the program and stop any new applications.

Malaysia is likely to launch a FiT earlier than the scheduled time of June, and the Philippines are, after considerable delay, expected to release FiT rates in spring 2011.

After decreases in its PV market in 2009 and 2010, South Korea is expected to grow again from 2011 from its current level of 131 MW installed. Despite its potential, the market will probably be constrained to around 200 to 360 MW each year over the next five years.

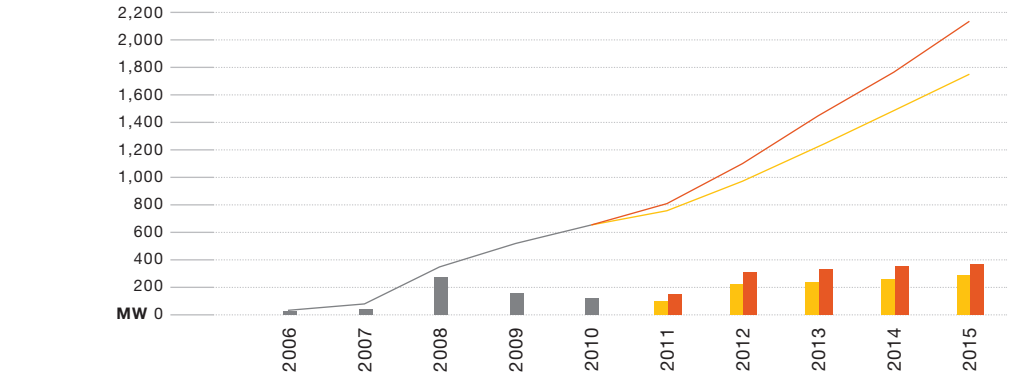


Figure 28 - South Korea

Finally, Taiwan installed 12 MW in 2010, as in 2009, and while its potential still has to be confirmed, some 130 to 250 MW could be installed in 2015 on the island.

- **Latin America**

Compared with other Sunbelt regions, Latin America has not shown a great deal of PV activity. Mexico, whilst having a tiny current base for PV (28 MW at the end of 2010), has the largest PV manufacturing capacity in the region, and is slowly starting to show signs of promise. A FiT is not expected but Mexico has net-metering measures in place and will further build on this. Last year a new interconnection contract for renewable energy sources for small- to mid-scale co-generation systems (up to 500 kW) has been approved. These developments should kick-start the domestic market as of next year.

Brazil has an even smaller PV base (20 MW at the end of 2010, 99% of this being off-grid) and currently no existing national programs or support schemes (hydro and wind are strongly favoured), though the first on-grid projects should gradually come on-line from 2011.

- **MENA countries**

Barriers to PV deployment persist, such as the lack of awareness among policy makers, the subsidised prices of electricity produced by fossil fuel plants and the lack of appropriate regulatory frameworks. Despite this, North African countries are setting up some ambitious targets for renewables by 2020. Morocco has launched a 2 GW solar plan with a dedicated implementing agency, under which PV and Concentrated Solar Power (CSP) technologies will compete openly.

In the United Arab Emirates, the Masdar city program is to be implemented soon. In addition, in line with the MENA Governments' will to deploy renewables only in exchange of substantial local value creation, some polysilicon plants should be established in the Gulf region according to recent announcements. Finally, Jordan is looking into using desert areas for PV technology.

Turkey's latest regulations leave little space for creating a real PV market. The low level of incentives will make it difficult even for the most competitive developers to enter this market. A small change in tariffs is foreseen to develop and favour local industry. Meanwhile, prospects remain vague, with low electricity prices and little desire from the authorities to develop PV.

The current turmoil in many countries of the region could put at stake the Mediterranean Solar Plan launched in 2010, while the prospects for Desertec beyond 2020 remain valid. Moreover the need for an enhanced electricity grid for both local consumption and imports/exports of electricity could represent a major constraint for large power plants in the region. This may push in the short term towards well-integrated residential and commercial systems, while medium-sized plants (up to 20 MW) would be more easily connected to the existing grid than very large ground-mounted installations.

3.3.c. Forecasts until 2015

While growth in the EU in coming years could be low, or even negative, non-EU countries should more than pick up the slack from 2011 and 2012 onwards, ensuring continuous global PV market growth until 2015 and beyond.

The Policy-Driven scenario proved to be the most accurate one over the past years. However, a market stagnation or even a small decrease in 2011 is not impossible. The speed at which political decisions have been taken during the year 2010 and the beginning of 2011 should remind us that PV will be an incentive-driven market until competitiveness is reached in all market segments in a defined country.

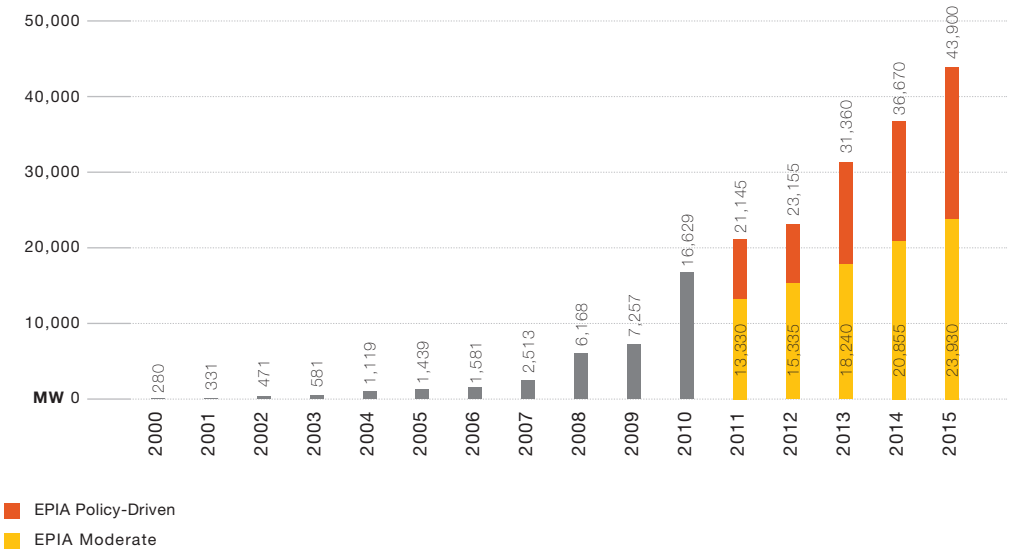
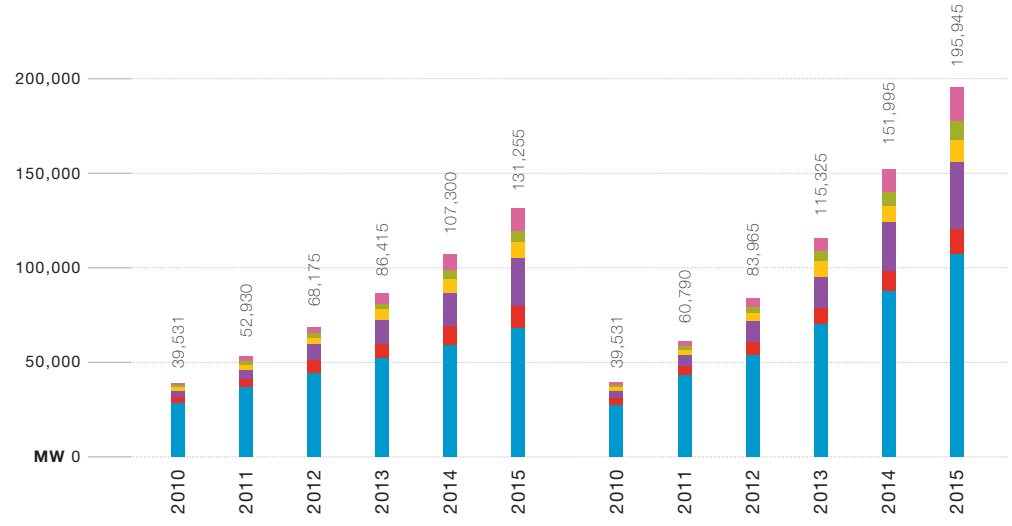


Figure 29 - Global annual market scenarios - Moderate and Policy-Driven

The market developments detailed in the above graph could put total installed PV capacity in the world in 2015 at between 131 and 196 GW depending on the scenario considered. The 100 GW mark could already be reached in 2013.



	EPIA Moderate (cumulative)						EPIA Policy-Driven (cumulative)					
	2010	2011	2012	2013	2014	2015	2010	2011	2012	2013	2014	2015
China	893	1,643	3,143	5,143	7,643	10,643	893	1,893	3,893	6,893	11,393	18,393
APEC	1,191	1,605	2,347	3,274	4,577	6,089	1,191	1,858	3,189	4,918	7,076	9,480
Rest of the world	1,844	2,644	4,144	6,144	8,144	10,144	1,844	2,844	4,644	7,144	9,644	12,144
North America	2,727	4,477	7,827	12,227	17,677	24,177	2,727	6,227	10,927	17,727	25,627	35,627
Japan	3,622	4,672	5,922	7,422	9,172	11,172	3,622	4,872	6,372	8,122	10,122	12,622
EU	29,252	37,817	44,812	52,222	60,072	68,992	29,252	42,977	54,802	70,382	87,992	107,492
Total	**39,531**	**52,930**	**68,175**	**86,415**	**107,300**	**131,255**	**39,531**	**60,790**	**83,965**	**115,325**	**151,995**	**195,945**

Figure 30- Evolution of global cumulative installed capacity 2010-2015

A global rebalancing could happen quickly in the coming years, with the EU accounting for less than 40% of the world market by 2015 in the Moderate scenario, and remaining at around 45% in the Policy-Driven scenario. While 2010 didn't show any sign of such a change, with most of the major growth occurring in EU markets, the rest of the world, and especially Asia, could represent a fertile market for PV in the coming years. In terms of installed capacity, however, the EU is likely to retain its lead for the next decade.

4

INDUSTRY EVOLUTION
A brief look into the PV value chain dynamics

Once balanced between the EU and other countries, production has tended to grow faster in Asia, and particularly China, during the recent years. Given the current Asian market size, modules are mainly shipped to the EU. However, nowadays, about half of the value of a PV system is created further downstream and closer to the consumers. With the foreseen potential growth of markets outside the EU, this mismatching between supply and demand will also probably decline in the coming years.

The relative overcapacity that is currently observed should drive module prices further down during the coming years and thus trigger more demand.

4.1. China and the EU: 2 faces of the same medal?

The graph below outlines the evolution of world-wide PV module supply and demand over the last decade. With only small quantities (less than 1 GW annually) of modules shipped and installed during the years 2000-2003, local markets were supplied by local production. From 2004 onwards, an increasing number of Japanese modules were imported to the EU in order to supply its rapidly growing market. The same phenomenon happened with Chinese modules, reaching more than 50% of the global PV module production in 2010, against less than 15% in 2006.

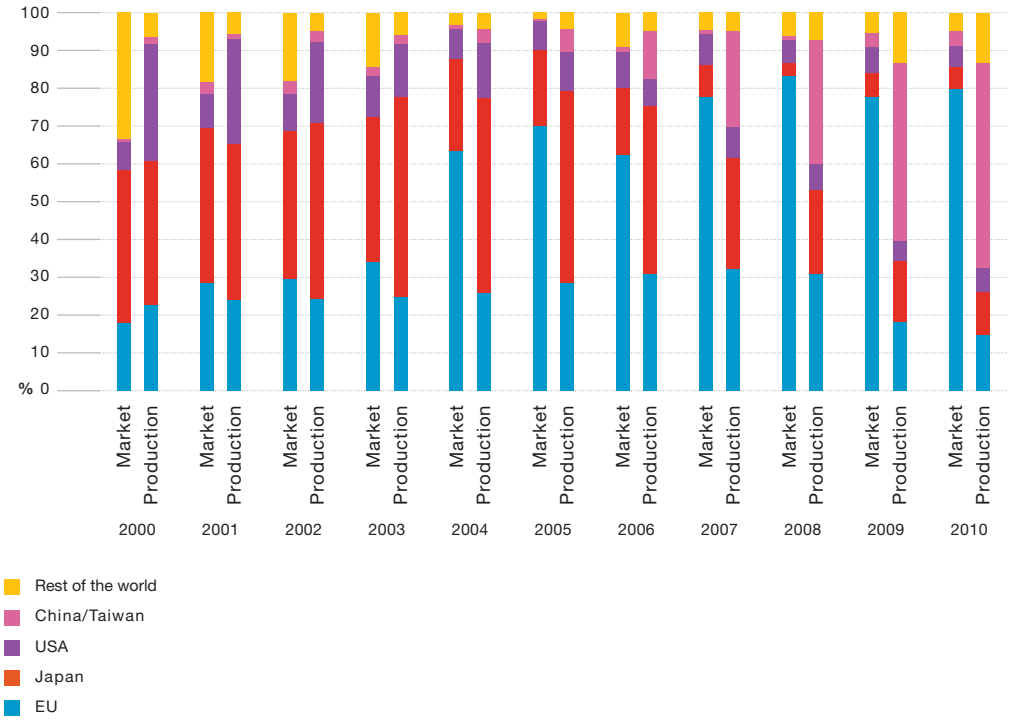


Figure 31 - Market vs production

source: EPIA, Navigant Consulting (Paula Mints)

However, this graph only shows module shipments and installations; it does not take into account the entire PV value chain. While in 2005, PV modules represented almost 75% of a PV system price for large ground-mounted systems, nowadays they account for less than 60%. For small residential systems, this can even be as low as 50%. The remaining part includes the cost of the inverter, other balance of system elements (such as cables, mounting structures, etc.) as well as the cost and margins of wholesalers and installers which are close to the end market.

In 2010, about 80% of all PV inverters were produced in the EU. A large part of the equipment, and to a smaller extent of the raw input materials used to produce PV modules, is being shipped from the EU and the USA to module manufacturers in Asia.

In fact at least 50-55% of the total value of a PV system is created close to the end market, of which 80% was located in EU countries in 2010.

4.1.a. A temporary mismatching?

The mismatching in terms of installations between the EU and the rest of the world should decrease over the next five years. On the supply side, this imbalance should also progressively decline:

- The relative share of transportation in the cost of a PV module will increase, as module prices are decreasing while transport costs are evolving the opposite way. This should encourage production closer to the end market.
- With the continued decreasing prices of PV modules, the share of the module in the total PV system value will further continue to decline in the coming years.

4.2. Production capacity overview

4.2.a. Overcapacity: the numbers

There is no doubt that, in 2010, global production capacities were substantially higher than the demand for PV products. This contrasts with the announcement of several PV manufacturers to accelerate their capacity expansion plans in the coming years.

This contradiction does not only hold for PV module manufacturers; the same tendency can be observed further upstream in the PV value chain.

EPIA estimates that:

- In 2011, the global production capacity for silicon could be of 370,000 tons, up from approximately 350,000 tons in 2010. Huge expansions have taken place since the 2005 and 2008 shortages, many of which only came on-line last year. Various small Chinese players are being forced to shut down production while the largest established companies are announcing capacity expansions to as high as 40,000 to 60,000 tons by 2012.
- In terms of **wafers**, the global production capacity was between 30 to 35 GW in 2010, of which more than 55% in China. Germany accounts for more than 10% of global capacities, followed by Japan, Taiwan, Norway and the USA.
- **Crystalline-silicon (c-Si) cells & modules** capacities are now mainly located in Asia. EPIA estimates the global c-Si cell production capacity to have been around 27 to 28 GW in 2010. Almost 50% of this capacity is located in China. The rest is produced in Taiwan (over 15%), the EU (over 10%), Japan (slightly less than 10%) and the USA (less than 5%). Module production capacities for c-Si are estimated to have been slightly higher and could have range between 30 and 32 GW in 2010.

- The global production capacity of **Thin Film (TF) modules** has reached around 3.5 GW in 2010. This is likely to increase to more than 5 GW in 2011 and might reach 6 to 8.5 GW in 2012. Today, Copper (Gallium) Indium (di)Selenide (CI(G)S) modules represent about 15% of the TF total capacity, with the remainder equally shared between Cadmium Telluride (CdTe) and Silicon TF. However, by 2012, EPIA expects that each of the TF technologies will represent an equal share in terms of production capacity. While a large part of c-Si modules are assembled in China, most of the TF manufacturing plants are located in other parts of the world; the leaders being the USA, the EU, Japan and Malaysia.

4.2.b. Overcapacity: a real problem?

When it comes to overcapacity, an important point is how much of this capacity is actually operational. All numbers mentioned above are based on *announced production capacities*. The announced capacity is typically higher than the actual capacity due to non-realised expansion plans or obsolete and non-competitive production lines. In addition, the average capacity utilisation is not of 100% because of downtime (maintenance, insufficient material and component supply), production facilities that are still in the ramp-up phase or simply because of a temporary lack of demand. Finally, contract manufacturing is becoming an important phenomenon in the PV industry, increasing the risk of double counting of the production capacities.

The existing overcapacity offers a kind of built-in flexibility that shields the PV industry from severe fluctuations in the current demand.

Once the demand has stabilised, further consolidation will bring global capacity utilisation to more competitive levels. In a recent report, PricewaterhouseCoopers shows that there were 32% more Mergers & Acquisitions (M&A) in the solar sector in 2010 than in 2009. For the time being, the number of new entrants is still increasing as power, engineering, technology and chemical companies are investing more and more in the PV sector.

Consolidation occurs mainly between companies that are active in different steps of the PV value chain. Currently there is a clear trend to ensure the security of supply through conclusion of long-term contracts or in-house PV components production (upstream integration). Consolidation between module manufacturers and large project developers in order to ensure that the products find their way to the market is also observed.

5

CONCLUSION

Three main factors have driven the spectacular growth enjoyed by PV in recent years:

- Firstly, renewable energy is no longer considered a curiosity. PV has proven itself to be a reliable and safe energy source in all regions of the world.
- Secondly, the price decreases that have brought PV close to grid parity in several countries have encouraged new investors.
- And finally, smart policy makers in key countries have set adequate FiTs and other incentives that have helped develop markets, reduce prices and raise investors' awareness of the technology.

Over the last 10 years, progress has been impressive. **The total installed PV capacity in the world has multiplied by a factor of 27, from 1.5 GW in 2000 to 39.5 GW in 2010 - a yearly growth rate of 40%**. That growth has proved to be sustainable, allowing the industry to develop at a stable rate.

The EU, having overtaken Japan, is now the clear leader in terms of market and total installed capacity - thanks largely to German initiatives that have in turn helped create global momentum. In the rest of the world, the leading countries continue to be those that started installing PV even before the EU. The market is expanding every year, with new countries joining progressively. In the so-called Sunbelt countries, decreasing prices are bringing PV closer to grid parity and helping spread awareness of its potential.

But what about the future of PV market development? With **between 131 and 196 GW of PV systems likely to be installed in 2015**, the forecasts are promising. But the financial crisis and competition with other energy sources have put pressure on policy makers to streamline the incentives for PV. PV is now a mature technology that is rapidly approaching grid parity. The time has come for reasonable support schemes in line with price evolution. In the coming months and years EPIA will support the adaptation of support schemes to prices. But **until grid parity is reached, the PV industry is committed to ensuring the best possible use of support schemes**.

The future of the PV market remains bright in the EU and the rest of the world. Uncertain times are causing governments everywhere to rethink the future of their energy mix, creating new opportunities for a competitive, safe and reliable electricity source such as PV.

ANNEXES

Country	Scenario	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
EU											
Austria	Moderate	1	2	5	20	50	55	60	80	100	120
	Policy-Driven						75	100	130	160	200
Belgium	Moderate	2	19	71	285	424	200	240	280	350	400
	Policy-Driven						300	325	350	400	500
Bulgaria	Moderate	0	0	1	6	11	100	100	100	125	150
	Policy-Driven						150	200	250	300	400
Czech Republic	Moderate	0	3	61	398	1,490	100	150	200	200	200
	Policy-Driven						200	350	400	450	500
France	Moderate	8	11	46	219	719	1,000	600	500	500	500
	Policy-Driven						1,250	800	1,500	2,000	2,500
Germany	Moderate	843	1,271	1,809	3,806	7,408	3,000	3,000	3,000	3,000	3,000
	Policy-Driven						5,000	5,000	5,000	5,000	5,000
Greece	Moderate	1	2	11	36	150	150	175	200	225	250
	Policy-Driven						250	300	350	400	450
Italy	Moderate	10	70	338	717	2,321	3,000	1,500	1,500	1,500	2,000
	Policy-Driven						5,000	3,000	5,000	5,000	5,000
Portugal	Moderate	1	11	44	55	16	100	100	150	150	150
	Policy-Driven						150	150	200	250	300
Slovakia	Moderate	0	0	0	0	145	200	50	75	100	200
	Policy-Driven						300	100	200	300	400
Spain	Moderate	102	542	2,708	17	369	400	500	500	500	500
	Policy-Driven						500	600	700	850	1,000
United Kingdom	Moderate	1	4	6	10	45	110	220	375	500	700
	Policy-Driven						300	400	750	1,500	2,000
Rest of the EU	Moderate	14	14	30	50	98	150	300	450	600	750
	Policy-Driven						250	500	750	1,000	1,250
Total	**Moderate**	983	1,950	5,130	5,619	13,246	**8,565**	**6,995**	**7,410**	**7,850**	**8,920**
	Policy-Driven						**13,725**	**11,825**	**15,580**	**17,610**	**19,500**
ASIA PACIFIC											
Australia	Moderate	10	12	18	79	320	100	250	350	475	600
	Policy-Driven						250	500	600	700	800
China	Moderate	12	20	45	228	520	750	1,500	2,000	2,500	3,000
	Policy-Driven						1,000	2,000	3,000	4,500	7,000
Japan	Moderate	287	210	230	483	990	1,050	1,250	1,500	1,750	2,000
	Policy-Driven						1,250	1,500	1,750	2,000	2,500
South Korea	Moderate	23	45	276	167	131	100	220	240	260	280
	Policy-Driven						150	300	320	340	360
Taiwan	Moderate	1	2	4	10	12	15	20	40	70	130
	Policy-Driven						20	30	60	120	240
Total	**Moderate**	332	289	573	967	1,973	**2,015**	**3,240**	**4,130**	**5,055**	**6,010**
	Policy-Driven						**2,670**	**4,330**	**5,730**	**7,660**	**10,900**
NORTH AMERICA											
USA	Moderate	145	207	342	477	878	1,500	3,000	4,000	5,000	6,000
	Policy-Driven						3,000	4,000	6,000	7,000	9,000
Canada	Moderate	4	5	7	62	105	250	350	400	450	500
	Policy-Driven						500	700	800	900	1,000
Total	**Moderate**	149	212	349	539	983	**1,750**	**3,350**	**4,400**	**5,450**	**6,500**
	Policy-Driven						**3,500**	**4,700**	**6,800**	**7,900**	**10,000**
REST OF THE WORLD											
Total	**Moderate**	118	63	117	132	427	**1,000**	**1,750**	**2,300**	**2,500**	**2,500**
	Policy-Driven						**1,250**	**2,300**	**3,250**	**3,500**	**3,500**
TOTAL WORLD	**Moderate**	1,581	2,513	6,168	7,257	16,629	**13,330**	**15,335**	**18,240**	**20,855**	**23,930**
	Policy-Driven						**21,145**	**23,155**	**31,360**	**36,670**	**43,900**

Table 3 - Detailed global market outlook until 2015

Country	Scenario	2006	2007	2008	2009	2010	2011	a2012	2013	2014	2015
EU											
Austria	Moderate	26	28	33	53	103	160	220	300	400	520
	Policy-Driven						180	280	410	570	770
Belgium	Moderate	4	23	94	379	803	1,000	1,200	1,520	1,870	2,270
	Policy-Driven						1,100	1,425	1,775	2,175	2,675
Bulgaria	Moderate	0	0	1	7	18	120	220	320	445	595
	Policy-Driven						170	370	620	920	1,320
Czech Republic	Moderate	1	4	65	463	1,953	2,100	2,250	2,450	2,650	2,850
	Policy-Driven						2,200	2,550	2,950	3,400	3,900
France	Moderate	30	41	87	306	1,025	2,000	2,600	3,100	3,600	4,100
	Policy-Driven						2,300	3,100	4,600	6,600	9,100
Germany	Moderate	2,899	4,170	5,979	9,785	17,193	20,200	23,200	26,200	29,200	32,200
	Policy-Driven						22,200	27,200	32,200	37,200	42,200
Greece	Moderate	7	9	20	56	206	360	535	735	960	1,210
	Policy-Driven						460	760	1,110	1,510	1,960
Italy	Moderate	47	117	456	1,173	3,494	6,500	8,000	9,500	11,000	13,000
	Policy-Driven						8,500	11,500	16,500	21,500	26,500
Portugal	Moderate	3	15	59	114	130	230	330	480	630	780
	Policy-Driven						280	430	630	880	1,180
Slovakia	Moderate	0	0	0	0	145	350	400	470	570	770
	Policy-Driven						450	550	750	1,050	1,450
Spain	Moderate	148	690	3,398	3,415	3,784	4,200	4,700	5,200	5,700	6,200
	Policy-Driven						4,300	4,900	5,600	6,450	7,450
United Kingdom	Moderate	1	5	11	21	66	180	400	770	1,275	1,975
	Policy-Driven						370	770	1,520	3,020	5,020
Rest of the EU	Moderate	141	155	185	235	333	480	780	1,200	1,800	2,600
	Policy-Driven						580	1,100	1,800	2,800	4,100
Total	**Moderate**	3,307	5,257	10,387	16,006	29,252	**37,880**	**44,835**	**52,245**	**60,100**	**69,070**
	Policy-Driven						**43,090**	**54,935**	**70,465**	**88,075**	**107,625**
ASIA PACIFIC											
Australia	Moderate	75	87	105	184	504	600	850	1,200	1,700	2,275
	Policy-Driven						750	1,250	1,850	2,550	3,350
China	Moderate	80	100	145	373	893	1,600	3,100	5,100	7,600	10,600
	Policy-Driven						1,900	3,900	6,900	11,400	18,400
Japan	Moderate	1,708	1,919	2,149	2,632	3,622	4,700	5,950	7,450	9,200	11,200
	Policy-Driven						4,900	6,400	8,150	10,150	12,650
South Korea	Moderate	36	81	357	524	655	760	980	1,220	1,480	1,760
	Policy-Driven						810	1,110	1,430	1,770	2,130
Taiwan	Moderate	2	4	6	12	24	40	60	100	170	300
	Policy-Driven						40	70	130	250	490
Total	**Moderate**	1,901	2,191	2,761	3,725	5,698	**7,700**	**10,940**	**15,070**	**20,150**	**26,135**
	Policy-Driven						**8,400**	**12,730**	**18,460**	**26,120**	**37,020**
NORTH AMERICA											
USA	Moderate	624	831	1,173	1,650	2,528	4,000	7,000	11,000	16,000	22,000
	Policy-Driven						5,500	9,500	15,500	22,500	31,500
Canada	Moderate	21	26	33	95	200	450	800	1,200	1,650	2,150
	Policy-Driven						700	1,400	2,200	3,100	4,100
Total	**Moderate**	645	856	1,205	1,744	2,727	**4,450**	**7,800**	**12,200**	**17,650**	**24,150**
	Policy-Driven						**6,200**	**10,900**	**17,700**	**25,600**	**35,600**
REST OF THE WORLD											
Total	**Moderate**	1,127	1,188	1,303	1,427	1,854	**2,900**	**4,600**	**6,900**	**9,400**	**11,900**
	Policy-Driven						**3,100**	**5,400**	**8,700**	**12,200**	**15,700**
TOTAL WORLD	**Moderate**	6,980	9,492	15,657	22,902	39,531	**52,930**	**68,175**	**86,415**	**107,300**	**131,255**
	Policy-Driven						**60,790**	**83,965**	**115,325**	**151,995**	**195,945**

Table 4 - Detailed global cumulative installed capacity outlook until 2015

DEFINITIONS

Compound Annual Growth Rate (CAGR)

The year-over-year growth rate of an investment over a specified period of time.

Connected capacity vs. installed capacity

Installed capacity refers to systems put in place but awaiting the approval of the grid operator to inject electricity into the grid. Connected capacity refers to systems that have been allowed to inject their electricity on the grid and can be considered as online.

Corridor system

Automatic way to decrease/increase the level of the Feed-in Tariffs if the market over-performed/under-performed in order to keep the market development under control.

Green certificate

Alternative support scheme to Feed-in Tariffs that provides a variable, market-based revenue for electricity.

Grid parity

Moment in time when the savings in electricity cost and/or the revenues generated by selling electricity on the market are equal to or higher than the long-term cost of installing and financing a PV system.

EU

In this publication, EU stands for the European Union 27 Member States + Switzerland.

Feed-in Tariff (FiT)

Incentive structure to encourage the implementation of renewable energy through government legislation. The regional or national electricity utilities are obliged to buy renewable electricity (electricity generated from renewable sources, such as solar PV) at above-market rates set by the government.

Net-metering

Compensation scheme that allows electricity consumers to reduce their electricity bills through the electricity produced by their PV system in a certain period of time (in general one year).

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The European Photovoltaic Industry Association (EPIA) is the world's largest industry association devoted to the solar photovoltaic (PV) electricity market. The association aims to promote PV at national, European and world-wide levels and to assist its Members in their business development in both the European Union and export markets.

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