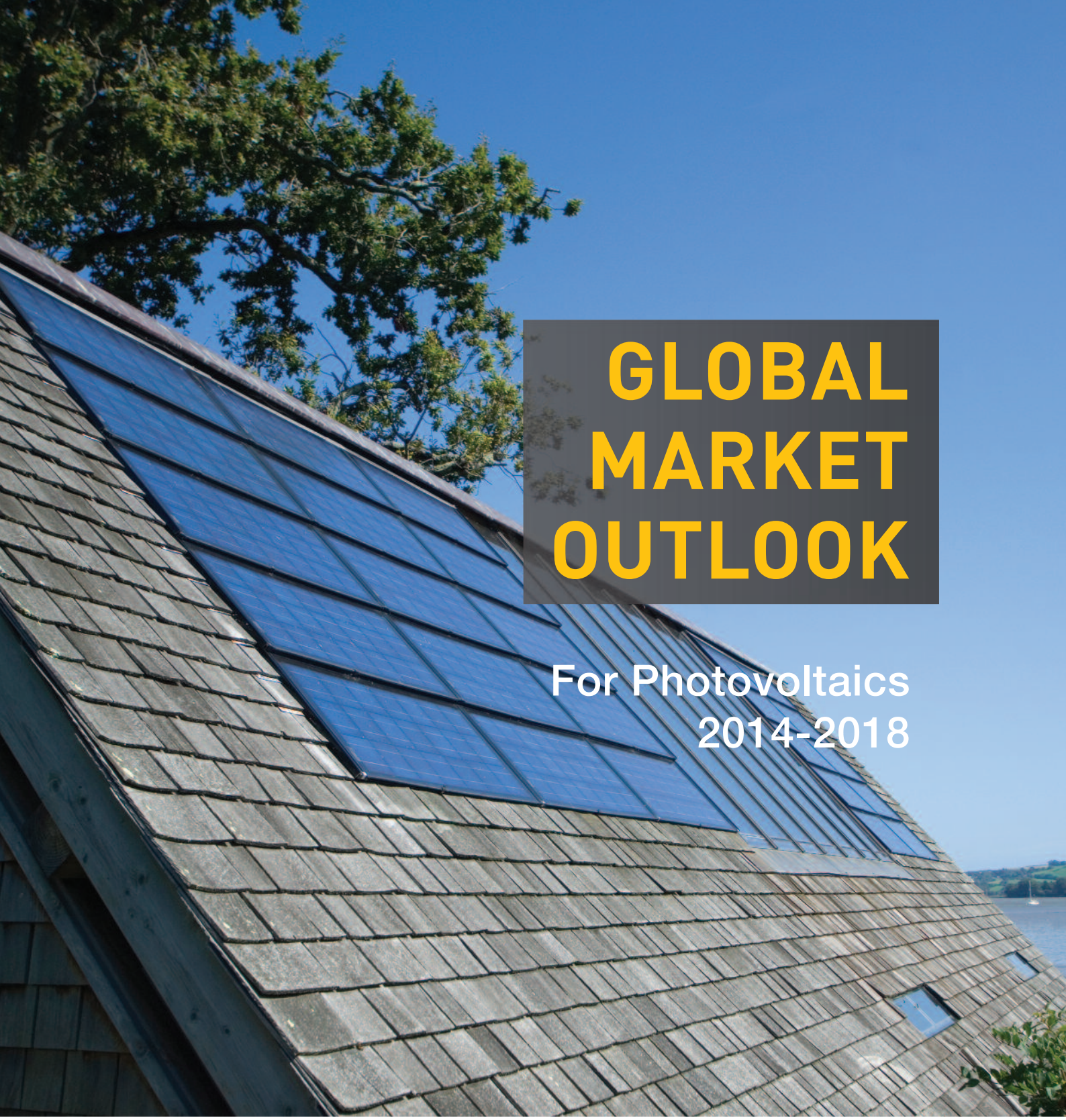

GLOBAL MARKET OUTLOOK

For Photovoltaics 2014-2018

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EPIA
European Photovoltaic Industry Association

GLOBAL MARKET OUTLOOK

For Photovoltaics 2014-2018

EPIA
European Photovoltaic Industry Association

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GeoModel SOLAR

FOREWORD

Dear EPIA Members,
Dear Friends of EPIA,

Since its creation in 1985, EPIA – the European Photovoltaic Industry Association – has experienced great changes and challenges. Just like the solar photovoltaic (PV) industry. Only a niche market a few years ago, **PV is now becoming a mainstream electricity provider, changing the way the world is powered. As the voice of photovoltaics in Europe, EPIA is leading the way to this energy transition**.

To ensure PV gets favourable and sustainable framework conditions, EPIA is intensively engaging in the European decision making process on all relevant regulations shaping the energy sector. EPIA is also proactively engaging on key issues for the future development of PV, such as the energy market design and the integration of PV into the electricity grid. Our profound intelligence work on these issues is **further reinforcing the PV sector's credibility and our ability to secure a sustainable development pathway for PV**.

Over the years, EPIA has established itself as **an opinion leader and a credible information hub on markets and policy, reinforcing its key role in the European energy sector**. The 2014 edition of our flagship report "*Global Market Outlook for Photovoltaics*", with comprehensive historical market data, five-year forecasts for the main global markets under different policy assumptions, hopefully not too optimistic, as well as an analysis of the role that PV is playing in the European energy system, will once again be an indispensable tool for the global PV sector and energy stakeholders alike.

Even during a difficult period of industry consolidation and economic crisis, PV installations saw another record-year in **2013: at least 38.4 GW of newly-added capacity around the globe, and almost 11 GW in Europe**. While the latter figure represents a significant decrease compared to the year before, it should however be put into perspective. **In 2013, apart from wind, no other source of electricity reached the levels of new installations that PV did in Europe**. Some, such as gas, even experienced negative net numbers, with more capacity decommissioned than installed.

This proves, if need be, that solar photovoltaics is on the way to becoming a major part of the electricity system, **delivering clean, safe and affordable energy to the greater number all around the globe**.

The energy transition is underway, let's embrace it!

Enjoy your reading.
Best regards,

Oliver Schäfer
EPIA President

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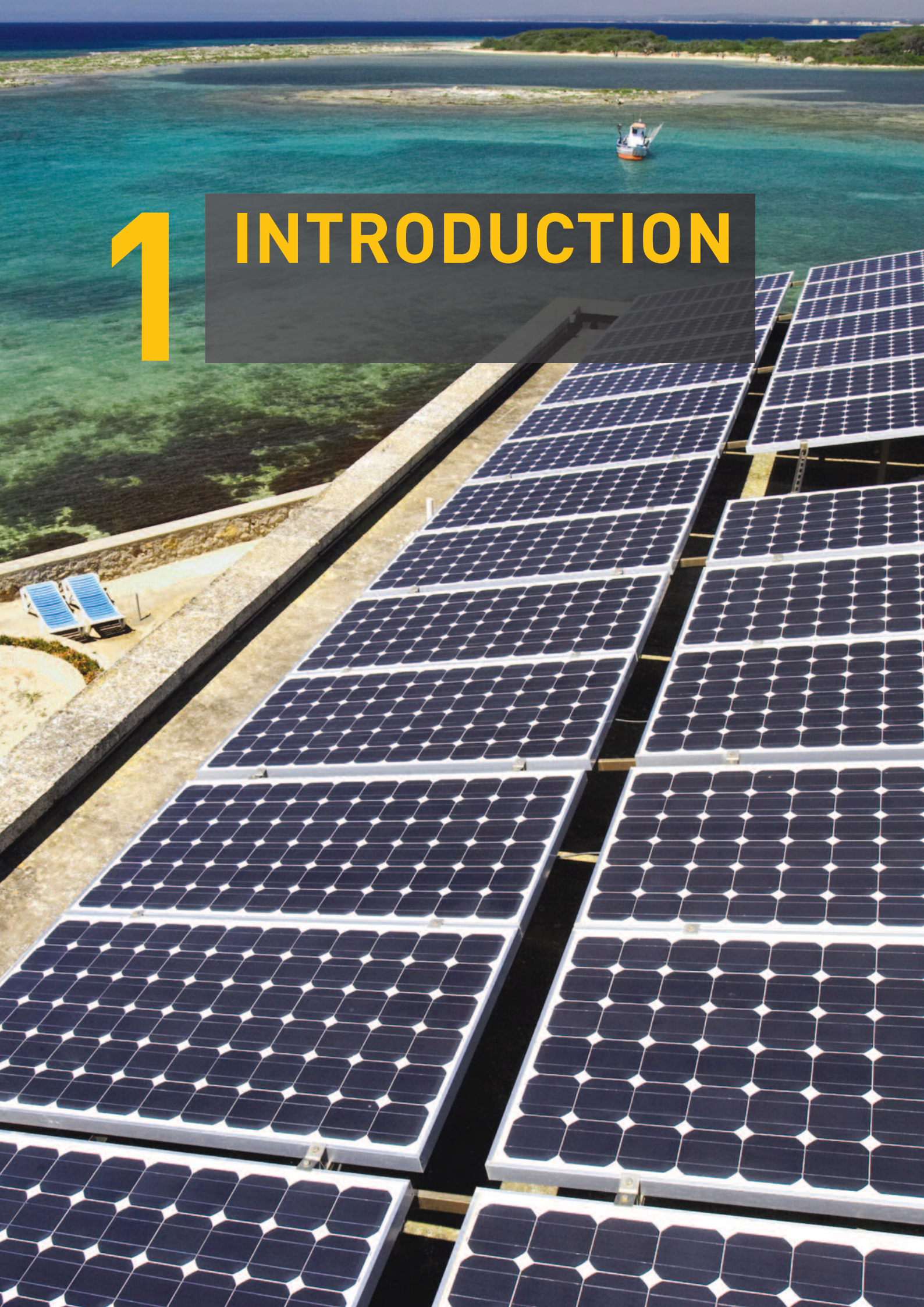


1 INTRODUCTION

1. INTRODUCTION

With at least 38.4 gigawatts (GW) of newly-installed solar photovoltaic (PV) capacity worldwide and a global cumulative installed capacity of 138.9 GW, 2013 was another historic year for solar PV technology.

Compared to the two previous years, where installed capacity hovered only slightly above 30 GW annually, the PV market progressed remarkably in 2013. Despite this, the global PV market is at a turning point which will have profound implications in the future. For the first time in more than a decade, the European PV market was no longer the top regional PV market in the world. Asia surpassed Europe in a dramatic way, representing around 56% of the world PV market in 2013. This **Asian progress occurred in parallel with the relative decline in Europe already observed in 2012**. Vigorous growth in non-European markets kept global PV development on an upward trajectory and largely compensated for the European slowdown.

→ EPIA's major findings for 2013 include:

- **At least 38.4 GW of PV systems were installed globally in 2013, up from 30 GW in 2012**; PV remains, after hydro and wind power, the third most important renewable energy source in terms of globally installed capacity
- **Almost 11 GW of PV capacity were connected to the grid in Europe in 2013, compared to 17.7 GW in 2012 and more than 22.4 GW in 2011**
- **For the first time since 2003 Europe lost its leadership to Asia** in terms of new installations
- **China was the top market in 2013 with 11.8 GW** of which 500 MW represent off-grid systems. Statistics released in May 2014 report that the country may have installed an additional 1.1 GW on top of the 11.8 GW estimated by EPIA. Since it is unsure whether these installations were connected to the grid EPIA did not take them into account. China was followed by **Japan with 6.9 GW and the USA with 4.8 GW.**
- **Germany was the top European market with 3.3 GW**. Several other European markets exceeded the one GW mark: the UK (1.5 GW), Italy (1.4 GW), Romania (1.1 GW) and Greece (1.04 GW)
- Several European markets that performed well in the past went down in 2013, a consequence of political decisions to reduce PV incentives, Belgian installations went from 600 megawatts (MW) to 215 MW, French went from 1,115 MW to 613 MW, and Danish went down from 300 to around 200 MW
- Aside from the significant decline in Germany and Italy, the size of the remaining European PV market was stable, with around 6 GW per year in the last three years
- Outside Europe, several markets continued to grow at a reasonable pace: India with 1,115 MW, Korea with 442 MW, Thailand with 317 MW, Canada with 444 MW and many others

→ Changing regional trends, new market leaders

Europe's role as the unquestioned leader in the PV market has come to an end. While **Europe** accounted for 74% of the world's new PV installations in 2011, and even around 55% the year after, **the region only represented 29% of the world's new PV installations in 2013**. That said, various markets in Europe still have strong and almost untapped potential for significant PV growth in the coming years.

In 2013, growth came mainly from Asian countries and especially China and Japan, which now rank as the first and second global markets respectively. Markets in the Americas grew less quickly than expected, but growth was observed in the USA, Canada and Mexico. In other regions of the world, interest in PV has not yet translated into significant market development.

→ Increasing competitiveness

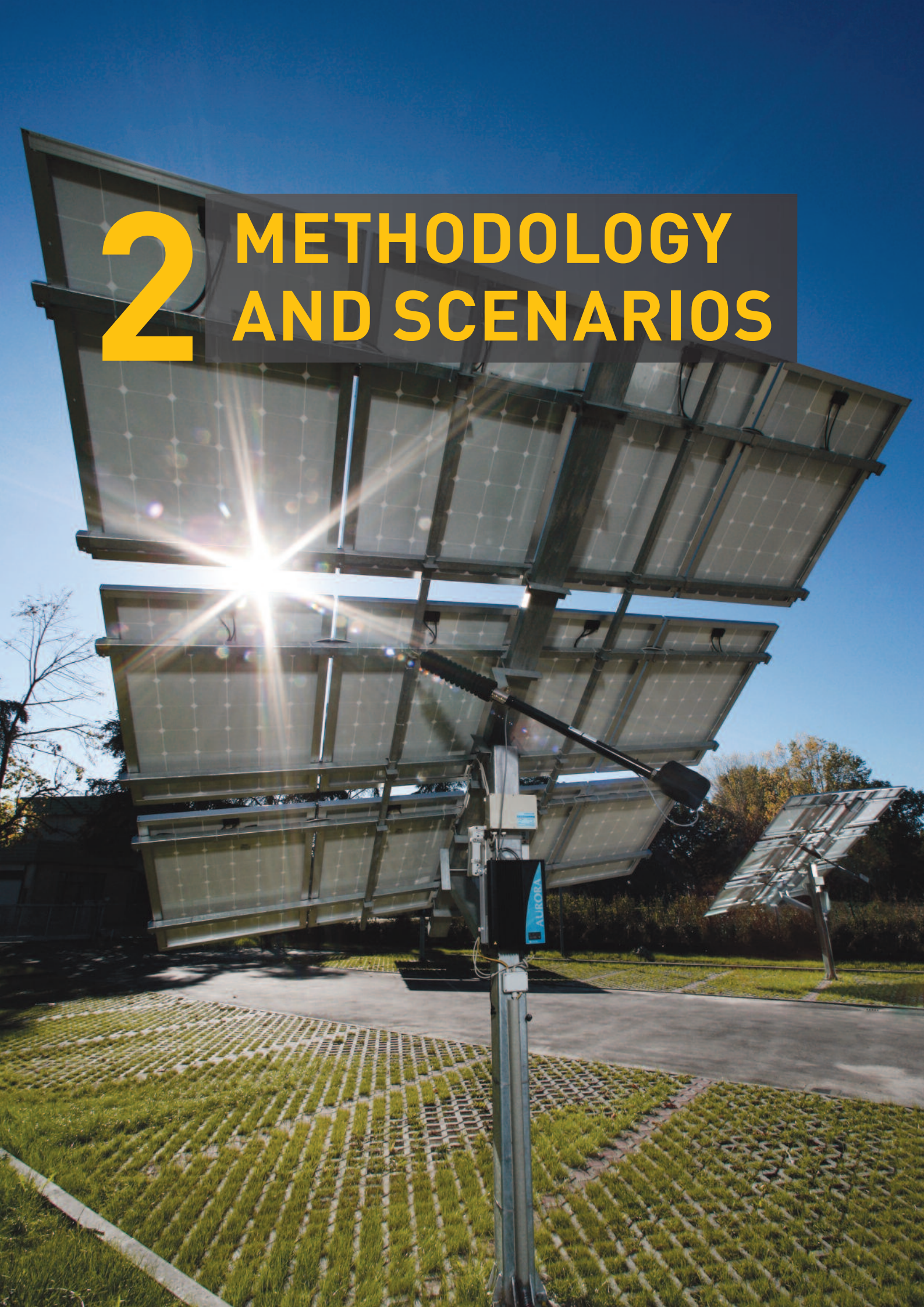
PV markets in Europe and around the world continued to make rapid progress toward competitiveness in the electricity sector in 2013. Strong PV technology price decreases and electricity prices on the rise have helped drive momentum toward "dynamic grid parity" - when the savings in electricity cost and/or the revenues generated by selling PV electricity on the market are equal to or higher than the long-term cost of installing and financing a PV system. **Competitivenes is being reached progressively in some market segments of several EU countries.**

→ PV as a policy-driven market

In most countries however, PV remains a policy-driven market. The introduction, modification or phasing-out of national support schemes, which heavily impact the development of PV markets and industries in these countries, also significantly influence EPIA's forecasts and scenarios. Indeed, **declining political support for PV has led to reduced markets in several European countries** (Germany, Italy, Belgium, France and Spain for instance) while the implementation of new feed-in tariff policies has led to a dramatic increase of the markets in other countries (such as China and Japan).

→ PV in the electricity mix

For the third year in a row, PV in 2013 was amongst the two most installed sources of electricity in the European Union. While wind energy exceeded PV in 2013 by some hundreds of MW, these two sources of electricity are the clear leaders of new generation sources of installations. PV now covers 3% of the electricity demand and 6% of the peak electricity demand in Europe. As the share of PV in the electricity mix increases, grid and market integration challenges are becoming more and more important for the future development of PV.



2 METHODOLOGY AND SCENARIOS

2. METHODOLOGY AND SCENARIOS

Forecasting PV market evolution has become more complex than it was in the past. The PV market is clearly driven by policy, but as we are now in an era of energy market integration, the market potential of PV also depends on electricity savings and/or potential sales on the wholesale electricity market. While EPIA's latest analyses indicate that in 2014 a part of the European market will still be driven by incentives, several key markets are already entering the transition phase from an investor-driven market to a market driven by savings on the energy bill through self-consumption in the construction segment (residential, commercial and industrial).

In addition, economic uncertainty in several European countries has in some cases led policymakers to make decisions that have a negative effect on the PV market, such as imposing retrospective measures. These decisions severely erode investor confidence even as PV technology and competitiveness improve – slowing market development in a way that is not easily predictable. In 2013, several retrospective measures were taken, severely damaging the reputation of PV. Moreover, such measures harm the credibility of the countries beyond PV, affecting their whole financing sector.

In March 2014, EPIA completed an extensive data-collection exercise from 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 three scenarios for the future development of PV markets:

- The **High Scenario** assumes the continuation, adjustment or introduction of adequate support mechanisms, accompanied by a strong political will to consider PV as a major power source in the coming years. Achieving this will also require removing unnecessary administrative barriers and streamlining grid connection procedures. Although market booms caused by inadequate support mechanisms are less likely to happen because of the growing exchange of best practices when designing support policies, they can still be observed in some cases.
- The **Low Scenario** assumes rather pessimistic market behaviour with no major reinforcement or adequate replacement of existing support mechanisms, or a strong decrease/limitation of existing schemes, or no adequate policies. In this scenario, it is assumed that in countries close to transition, markets significantly slow down when Feed-in Tariffs (FiTs) are phased out.
- The **Medium Scenario** weights the two previous scenarios according to the probability of achieving them. This new scenario defines the most probable market development forecast, according to the information available in March 2014.

Under these three scenarios, this report analyses the historical development of the PV market and its potential for the future. Based on a bottom-up approach at country level, it presents aggregated figures and scenarios. In this approach, consolidated forecasts should be understood as a range of possible PV market developments, with a high probability between the Low Scenario as the lower boundary and the High Scenario as the top of the range. Lower or higher forecasts are of course possible as the history of PV market development has shown, although with a lower likelihood.

→ Installations and connections

EPIA's methodology includes only 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 energy demand. This also reflects both the energy system point of view and the regulatory point of view, as PV electricity tariffs are paid only to systems that are connected and producing electricity. The difference between installations and systems connected to the grid can be quite significant in some cases, as was detailed in previous editions of the "Global Market Outlook".

→ The role of 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 Europe account for less than 1% of the installed PV capacity, they represent a significant power source in other parts of the world. 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 and declined since then. 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. In countries such as India or Peru, the development of PV in the coming years could originate at least partially from hybrid systems and micro-grid applications. In that respect the notion of on-grid or off-grid installations could be more difficult to assess outside Europe.

→ AC-DC numbers: counting comparable numbers

PV panels generate direct-current (DC) electricity; electricity systems are based on alternating-current (AC) electricity. Most countries refer to installed PV systems by counting DC power, but some report AC power. The major difference lies in the small percentage of energy lost during the DC-AC conversion in the inverters and the inverter parameters, which could deliver non-comparable data. This report presents data as they are produced by national authorities to ensure the compatibility of historical data, whatever the conventions used. However, in the case of countries reporting AC power, this report also calculates DC power numbers. All forecasts and consolidated data are presented in DC power, while electricity production data must consider AC power. In such cases, a realistic loss during conversion is assumed. In Europe, Spain falls into this category. Canada and Japan, amongst others are also reporting (at least partially for the latter) in AC.

3 MARKET EVOLUTION

3. MARKET EVOLUTION

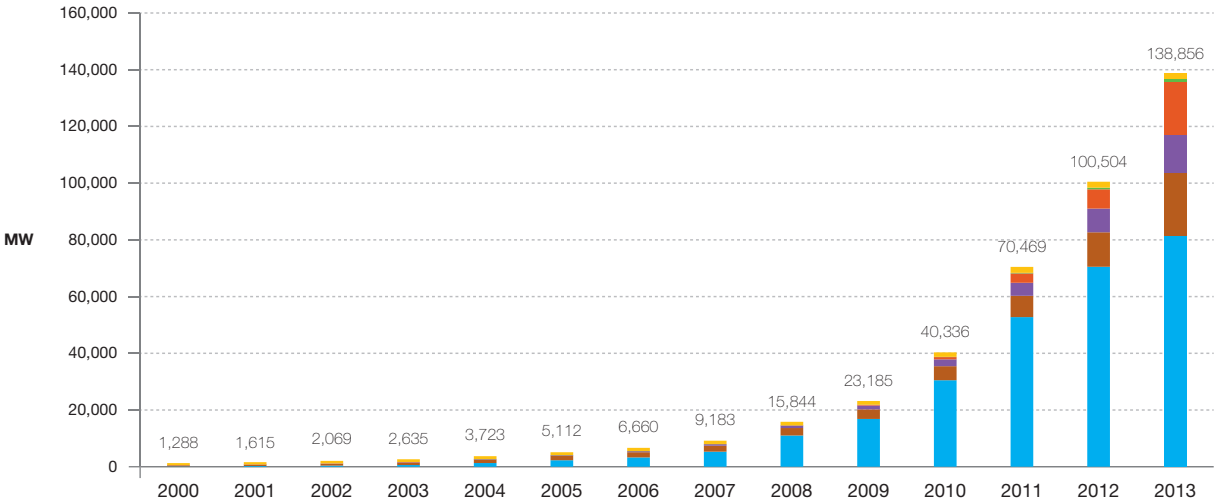
A. HISTORICAL PV MARKET DEVELOPMENT

The PV market has grown over the past decade at a remarkable rate – even during difficult economic times – and is on the way to becoming a major source of power generation for the world. After record growth in 2011, the global PV market stabilised in 2012, and grew again significantly in 2013.

1. World cumulative installed capacity

At the end of 2009, the world's cumulative installed PV capacity was more than 23 GW. One year later it was 40.3 GW and at the end of 2011 it was 70.5 GW. **In 2012, the 100 GW mark was reached and by 2013, almost 138.9 GW of PV had been installed globally —an amount capable of producing at least 160 terawatt hours (TWh) of electricity every year.** This energy volume is sufficient to cover the annual power supply needs of over 45 million European households. This is also the equivalent of the electricity produced by 32 large coal power plants. The global cumulative installed capacity could have even reached 140 GW in 2013 if the additional 1.1 GW in China were taken into account.

Europe remains the world's leading region in terms of cumulative installed capacity, with 81.5 GW as of 2013. This represents about 59% of the world's cumulative PV capacity, down from 70% in 2012 and about 75% of the world's capacity in 2011. Asia Pacific countries are growing fast, with 40.6 GW now installed. Next in the rankings are the America's (13.7 GW).



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
RoW	751	807	887	964	993	1,003	1,108	1,150	1,226	1,306	1,590	2,098	2,098	2,098
MEA	n/a	n/a	n/a	n/a	1	1	1	2	3	25	80	205	570	953
China	19	24	42	52	62	70	80	100	140	300	800	3,300	6,800	18,600
Americas	21	24	54	102	163	246	355	522	828	1,328	2,410	4,590	8,365	13,727
APAC	368	496	686	916	1,198	1,502	1,827	2,098	2,628	3,373	4,951	7,513	12,159	21,992
Europe	129	265	399	601	1,306	2,291	3,289	5,312	11,020	16,854	30,505	52,764	70,513	81,488
Total	**1,288**	**1,615**	**2,069**	**2,635**	**3,723**	**5,112**	**6,660**	**9,183**	**15,844**	**23,185**	**40,336**	**70,469**	**100,504**	**138,856**

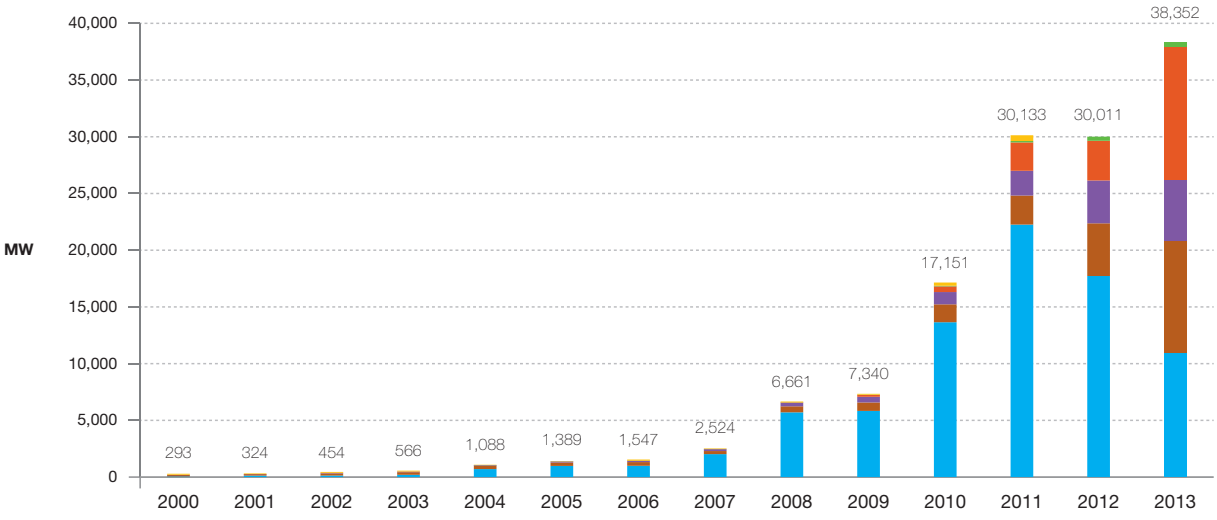
RoW: Rest of the World. MEA: Middle East and Africa. APAC: Asia Pacific.
Methodology used for RoW data collection has changed in 2012.

Figure 1 - Evolution of global PV cumulative installed capacity 2000-2013

Many of the markets outside the EU - in particular the USA or India - have tapped only a very small part of their enormous potential. In 2013, Asian countries took the lead and started to develop faster than traditional European markets. Several countries from large Sunbelt regions like Africa, the Middle East, South East Asia and Latin America are on the brink of starting their development. **The cumulative installed capacity outside Europe almost doubled from 30 GW as of 2012 to close to 60 GW in 2013, demonstrating the ongoing rebalancing between Europe and the rest of the world and more closely reflecting the patterns in electricity consumption**.

2. World PV market development

The global PV market progressed in 2013: after two years of around 30 GW of installations annually, the market reached more than 38 GW in 2013, establishing a new world record. But the most important fact from 2013 is **a rapid development of PV in Asia combined with a sharp drop of installations in Europe**. This record could have been even higher. In fact almost 40 GW have been installed in 2013 if we consider the 1.1 GW more installed by China.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
RoW	88	56	80	77	29	10	105	42	76	80	284	508	n/a	n/a
MEA	n/a	n/a	n/a	n/a	1	0	0	1	1	22	55	125	365	383
China	19	5	19	10	10	8	10	20	40	160	500	2,500	3,500	11,800*
Americas	2	3	30	48	61	82	110	166	306	500	1,082	2,181	3,774	5,362
APAC	126	128	190	230	282	304	325	271	530	745	1,578	2,562	4,646	9,833
Europe	58	133	134	202	705	985	997	2,023	5,708	5,833	13,651	22,259	17,726	10,975
Total	**293**	**324**	**454**	**566**	**1,088**	**1,389**	**1,547**	**2,524**	**6,661**	**7,340**	**17,151**	**30,133**	**30,011**	**38,352**

RoW: Rest of the World. MEA: Middle East and Africa. APAC: Asia Pacific.
Methodology used for RoW data collection has changed in 2012.
**This number could be increased to 12,920 MW.*

Figure 2 - Evolution of global annual installations 2000-2013

China became the top PV market in the world in 2013 and achieved the world's largest PV installation figure in one year with 11.8 GW connected to the grid, after Italy installed 9.3 GW in 2011 and Germany installed between 7.4 GW and 7.6 GW from 2010 to 2012. **Japan scored 6.9 GW and took the second place in 2013, while the USA installed 4.8 GW**.

Europe's market had progressed rapidly over the past decade: from an annual market of less than 1 GW in 2006 to a market of over 13.7 GW in 2010 and 22.3 GW in 2011 - even in the face of difficult economic circumstances and varying levels of opposition to PV in some countries. But the record performance of 2011, driven by the fast expansion of PV in Italy and a continued high level of installations in Germany, was not repeatable and the market went down to 17.7 GW in 2012 and almost 11 GW in 2013, the lowest market level since 2009.

After holding the world's top PV market position seven times in the last 14 years, Germany was only fourth in 2013 with 3.3 GW, and yet still by far the largest European market. The UK was the second European market with 1.5 GW. Italy, which was the second European market in 2012, installed more than 1.4 GW in 2013, down from 3.6 GW the year before and 9.3 GW in 2011. Other European countries that installed more than 1 GW are Romania (around 1.1 GW) and Greece (1.04 GW).

Together, China, Japan, the USA, Germany and the UK accounted for nearly 28.3 GW, or three-quarters of the global market over the last year. This is even higher than in 2012 when together the top-five global markets represented around 65%.

Regionally, the **Asia-Pacific (APAC) region**, which in addition to China and Japan includes Korea, Australia, Taiwan and Thailand, **scored first place in 2013 with close to 56% of the global PV market. Europe came second with almost 11 GW** out of 38.4 GW or 29%. The third leading region is **North America**, with Canada developing steadily alongside the USA. Elsewhere, 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 and numerous projects that have started will lead to installations in 2014 and after.

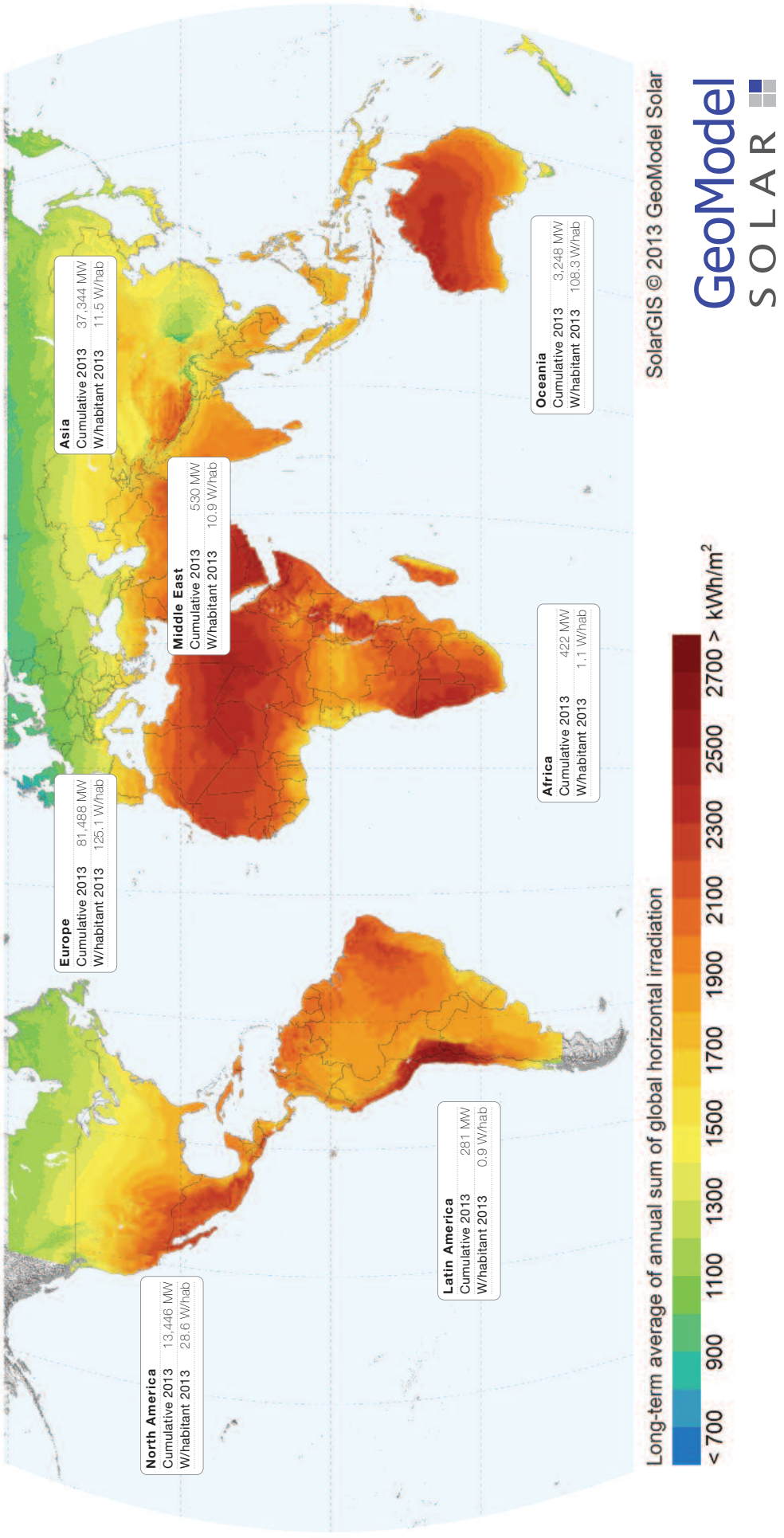


Figure 3 - Global PV regional installations per habitant

3. European market development

Europe's strong PV market development until 2012 was the result of a few countries taking the lead year after year, with German policymakers showing a constant commitment to supporting the development of PV. After the Spanish boom in 2008, Germany alone was the leading market in 2009, and consequently European growth as a whole was limited. In retrospect this can be seen as a consequence of the first phase of the financial crisis but also as a year of stabilisation after the boom PV experienced in 2008. Major growth returned in 2010, with Germany achieving unprecedented installation numbers, and Italy and the Czech Republic adding together close to 3.8 GW of PV systems.

Spain and the Czech Republic demonstrated that overheated market development can produce a boom in one year and a bust in the next, as a result of pressure from conventional energy producers and policymakers concerned about the rapid growth of the market. In 2011, the combined boom in Italian connections and German installations led again to huge growth. France's growth in 2011 was at least partly due to its connection of projects installed in 2010 and consequently in 2012 the French market went down as expected. In 2012, the record year for Germany allowed the European market to maintain a reasonable level of 17.7 GW of installations, with 11.4 GW coming from Germany and Italy alone. Aside from these two, the UK, Greece, Bulgaria and Belgium provided a large part of the European market development.

In 2013, the decline of Germany and Italy as the main drivers of the European market was confirmed. While the sum of the market in other countries remained around 6 GW, the drop in installations in Germany and Italy decreased the total European market to nearly 11 GW. In 2013, the decline of markets that performed well in recent years, such as Belgium or France, was compensated by the boom in Greece and Romania, although, depending on the political circumstances, these latter markets could see a serious decline in the coming years. The rest of the European market development took place in the UK, but also smaller-sized markets such as Switzerland, the Netherlands, Austria, and Belgium still showing progress.

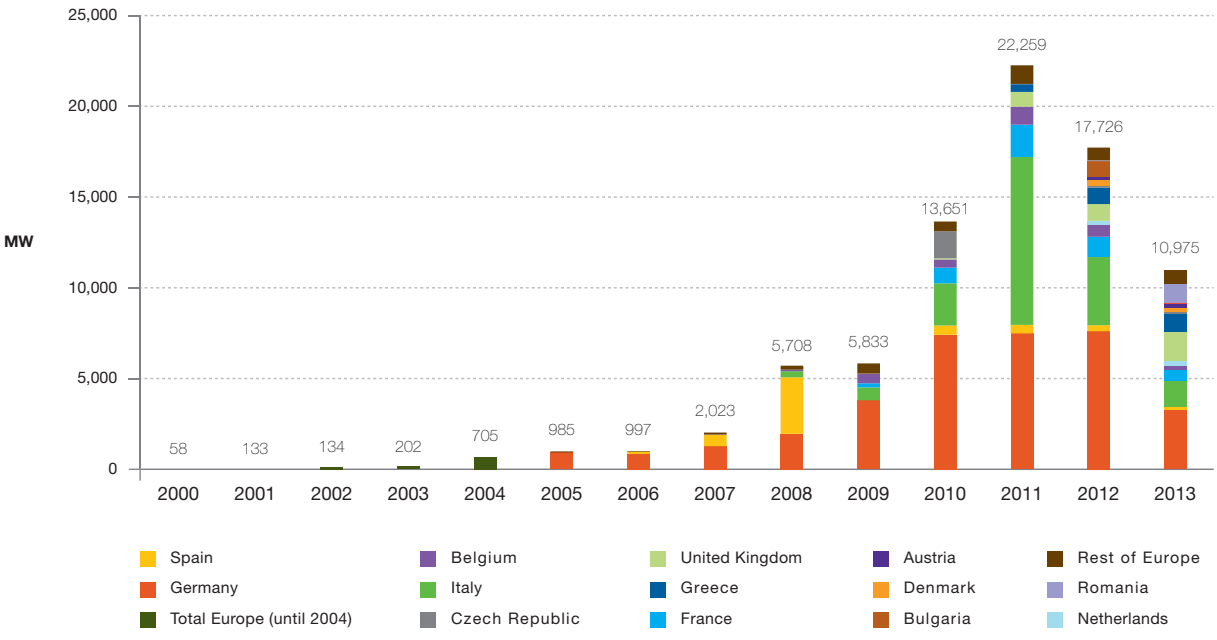


Figure 4 - Evolution of European new grid-connected PV capacities 2000-2013

The cumulative evolution shows a similar story, with countries stabilising their installed capacity after major growth years, as Germany continues to expand its PV base, albeit at a slower speed than in previous years. While the 80 GW mark has been reached in Europe, the pace of PV market deployment has been clearly reduced, which will have consequences for the ability of PV to reach high penetration levels in the short to medium term in Europe.

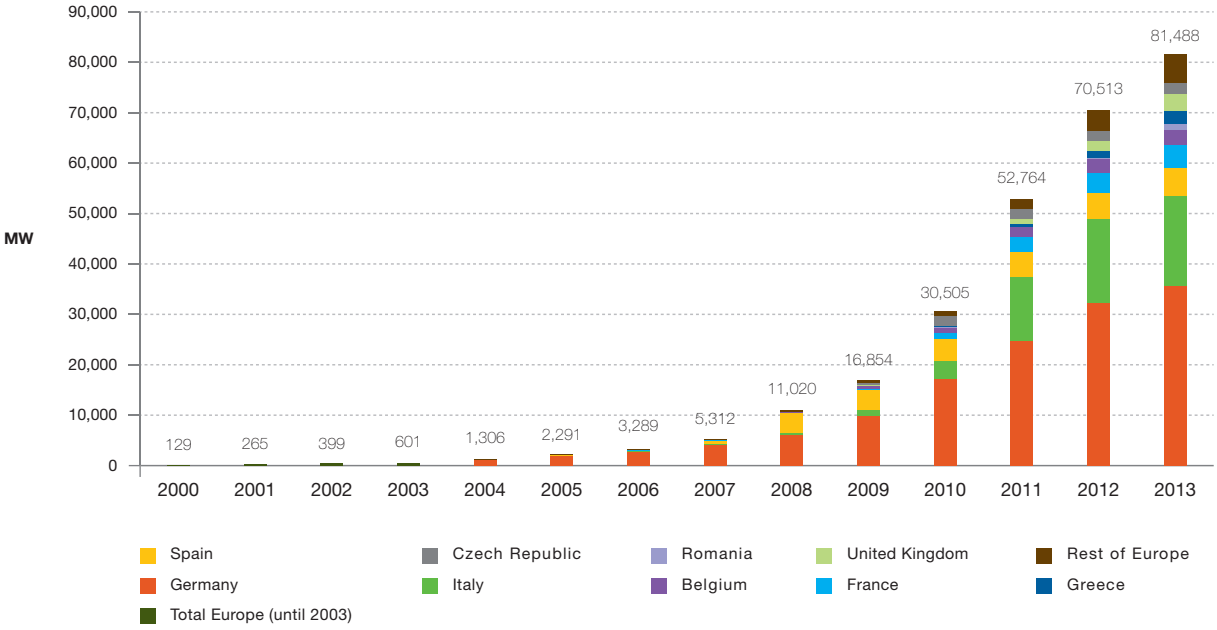
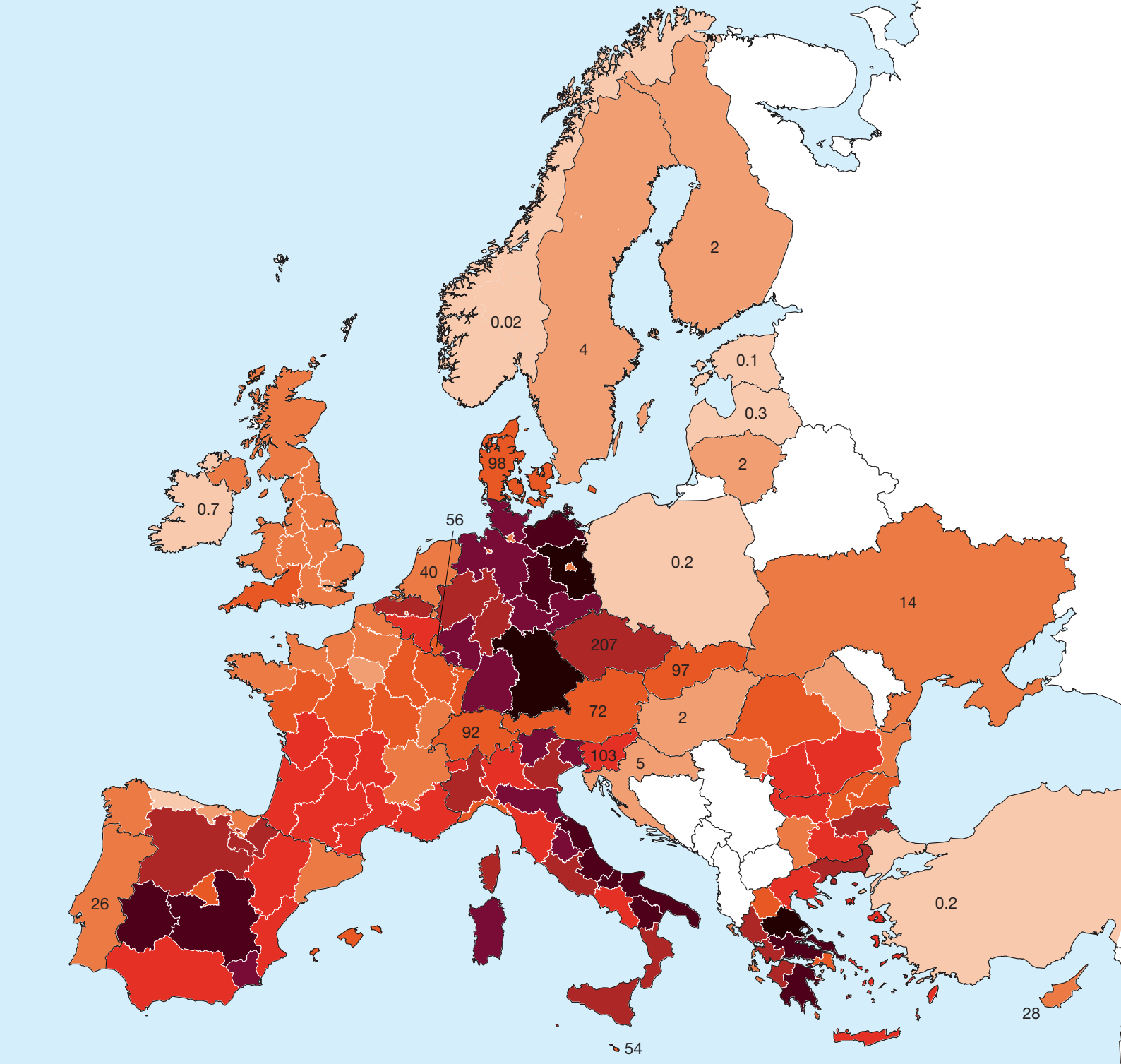


Figure 5 - Evolution of European PV cumulative installed capacity 2000-2013

Germany saw steady growth for nearly a decade and clearly represents the most developed PV market, despite the 2013 market downturn. Countries which got a later start – the Czech Republic, Italy, Greece and Belgium – quickly reached high levels, and decreased rapidly afterwards. Next to these leaders, Spain now appears quite low since its market has been constrained. **The results for France and the UK still reveal untapped potential in both countries, but with different trajectories**. While the French market significantly decreased **in 2013, the UK unexpectedly almost doubled its annual installed capacity** during that year. Indeed, in 2013, the UK installed more than Italy, becoming together with Germany the main drivers of the European market.

Europe's PV development was unrivalled for a decade until 2013. The USA and Japan, once PV pioneers, used to be behind Europe in terms of PV penetration, yet China has reached their level with just a few years of fast development. Apart from Australia, the rest of the world scores quite low in terms of PV penetration, although in many countries there remains great untapped potential, especially in the Sunbelt.

For the most part, the development of PV has until now corresponded with economic development; after taking root in OECD countries (Europe, North America, Japan, Australia), it has started to reach emerging countries. While the BRIC countries score low as a bloc, China and India will lead Brazil and possibly Russia by example. Africa scores last on the development list, though projects are piling up fast.



Legend

- >750 W/habitant
- 500-750 W/habitant
- 350-500 W/habitant
- 200-350 W/habitant
- 100-200 W/habitant
- 50-100 W/habitant
- 10-50 W/habitant
- 1-10 W/habitant
- 0-1 W/habitant
- N/A

	Market 2012 (MW)	Cumulative 2012 (MW)	Market 2013 (MW)	Cumulative 2013 (MW)	W/habitant 2013		Market 2012 (MW)	Cumulative 2012 (MW)	Market 2013 (MW)	Cumulative 2013 (MW)	W/habitant 2013
Austria	175	363	250	613	72	Lithuania	6	6	0	6	2
Belgium	683	2,768	215	2,983	268	Luxembourg	0	30	0	30	56
Bulgaria	843	1,010	10	1,020	140	Malta	4	16	7	23	54
Croatia	0	0	20	20	5	Netherlands	195	360	305	665	40
Cyprus	7	17	15	32	28	Norway	0	0	0	0	0.02
Czech Republic	116	2,087	88	2,175	207	Poland	4	7	1	7	0.2
Denmark	316	332	216	548	98	Portugal	70	242	36	278	26
Estonia	0	0	0	0	0.1	Romania	46	51	1,100	1,151	54
Finland	0	11	0	11	2	Slovakia	15	523	0	524	97
France	1,115	4,060	613	4,673	71	Slovenia	122	201	11	212	103
Germany	7,604	32,411	3,304	35,715	436	Spain	332	5,221	118	5,340	116
Greece	912	1,536	1043	2,579	229	Sweden	8	22	18	40	4
Hungary	8	12	10	22	2	Switzerland	226	437	300	737	92
Ireland	0	3	0	3	0.7	Turkey	5	12	6	18	0.2
Italy	3,759	16,479	1,448	17,928	294	Ukraine	130	326	290	616	14
Latvia	0	1	0	1	0.3	United Kingdom	925	1,829	1546	3,375	53

Country regional data must be considered an approximation.

Figure 6 - European PV installations per habitant

B. THE MARKET IN EUROPE IN 2013 AND THE FORECAST UNTIL 2018

With almost 11 GW of new PV capacity in 2013, Europe has increased its cumulative capacity base to 81.5 GW. This relatively low 2013 result was mainly caused by the significant decrease of two markets, Germany and Italy, while the total size of other European markets remained stable around 6 GW (including the UK which ranked second in 2013). Several other key countries also underperformed, notably France, Belgium and Denmark.

1. Relevant European markets in 2013

The overall decline in Europe's PV market in 2013 hides various realities at national level; market evolution was very different from one country to another. The development until 2013 was accompanied by a progressive evolution in market dynamics, with PV in 2013 becoming increasingly self-sustainable in several market segments and countries. With PV's levelised cost of electricity (LCOE) now lower than the price of retail electricity, at least in the residential and commercial segment in Germany or Italy, PV development could be at least partially driven by self-consumption rather than only FiTs or similar support schemes.

But the competitiveness of PV installations not only depends on the ability of PV to reduce electricity bills, but also to sell excess electricity on the markets. From this point of view, 2013 was a difficult year, with several countries backtracking from previous commitments, through measures aimed at discouraging prosumers (Spain) or increasing grid costs for PV systems (Bulgaria, Belgium – although subsequently revoked). In addition, several countries took retrospective measures that reduced the revenues of existing PV plants in the last few years (Spain, Czech Republic, Greece…), damaging the attractiveness of PV as a long-term investment and penalising the market in these countries.

For the first time in years, the installations in **Germany** went down to 3.3 GW. Germany saw three consecutive years with a roughly stable 7.4-7.6 GW of connections, leading to a total installed capacity in the country of a record 35.7 GW. However, regulatory changes pushed the market down.

While the **UK** has approached the one GW mark in recent years, 2013 can be considered as a record year for the country. With 1.5 GW installed last year, the UK took the position of second European market over Italy.

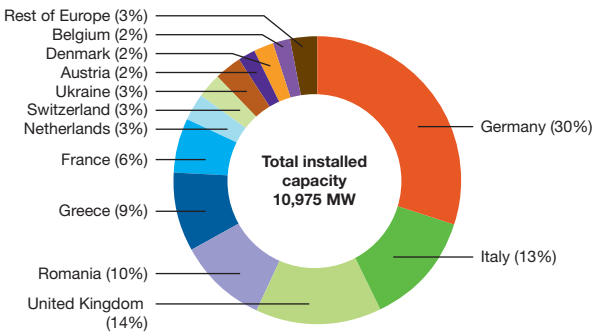


Figure 7 - European PV market split in 2013

In **Italy**, 1.4 GW of PV were connected to the grid in 2013, a sharp decrease compared to 2011 and 2012, causing it to lose the second place position it held for some years. In fact, after the rush of 2011 and 2012, the Italian market has dropped down to a level that nevertheless remains the third highest in Europe. Having reached a financial cap for FiTs, the Italian market is now experiencing the transition to the post-FiT era with a substantial market level decrease.

Other European markets together represented roughly the same level of installations as in 2011 and 2012, but the countries that significantly contributed were rather different from one year to another. In 2013, two countries installed slightly more than 1 GW of PV: after several years of expectations, **Romania** installed around 1.1 GW in only one year, a fast development level that is probably not going to be maintained there. A vigorous market saw **Greece** cross the one GW mark again with 1.04 GW installed, but without clear perspectives for 2014.

Amongst the countries that installed at least 1 GW in the last few years, **France** disappointed with only 613 MW installed in 2013, a sharp decline compared to 2011 and 2012, due to political uncertainty and a lack of political will to develop PV. In addition, government decisions to hastily freeze or reduce support mechanisms as well as opposition from the main conventional stakeholders led to a negative image of PV technology in the public eye. With 613 MW of PV in 2013, the country is still performing at rather low levels compared to the largest European markets and below 2011 when it scored 1.77 GW. While the government reconfirmed in 2013 its will to allow 1 GW of new capacity be installed every year, the constraints on market development remain significant.

Denmark had been one of the surprises of the year 2012 with 316 MW, but the boom was stopped in 2013 by a change in the net-metering policy: the compensation period which was an entire year in 2012 was reduced to an hour, reducing the attractiveness of PV in this country. Nevertheless the market level established itself at 216 MW. **Austria** installed around 250 MW and **Switzerland** 300 MW, in a growing market. The net-metering system in the **Netherlands** performed quite well and the country installed around 305 MW of new PV installations in 2013.

Belgium installed only 215 MW in 2013, after having reached high levels in 2011 and 2012, in a context of strong political concern over the cost of support schemes and long discussions about retrospective measures and additional grid fees for prosumers. **Bulgaria** experienced a boom in 2012, with a total of 843 MW installed before the government reacted with harsh retroactive measures to slow the market growth. The consequence in 2013 was clear with the country's market slowing down to only 10 MW. The **Czech Republic**'s boom is a story from the past and the market only reached 88 MW in 2013, significantly below the 2012 level when 116 MW were installed. Some countries, notably **Poland**, failed to fulfil expectations in 2013 and the prospects for 2014 remain weak, despite some potential.

In the Spanish context of economic crisis, huge overcapacities in the electricity sector and strong opposition to PV from the authorities and some electricity stakeholders, the decisions taken in 2013 resulted in a reduction of the market to a very low level. Only 118 MW were connected to the grid in 2013 in a country which has the potential to be among the European leaders. The long-expected net-metering scheme was never introduced and the self-consumption policy that was presented in 2013 will not allow PV to develop in the coming years: the levy imposed on prosumers, combined with dissuasive tariffs for grid connection, appears to be the most constraining regulation in Europe for self-consumption.

Ukraine's PV development continued in 2013 with 290 MW installed, a level that can be compared to 2011 and 2012. The turmoil in the country didn't really affect the market in 2013 but could be much more damaging in 2014, especially in the Crimea, where the Ukrainian government stopped support schemes due to the geopolitical crisis. **Slovakia**, which experienced a relative boom at the end of 2011 and the first semester of 2012, went down to zero in 2013. **Slovenia**, which grew over several years and installed 122 MW in 2012, went down in 2013 to 11 MW.

The development level in **Russia** remained quite low with only a few MW installed and few prospects in the short term. **Sweden** has seen several MW installed each year (18 MW in 2013) but without significant policies and prospects.

Turkey remained quite low at around 6 MW despite its potential, but the situation could change in 2014. Several other countries have reported some MW installed but without representing any significant change at European market level.

2. Segmentation

The European PV market remains quite varied, with very diverse segmentation from one country to another (Figure 8). The market segmentation has been split to distinguish between ground-mounted systems, commercial and industrial rooftop applications and residential applications.

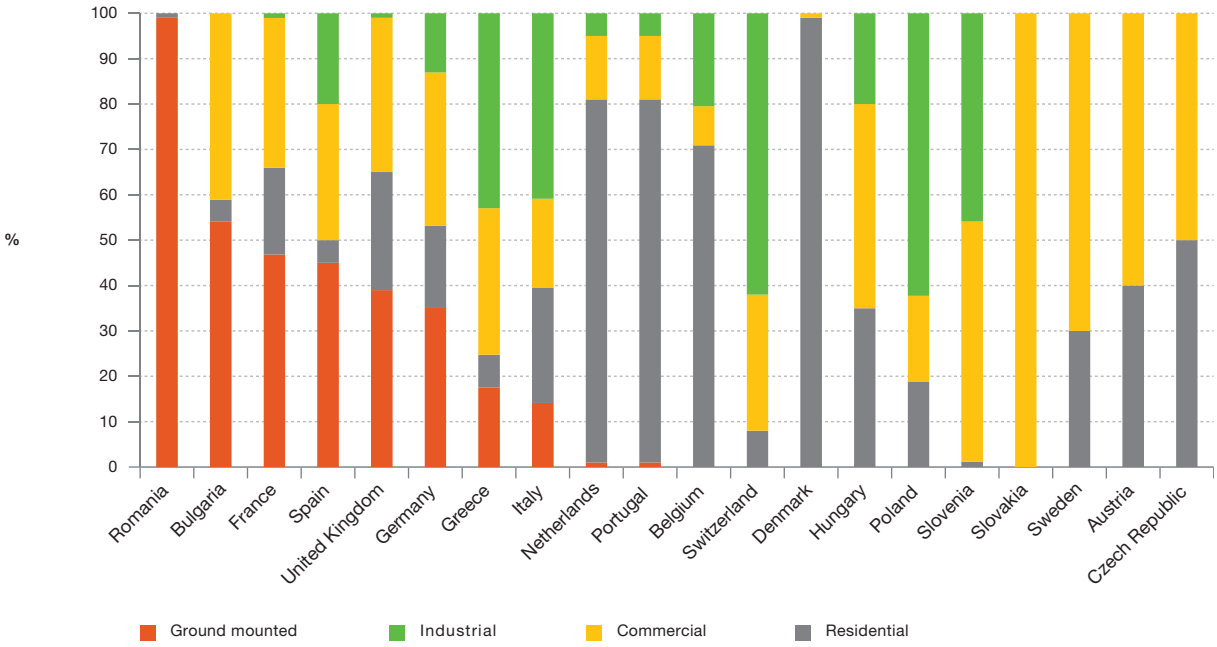


Figure 8 - European PV market segmentation by country in 2013

The segmentation is not classified according to standard sizes, since the size of system largely depends on the respective structure of support schemes, country by country. In general, the commercial segment should be distinguished from the residential segment not only according to the system size but also the nature of the investor (private or public person) and the respective regime of retail electricity prices. The same classification can be applied to distinguish between commercial and industrial segments, according to the electricity price contracts.

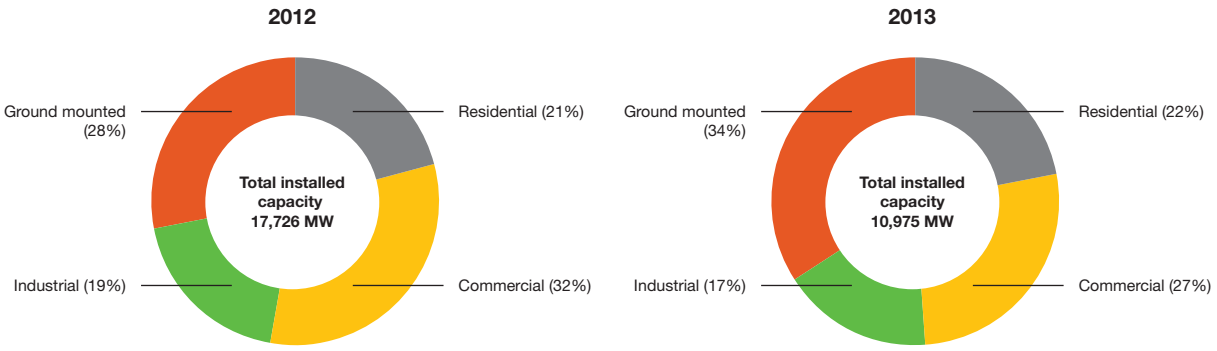


Figure 9 - European PV market segmentation in 2012 and 2013

Market segmentation in Europe evolved in 2013 compared to previous years. Given the 2012 and 2013 changes in regulatory frameworks, the ground-mounted segment was expected to decline in Europe in 2013. This was not the case and ground-mounted plants represented a higher share of a reduced market in 2013. **Overall a very large share of the market in Europe is still concentrated in the commercial and industrial rooftop segments; this trend will continue**, based on the foreseen evolution of the legal framework. **The residential segment has developed very rapidly in some countries**, such as Belgium (where 1 out of 13 households are now equipped with a PV system), Denmark, Greece and the UK.

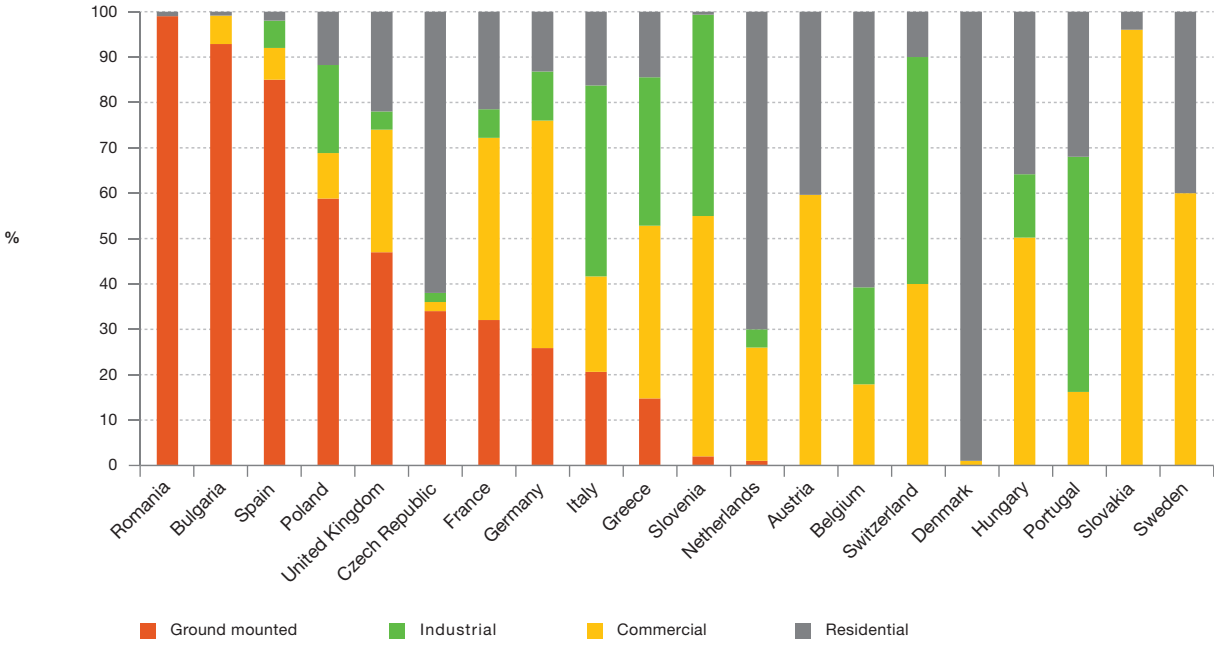


Figure 10 - European PV cumulative capacity segmentation by country in 2013

The top five countries per segment show the relative domination of the largest markets (Germany, Italy, UK and France).

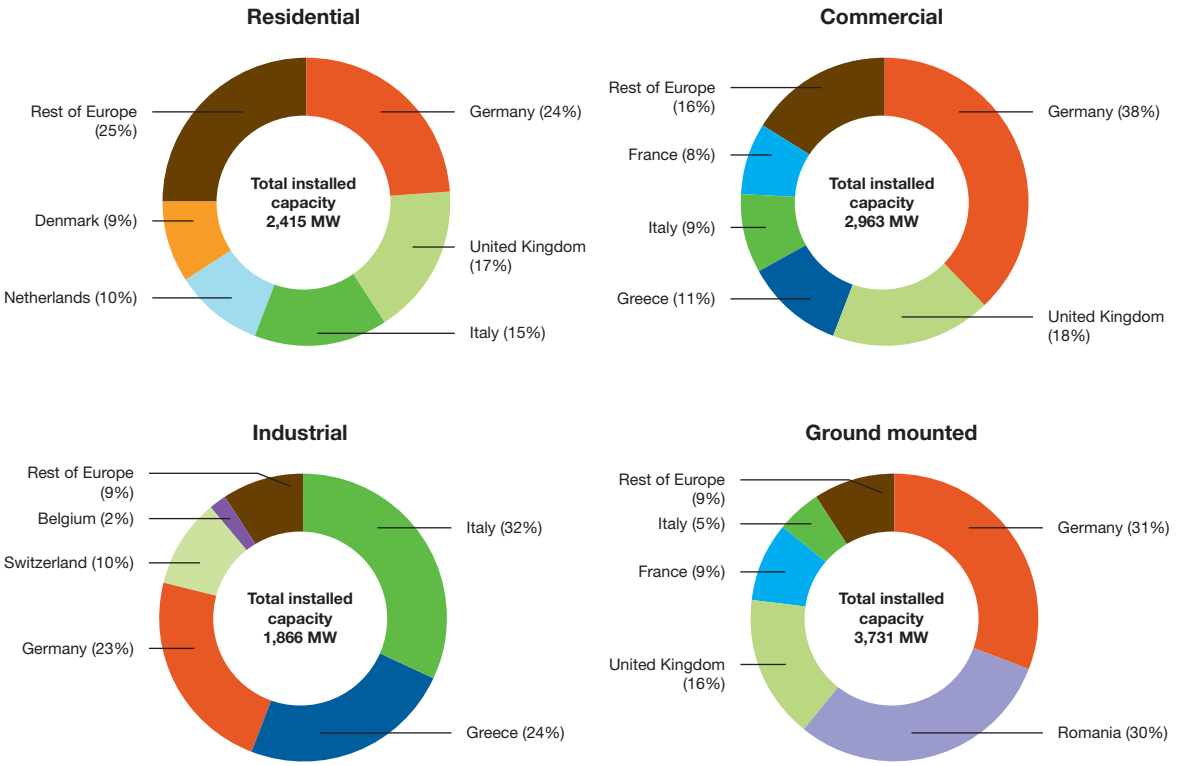


Figure 11 - Top 5 European markets per segment in 2013

3. Forecasts of PV in Europe until 2018

Forecasts for PV installations in the previous edition of the Global Market Outlook proved to be correct. The 2013 global market figure of 38.4 GW indeed represents the average from the Low Scenario (28 GW) and the High Scenario (48 GW) in last year's edition.

The European PV market peaked in 2011 with more than 22 GW installed. Such a high level was not sustainable and the market went down to 17.7 GW in 2012. The 2013 market declined further to nearly 11 GW, which is the lowest level since 2009 in Europe. While the market slowdown in Germany and Italy was predictable and expected, the stability of the rest of Europe (considered as a whole) should not be misinterpreted. What could appear at first sight as a sign of more sustainable market development in these countries is revealed as something different after an in-depth examination of the remaining 5-6 GW. Each year, some markets boomed before experiencing a bust in the following years, and the market was shored-up by different countries every year. The picture is clearer when looking at the countries that installed close to or at least 1 GW each year (outside of the top two countries); in 2011, Belgium, France, and the UK; in 2012, France again, the UK, Greece and Bulgaria; in 2013, Italy and Greece again, and Romania.

The instability of markets in Europe leads to the important conclusion, for market forecasts in Europe that, with the exception of a comparably soft landing of the market in Germany, no country that experienced a serious PV boom once has so far succeeded in restoring market confidence. On the contrary, policymakers seem to have ensured that in these countries PV would not be allowed to reach the same market levels reached previously. This was the case in Spain, Czech Republic, Slovakia, Bulgaria, and most probably in Belgium and Italy. The number of markets in Europe where PV hasn't developed yet remains limited and considering past experience, a further overall market decline could emerge if particular countries replicate the pattern of boom and bust seen elsewhere in Europe.

Overall, **the future of the European market is uncertain for the coming years**. The drastic decrease of some FiT programmes will push some markets down in 2014, with a limited number of emerging markets in Europe that could offset any major decline. Given these new conditions, **the short-term prospects for the European markets are stable in the best case**, and could even decline. In the Low Scenario, without support from policymakers for PV, the transition to a cost-competitive PV market driven less by financial support schemes could be difficult over the five years to come, with a rather low market in Europe (around 6-8 GW). In the High Scenario, the market could stabilise in 2014 and grow again from 2015 onwards, driven by the approaching competitiveness of PV and emerging markets in Europe. This would require a stabilisation in the largest European markets (Germany, Italy), a continuation of current policies in the UK and a renewed uptake in Spain and possibly France, and a soft landing of markets in the final years before 2018 (especially in Greece and Romania). The contribution of middle-size markets such as Belgium, the Netherlands, Denmark, Switzerland, Austria and Portugal could help maintain the market at its 2013 level during the coming years.

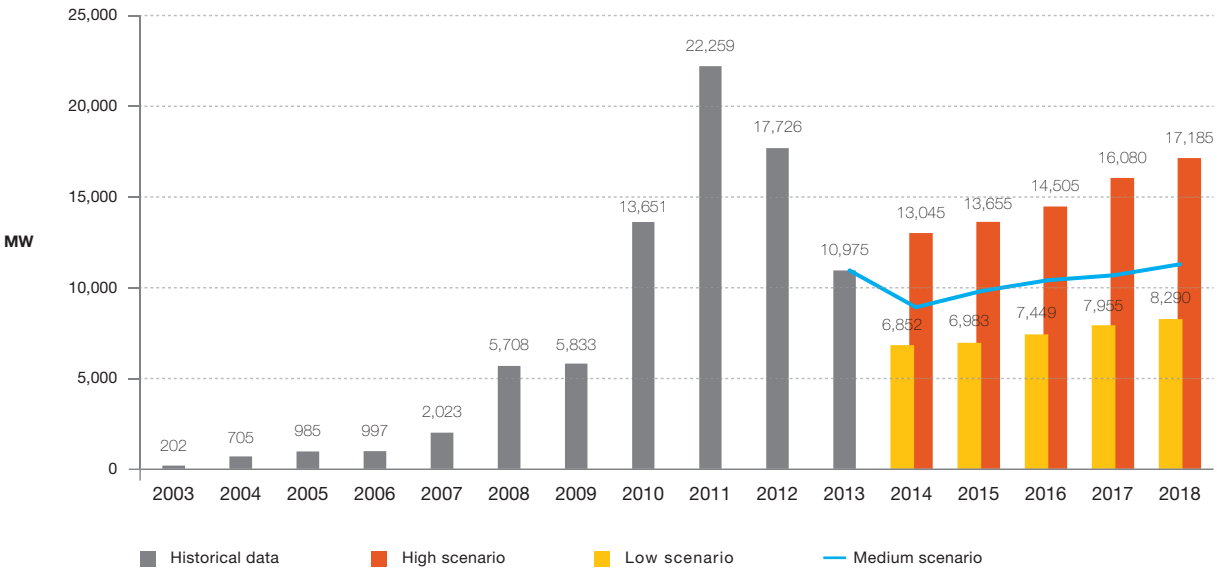


Figure 12 - European annual PV market scenarios until 2018

In the highest probability situation, 2014 will see a new market decline in Europe that could limit the amount of new connections to around 8-9 GW, while competitive PV in several key countries could help maintain the market at around 10-12 GW in the second part of the decade.

The total installed capacity in Europe could reach between 119 and 156 GW in 2018, starting from 81.5 GW at the end of 2013. In the best case, the 100 GW mark could be reached by 2015 in Europe.

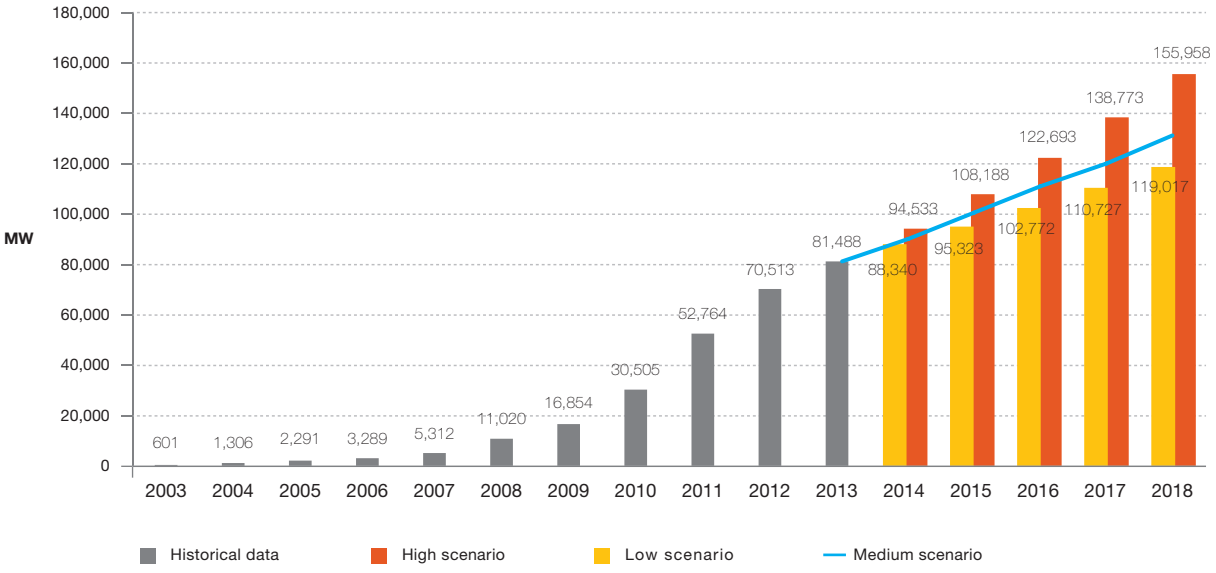


Figure 13 - European cumulative PV market scenarios until 2018

The countries where PV has not developed until now will be interesting to follow in the coming years, because of their untapped potential but also for the unique opportunity to witness a different market development than what was experienced until now in most European countries. **The history of PV proves that a stable policy framework using support schemes in a sustainable way increases market confidence.** Poland, Croatia, Hungary and to a lesser extent Ireland could develop in the coming years in various forms. Outside of the European Union, Turkey and some Balkan states will become focal points. Amongst the "old" markets, the rebirth of France, at the heart of the European grid, should be carefully followed and encouraged in a way that suits the specifics of this country. In a similar way, PV will not redevelop in Spain unless solutions can be found to the relative isolation of the country from a grid perspective. Finally, **the concept of *prosumers* seems to increasingly generate interest, but its materialisation in real markets remains unsure, depending also on regulatory framework conditions, including the allocation of charges and taxes. In 2013, the sum of installations that were at least partially driven by self-consumption in Europe amounted to over 2 GW. The question is how fast prosumers will become central actors of PV development in Europe.**

4. 2020 potential and targets in the EU

→ Potential vs. market reality for PV deployment in the EU

EPIA's report "Connecting the Sun: Solar photovoltaics on the road to large-scale grid integration", published in 2012, identifies several possible PV deployment scenarios to 2020 and 2030 that represent the technology's potential in line with the current economic and regulatory environment.

- The **Baseline scenario** envisages a 4% share of the electricity demand in the EU provided by PV in 2020. This represents about 130 GW of cumulative capacity by 2020. In 2030, PV could represent up to 10% of the electricity demand.
- The **Accelerated scenario**, with PV meeting 8% of the demand, represents about 200 GW of cumulative capacity by 2020. In 2030, PV could target up to 15% of the electricity demand.

EPIA has compared various PV market forecasts until 2018 against the two scenarios developed in the "Connecting the Sun" report as described above, as well as the NREAPs:

- The **Low Global Market Outlook Scenario for PV until 2018** that used to be aligned with the 4% target (Connecting the Sun's Baseline scenario) appears now to be slightly higher. This represents a rather stable perspective compared to previous EPIA forecasts. Thus, it looks reasonable to expect that 4-5% penetration for PV could be reached even in the low growth case
- The **High Global Market Outlook Scenario for PV until 2018** appears increasingly unlikely to be fully realised. While this scenario of reaching 8% by 2020 looked coherent and in line with optimistic market expectations, the current political backlash has led to a revision of this objective downwards to around 7%. Reaching a substantially higher share would require a real paradigm shift in the way PV is supported and incentivised, even after cost-competitiveness is reached in many countries and market segments. It is clear today that more ambitious scenarios are not realistic options anymore and would require tremendous market developments, currently unsupported by public policies in Europe
- The **NREAPs** as devised in 2009 are far from the reality of today's PV market. Apart from Germany and Greece (which defined ambitious targets), market evolution in most countries could easily overtake the action plans. Future expectations largely reflect the current balance of installations, with Germany and Italy dominating the market. In the EU forecasts, the NREAPs targets with the intermediary value for 2015 have been taken into account. The extent to which they have underestimated the market developments from 2012 and even 2013 is obvious (Figure 14)

The following table details for most EU markets the cumulative installed capacity at the end of 2013, the official National Renewable Energy Action Plan (NREAP) target for PV by 2020 and the necessary yearly market to reach this 2020 target (linear projection).

	Cumulative installed capacity in 2013	NREAPs' 2020 target for PV	Necessary yearly market until 2020	Target reached in...	Market in 2011	Market in 2012	Market in 2013
Austria	613	322	n/a	reached in 2012	92	175	250
Belgium	2,983	1,340	n/a	reached in 2011	996	683	215
Bulgaria	1,020	303	n/a	reached in 2012	135	843	10
Croatia	20	52	4.5	2014-2015	-	-	20
Czech Republic	2,175	1,695	n/a	reached in 2010	12	116	88
Denmark	548	6	n/a	reached in 2010	9.6	316	216
France	4,673	4,860	26.7	2014-2015	1,777	1,115	613
Germany	35,715	51,753	2,291.2	2014-2015	7,485	7,604	3,304
Greece	2,579	2,200	n/a	reached in 2013	426	912	1,043
Hungary	22	63	5.9	2014-2015	2.0	8	10
Italy	17,928	8,000	n/a	reached in 2011	9,251	3,759	1,448
Netherlands	665	722	8.1	2014-2015	58	195	305
Poland	7	2	n/a	reached in 2012	1.3	4	1
Portugal*	278	720	63.1	2016-2020	38	70	36
Romania	1,151	260	n/a	2014-2015	1.6	46	1,100
Slovakia	524	300	n/a	reached in 2011	321	15	0
Slovenia	212	139	n/a	reached in 2012	43	122	11
Spain	5,340	8,367	432.5	2016-2020	472	332	118
Sweden	40	8	n/a	reached in 2011	4	8	18
United Kingdom	3,375	2,680	n/a	reached in 2013	813	925	1,546
Rest of EU 28	99	308	29.9	2016-2020	24	17	42
Total EU 28	**79,964**	**84,381**	**630.9**	**2014-2015**	**21,961**	**17,265**	**10,395**

* In April 2013, a revised Renewable Energy Action Plan - REAP (2009/28/EC Directive) was published, adjusting the 2020 targets for each technology. For solar, the installed capacity target was reduced from 1500 MW to 720 MW.

Target already reached in 2010-2013: Country has significantly underestimated PV's potential.
Target to be reached by 2014-2015: Country has underestimated PV's potential.
Target to be reached by 2016-2020: Country has either properly estimated PV's potential (Germany) or has set measures constraining the market to meet the set target not earlier than 2020.

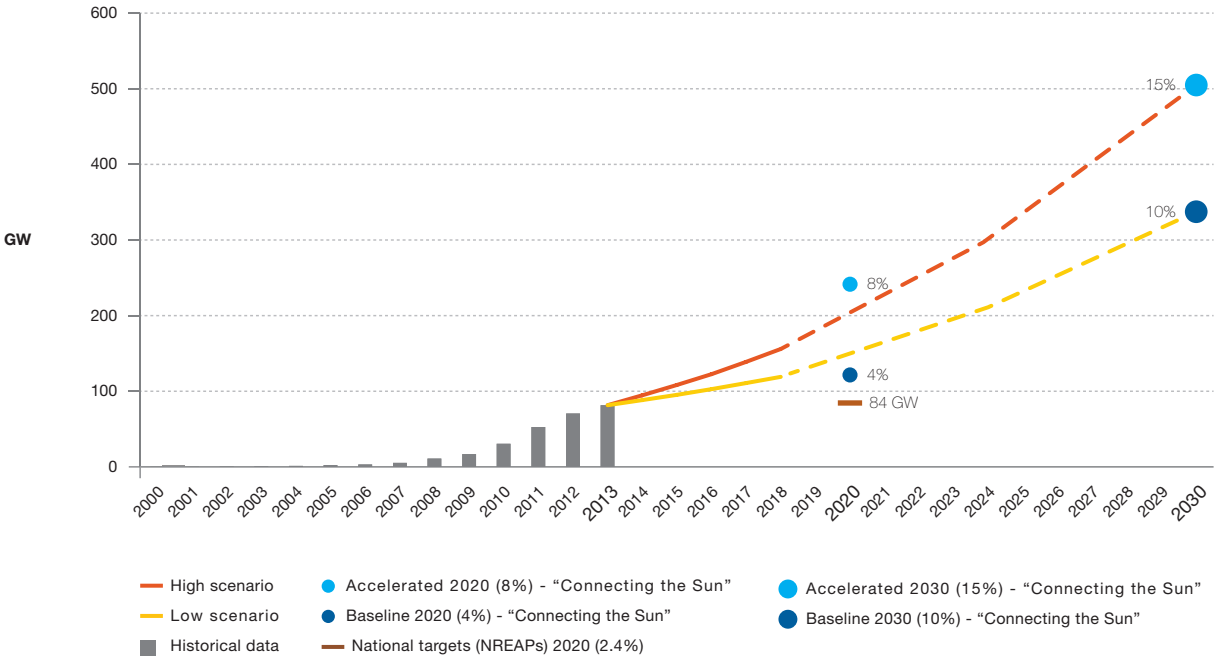
Source: European Commission, DG Energy, Transparency Platform

Table 1 - NREAPs vs. reality of PV markets in the EU 28

5. Medium-term scenario for 2030: How much can PV contribute to a binding 2030 target?

EPIA scenarios (published in 2012) show that PV penetration in Europe in 2030 could be between 10% and 15% of electricity demand. As outlined before however, with current market trends it is quite unlikely that the 8% scenario – which would have corresponded to a 15% share in 2030 - will be fully reached by 2020. Building on these trends, and **without major changes of policy, a share between 7% and 11% of PV in European electricity demand appears realistic**.

The potential for 2020 is roughly twice as high as the levels foreseen in the NREAPs, pushing towards at least 150 GW compared to 84 GW. In fact, with 81.5 GW installed by the end of 2013, the Europe-wide NREAP target of 84 GW will already be reached in 2014.



EPIA, "Connecting the Sun: Solar photovoltaics on the road to large-scale grid integration", 2012.
The percentage indicates the share of electricity demand.

Figure 14 - Cumulative capacity forecast compared to EPIA's new 2030 scenarios

6. Support schemes in Europe and prospects for PV

This table provides an overview of the support framework status in the most relevant European markets in early 2014.

	General political support situation	Political support environment
Austria		Clear FIT evolution in 2014. Self-consumption possible. Administrative barriers could limit market growth.
Belgium		Reduced support to PV for all segments. Streamlined administrative processes. Grid tariff cancelled in Flanders but could be reintroduced. In Wallonia, new scheme could recreate some confidence.
Bulgaria		Very unstable environment. Retroactive grid fees revoked and re-established. Incentives for residential and commercial projects available but administrative procedure complicated and slow.
Croatia		Clear FIT evolution in 2014. Introduction of self-consumption in 2014. Very low cap.
Czech Republic		Reduced tax but environment still hostile to rapid PV deployment. FiT no longer available for PV systems. New legislation foreseen but no details published.
Denmark		Net-metering transformed into quasi- self-consumption. New FiT scheme expected.
France		Clear FiT evolution in 2014. Slow administrative process still in place. FiT bonus for local content no longer available. Political willingness to increase the market up to 1 GW.
Germany		Clear FIT evolution in 2014, but really low return on investment. Simple and lean administrative process. Risk of grid tariff imposition that could harm the evolution towards self-consumption.
Greece		Clear FIT evolution in 2014. Adverse financial environment limiting development of new projects. Residential PV favoured over large-scale PV plants. Possibility of net-metering. Risk of retroactive changes and delays for FIT payments.
Italy		No FiT available but some direct incentives. Possibility of large-scale PV development due to new support schemes introduced in 2013. Risk of retroactive changes. Complex legislation not always easy to implement.
Netherlands		Net-metering and high electricity prices allowing for a residential market to develop rapidly together with an investment grant.
Poland		New FiT and green certificate scheme under discussion for over two years, no adoption foreseen before beginning 2015. Could lead to lack of investor confidence.
Portugal		Drastic changes in the FIT schemes affecting small-scale PV development. Large-scale development still slow due to administrative barriers.
Romania		Drastic reduction of the number of green certificates limiting the market growth.
Slovakia		Very low FIT and heavy administrative barriers. Slow administrative process still in place. Very low cap for 2014 (30 kWp).
Spain		Support to PV frozen since 2012 and any new development blocked for several reasons (overcapacity, tariff deficit, etc.). Heavy and slow administrative processes. Many attempts to revitalise the utility-scale segment without incentives, but no significant development so far. Risk of grid tariff imposition.
Switzerland		Clear FIT evolution in 2014 for large systems. Self-consumption now allowed for residential sector. Long waiting list progressively being cleared.
Turkey		Net-metering scheme for systems up to 500 kW. Administrative process unclear.
United Kingdom		Clear FIT evolution in 2014. Support scheme regularly adapted. Clear and lean administrative processes. Uncertainty for large scale PV development.

Table 2 - Support schemes in Europe and prospects for PV

C. THE GLOBAL MARKET IN 2013 AND FORECAST UNTIL 2018

1. Global PV market growth

While European electricity demand is stagnating, this is not the case globally and PV growth will continue to be driven by local and global energy demand. **The fastest PV growth is expected to continue in China and South-East Asia in general, with Latin America, the MENA countries and India following**. The PV potential of the Sunbelt countries – where PV can already compete with diesel generators for peak power generation without financial support – could range from 60 to 250 GW by 2020, and from 260 to 1,100 GW in 2030. And with the faster than expected price decrease in PV technology that the industry experienced in recent years, even more countries will see PV as a competitive energy source before the end of this decade.

More than 27 GW of new installations of PV systems occurred outside Europe in 2013, compared to 13.9 GW in 2012, 8 GW in 2011 and 3 GW in 2010. The rapid development of **China's** PV market allowed it to take the first position among these countries, followed by a booming **Japan** (6.9 GW) and the **USA** with 4.8 GW. **All three are expected to continue at the same level or even slightly more in 2014, with China probably above 10 GW for several years**.

Australia expanded rapidly in 2011 and 2012 with around 1 GW of new installations, but decreased to 830 MW in 2013. **India** installed more than 1 GW, finally realising a (small) part of its huge potential. In **Korea**, 442 MW were installed, a sign that the market has restarted but remains rather low, constrained by a quota system and some additional incentives. Some other countries experimented with embryonic PV markets: **Taiwan** had a 170 MW target for 2013 while **Thailand**, with a huge pipeline of projects, commissioned 317 MW, and Malaysia, where several manufacturers are producing, appears on the map with 57 MW.

In the Americas, **Canada** has expanded with 444 MW and **Mexico** and **Peru** installed several MW. **Brazil** and **Chile**, with their huge potential, have not commissioned many systems yet but the huge pipeline of potential projects in Chile should bring dozens of MW online in 2014. In the Middle East region, Israel remains the only country with a significant market (420 MW in 2013), while **Saudi Arabia** showed in 2012 and 2013 some interest for PV development that hasn't yet materialised.

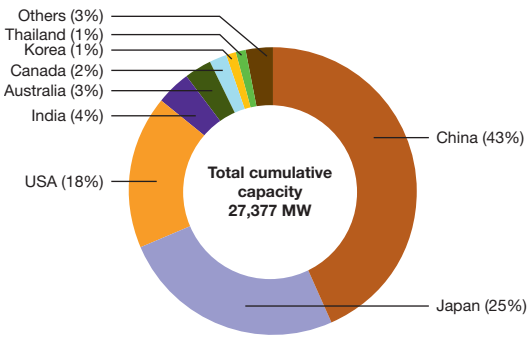
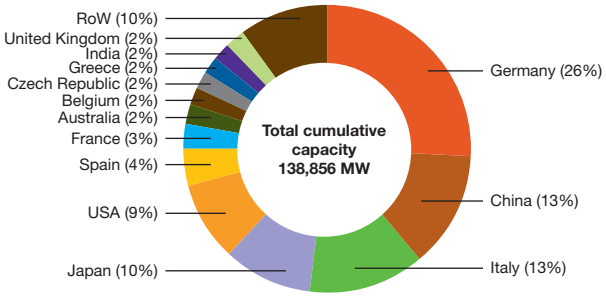


Figure 15 - PV market share outside Europe in 2013

2. Global PV capacity

An examination of the total installed capacity reveals greater contrasts, but differently from the past. **Outside Europe, the market used to be well-balanced, but this was no longer the case in 2013**. The gap has widened dramatically: **China now leads the non-European top three, far ahead of Japan** despite the growth there and even more than the USA. Their markets which remained under control in most countries until 2012, boomed in 2013 in Japan and China, but slowed down in Australia. In general however, the situation remains relatively disciplined, unlike the boom- and bust observed in several European countries. **With the PV potential progressively unleashed in these three countries, the share of PV installations outside Europe can only increase, ensuring the development of the market globally**.



Methodology used for RoW data collection has changed in 2012.

Figure 16 - Global PV cumulative installed capacity share

3. Forecasts until 2018

In the Low Scenario, the global market could remain between 35 and 39 GW annually in the five coming years. The combination of declining European markets and the difficulty of establishing durable new markets in emerging countries could cause this market stagnation.

While the decline of PV system prices in most markets paused in 2013, the installations that were triggered before that pause compensated for the EU decline. Most important markets outside Europe grew in 2013 and without these lost GW in Europe, the global PV market growth would have been even more impressive and reached well above 40 GW.

PV remains a policy-driven business, where political decisions considerably influence potential market take-off or decline. The highest probability scenario assumes a low market in Europe and a growing market in most emerging regions.

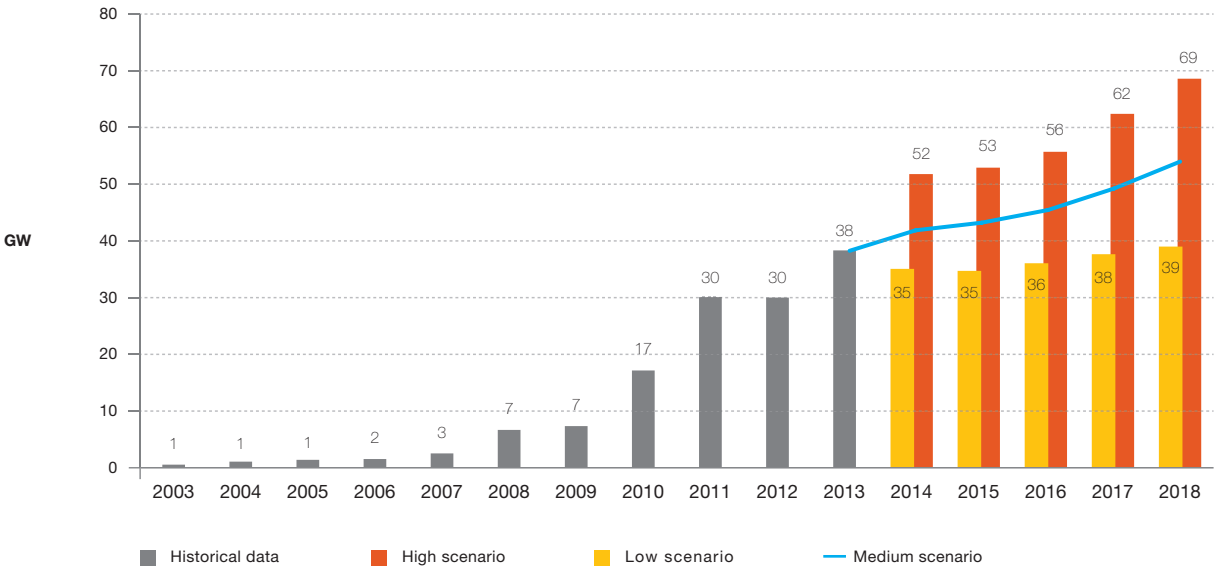


Figure 17 - Global annual market scenarios until 2018

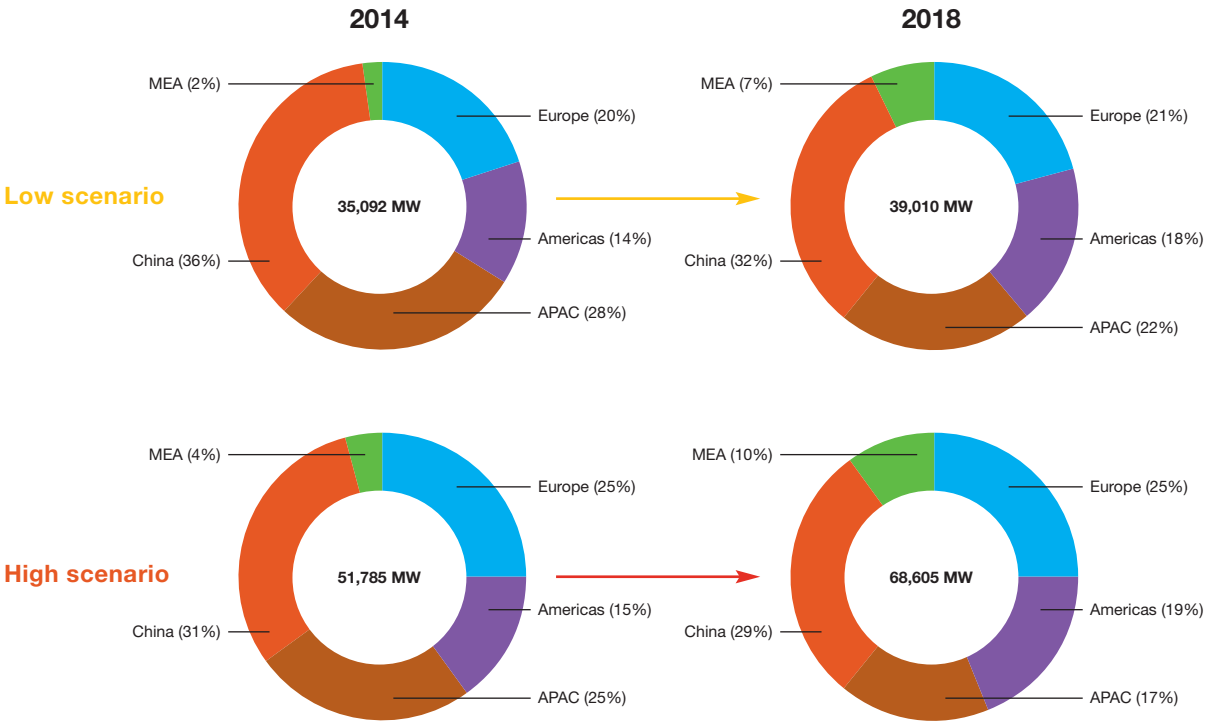


Figure 18 - Evolution of global annual PV market scenarios per region until 2018

In the High Scenario, the European market would first grow around 13 GW in 2014 before increasing slowly again to around 17 GW five years from now, a decline from EPIA expectations last year. In that case, the global market could top more than 68.6 GW in 2018.

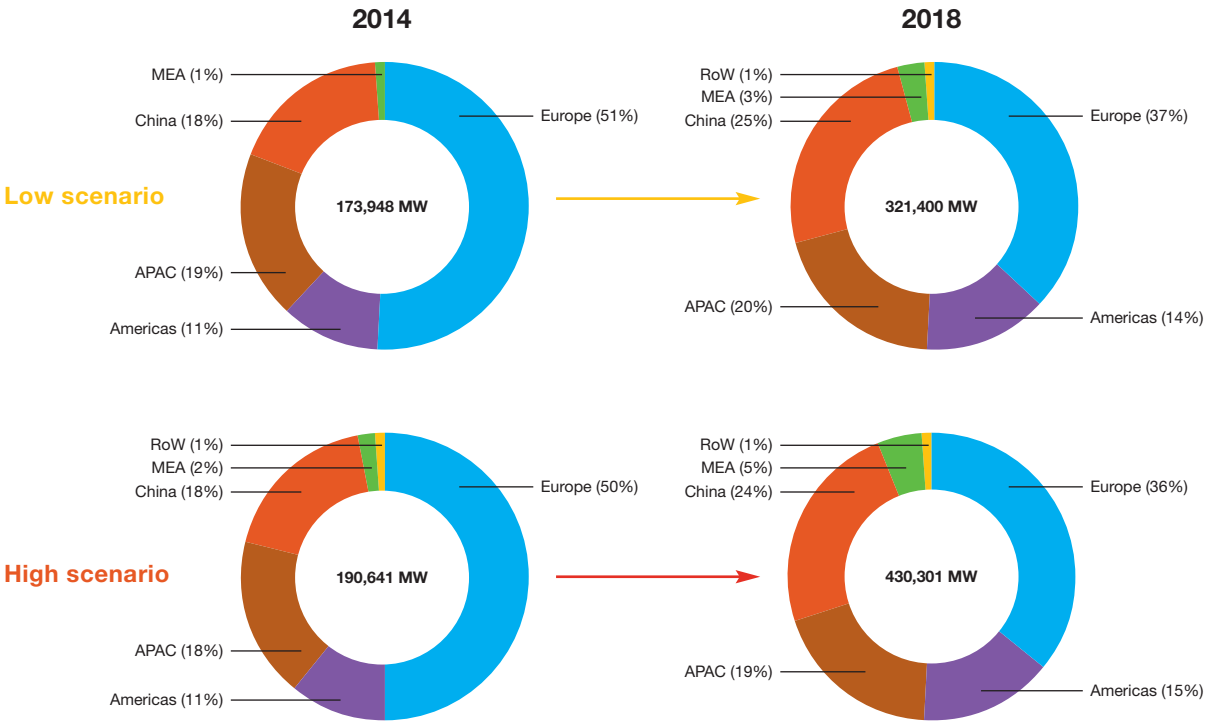


Figure 19 - Evolution of global PV cumulative installed capacity per region until 2018

The Asia-Pacific region, including China, should represent a major share of PV installations in the coming years. In the best case, the world could run up to 430.3 GW of PV systems five years from now, compared to 138.9 GW at the end of 2013.

Methodology used for RoW data collection has changed in 2012.

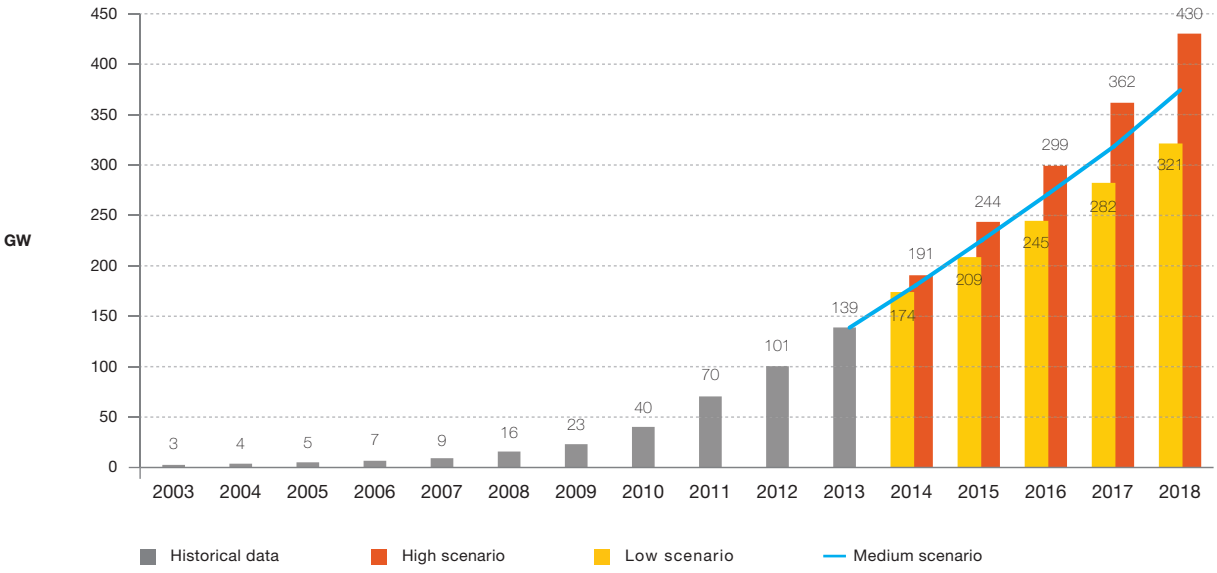


Figure 20 - Global PV cumulative scenario until 2018

4. Forecasts per segment

In 2013 the rooftop segment represented more than 23 GW of total installations, higher than in 2012. With **projections of more than 35 GW installed by 2018**, this segment should experience stable growth from a global point of view (Figure 21). However, the world PV installation segmentation is changing: last year in a Low Scenario more than 27 GW were expected to be installed in the rooftop segment by 2017. This year, expectations have been lowered to slightly above 20 GW which means a stable market until 2018. This can be explained by a shift towards utility-scale plants in the Sunbelt markets, due to a different nature of the investors and less opposition to ground-mounted PV systems than in Europe.

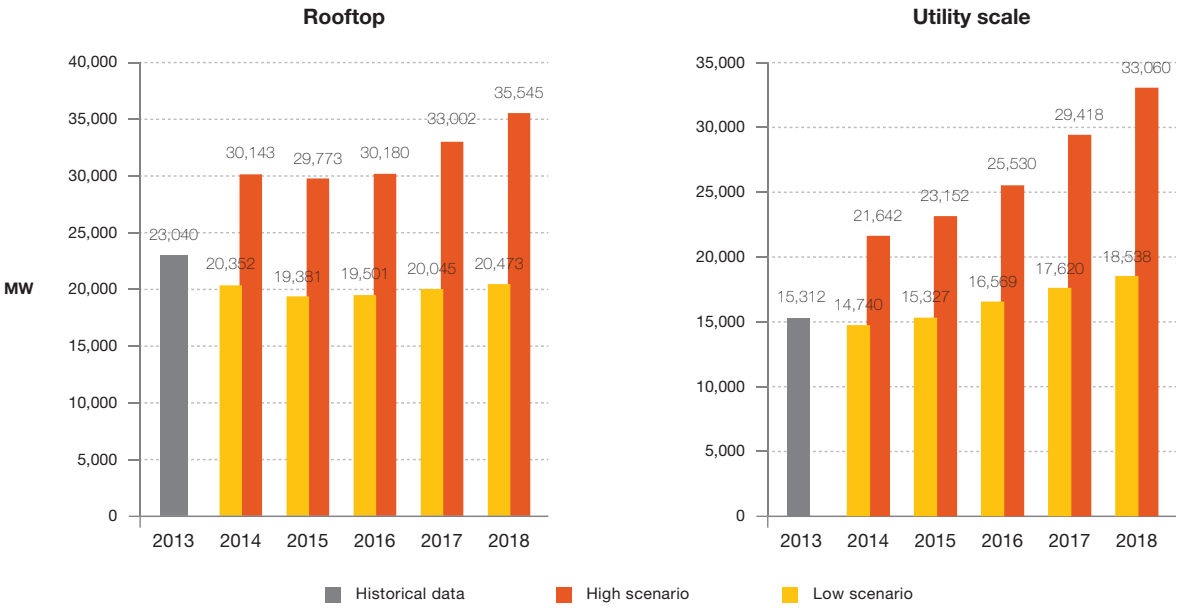


Figure 21 - Scenarios for rooftop and utility-scale segments development until 2018

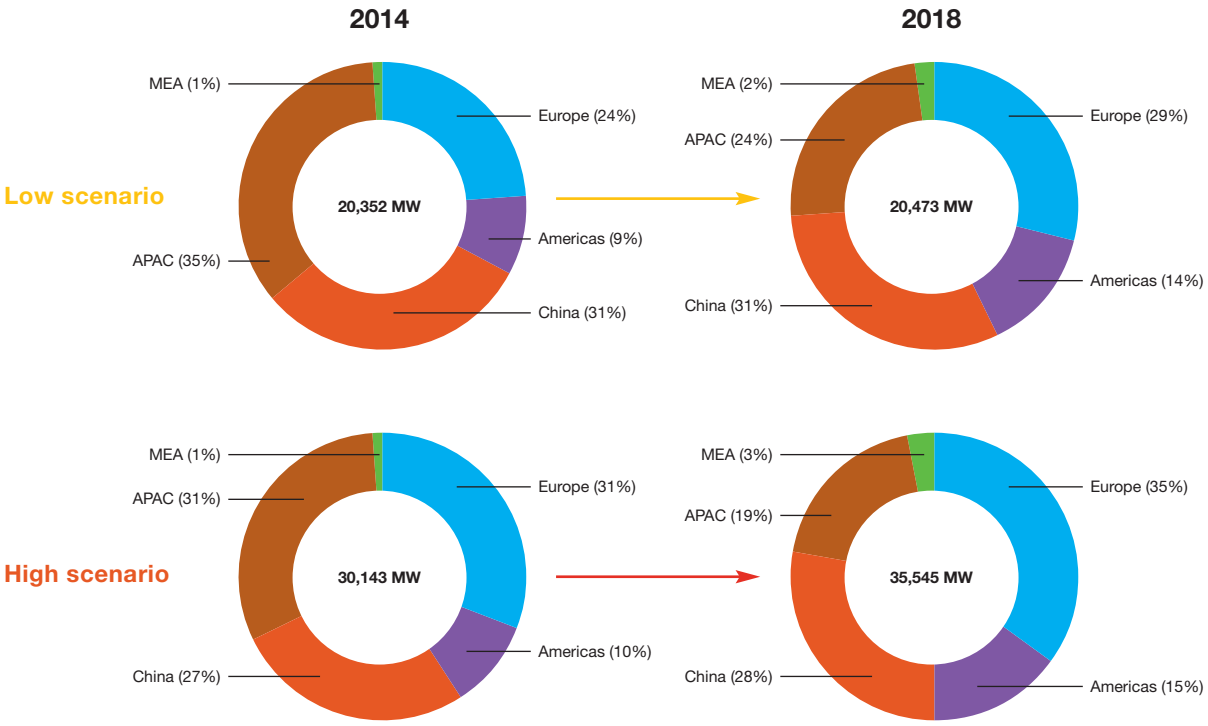


Figure 22 - Global rooftop PV market by region until 2018

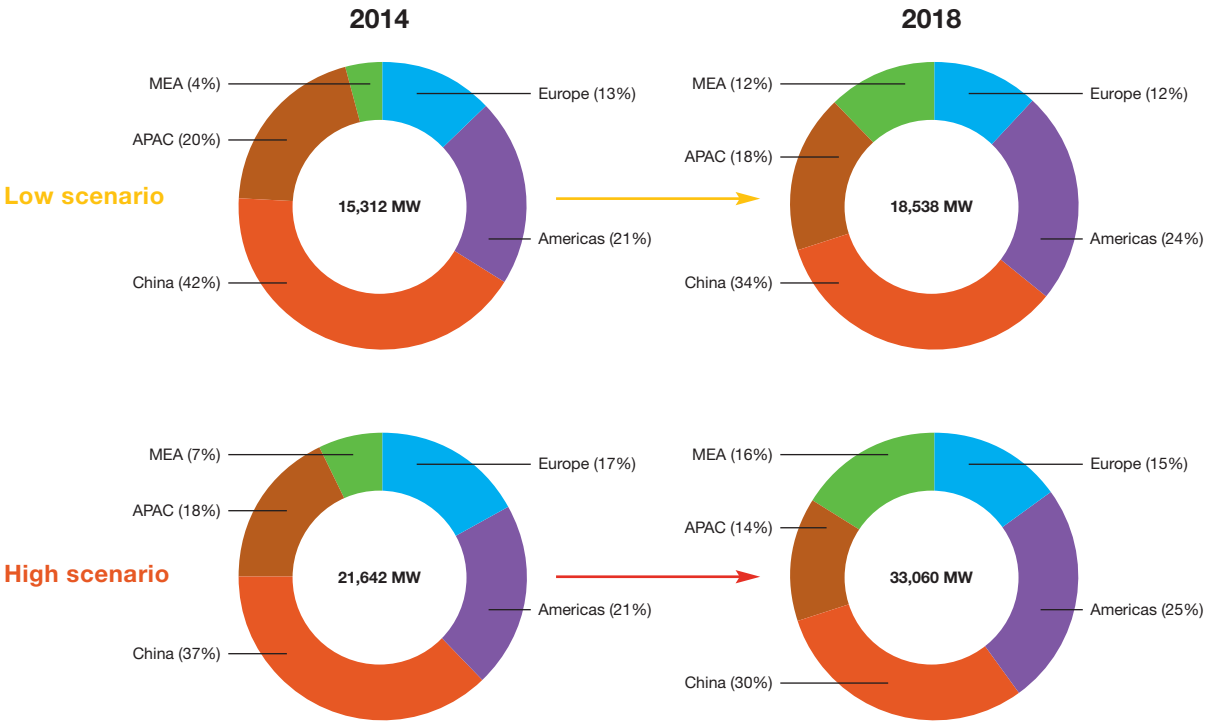


Figure 23 - Global utility-scale PV market by region until 2018

5. Future prospects for market development

In 2010 EPIA first published the "Unlocking the Sunbelt Potential of Photovoltaics" report, aimed at paving the way for the development of PV outside its initial developed markets. The report estimates the development for PV according to two sets of drivers - the country's attractiveness for investors, which can change rapidly, and the attractiveness for PV (Figure 24). The latter is not related to a country's political and business environment but rather calculated based on criteria such as the size of the electricity market and PV cost competitiveness (which includes country irradiation level, a key element in PV production possibility). Based on the same methodology as the report, Figure 24 uses data from 2012 and 2013 and gives an updated view of the PV potential in different countries.

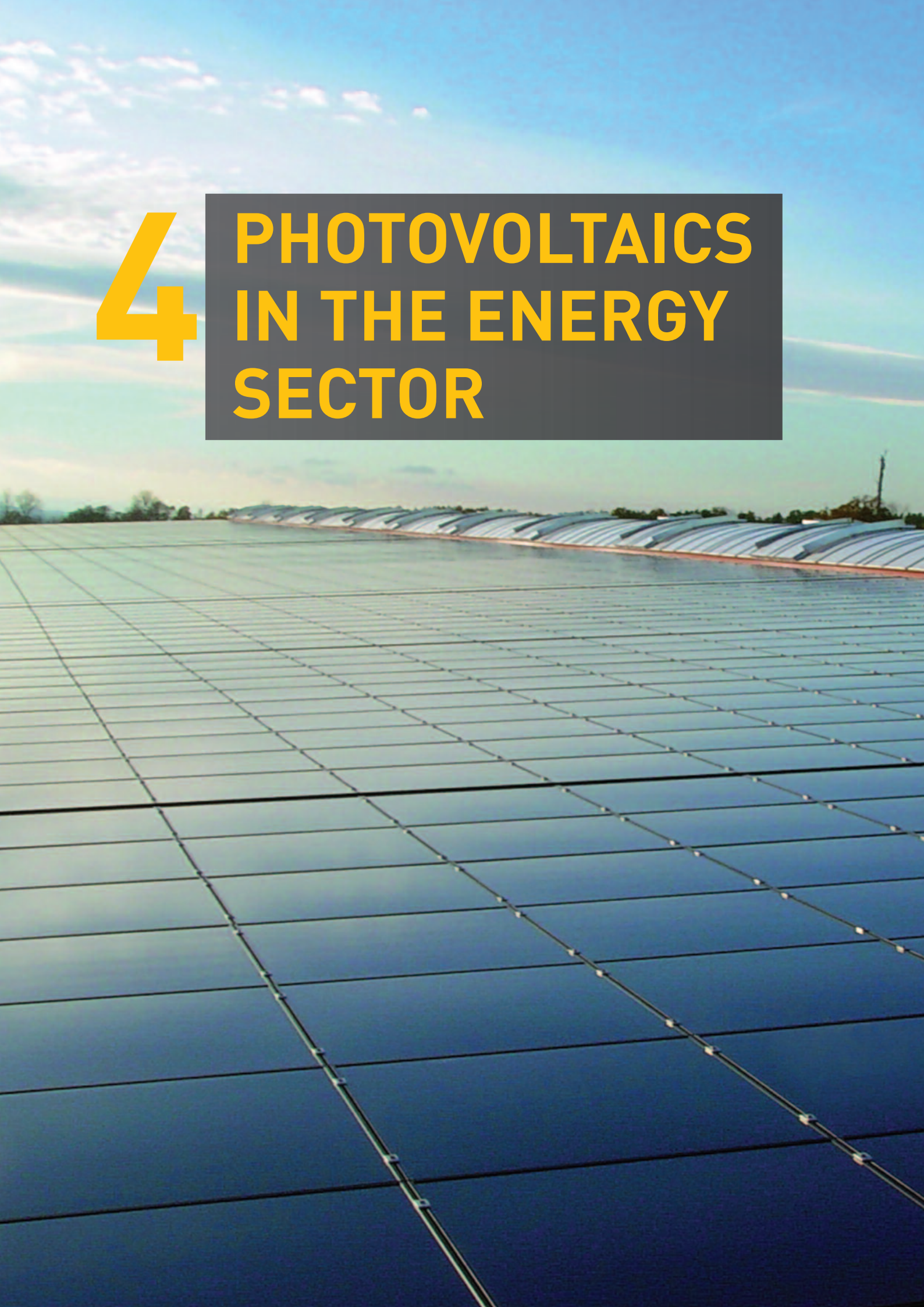
Since the publication of the EPIA report in 2010, the following markets have indeed experienced some PV market development - China, Australia, India and Israel – and several others are expected to grow fast in 2014 and 2016 - Mexico, South Africa and Chile.

However, even in countries considered attractive from a PV perspective, the possibility to develop PV can be dragged downwards by the general local conditions for investors (which includes the size of GDP and political/financial stability).

Source: EPIA 2014, Unlocking the Sunbelt Potential of Photovoltaics, 2010

Figure 24 - PV opportunity mapping of Sunbelt countries

4 PHOTOVOLTAICS IN THE ENERGY SECTOR



4. PHOTOVOLTAICS IN THE ENERGY SECTOR

A. POSITIONING PV IN THE ELECTRICITY GENERATION MIX

1. PV positioning in 2013

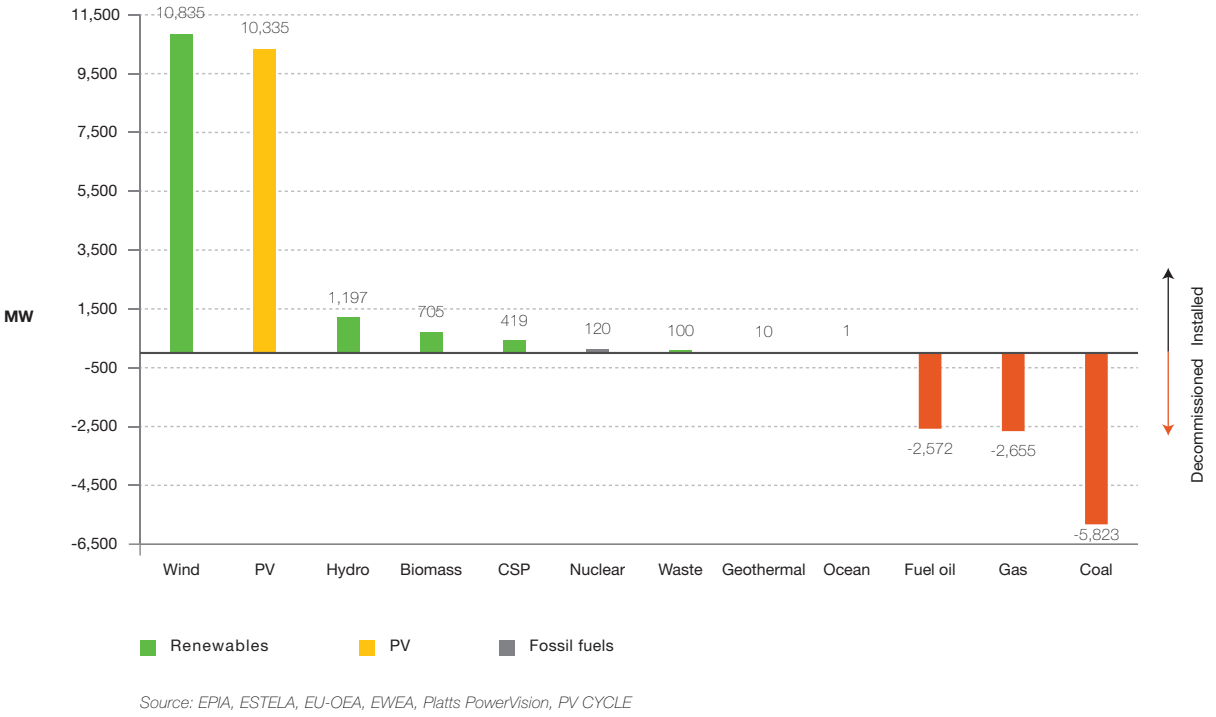
After having scored the top position in the EU in terms of new added capacity in 2011 and 2012, PV was in second place in 2013 ranking, after wind. **With more than 21 GW connected to the grid for PV and wind, these two renewable electricity sources together beat gas and all other sources of electricity**.

Following the continued growth of gas capacity in Europe over the last decade, a remarkable fact about 2013 was the negative net installed capacity of gas. **Gas installations reached a peak in 2010, with more than 20 GW newly connected to the grid, before falling to negative net numbers in 2013. All other conventional sources of electricity in the best case stagnated in 2013 (nuclear) or lost capacity (coal, oil).**

Source: EPIA, ESTELA, EU-OEA, EWEA, Platts PowerVision, PV CYCLE

Figure 25 - Power generation capacities added in the EU 28 in 2013

For the first time in history, the five top sources of newly installed electricity in Europe were renewables, with hydropower, biomass and thermosolar (CSP) following wind and PV. The decline of gas has to be understood in a context of stable electricity demand in Europe in the last decade, existing overcapacities in some regions of Europe, as well as the low price of wholesale power and competition from coal experienced in the last few years.

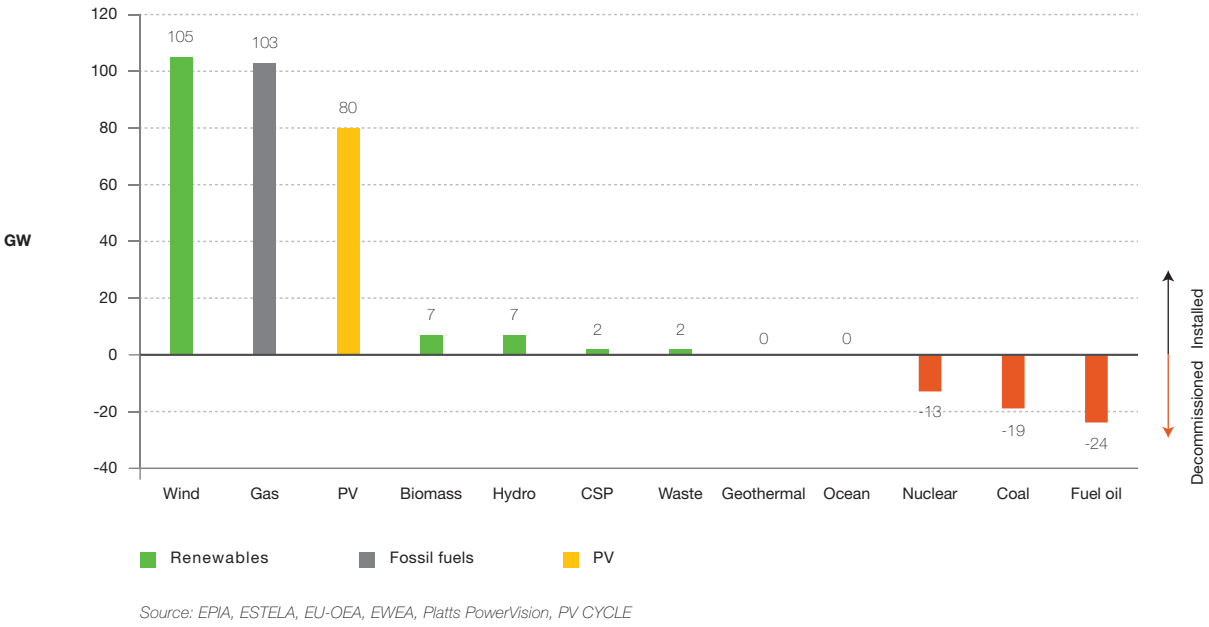


Source: EPIA, ESTELA, EU-OEA, EWEA, Platts PowerVision, PV CYCLE

Figure 26 - Net power generation capacities added in the EU 28 in 2013

2. Historical positioning

The evolution of new capacities in the last 13 years explains the current situation of the electricity markets in the EU. The addition of dozens of GW of gas, wind and PV have changed the electricity landscape in Europe, while at the same time, fuel oil plants, coal and nuclear power plants were decommissioned.



Source: EPIA, ESTELA, EU-OEA, EWEA, Platts PowerVision, PV CYCLE

Figure 27 - Net power generation capacities added in the EU 28 between 2000-2013

3. Share of PV in the EU 28

Based on the capacity installed and connected to the grid at the end of 2013, **PV can currently provide roughly 3% of electricity demand in Europe**, up from 1.15 % at the end of 2010. **In Italy, today more than 7.5% of the electricity comes from PV systems connected at the end of 2013. Greece jumped to the same level of electricity demand met with PV as Italy over the space of only three years**. In Germany, this figure is more than 6.5% and Romania reached 2.5% in only one year. Ten other European countries are now meeting more than 1% of their electricity demand with PV, including Belgium and Bulgaria, with others progressing rapidly.

In most EU countries today, PV contributes to reducing the mid-day peak, competing directly with other peak generators. Considering that peak power generation represents roughly 50% of the electricity demand in Europe, these percentages take on a new dimension: **PV can today provide 6% of the peak electricity demand in Europe, more than 15% in Italy and Greece, and more than 13% in Germany. This was achieved in just a few years and again shows how the development of PV electricity in Europe is occurring at a faster rate than almost anyone had expected**.

In the current debate on the financing of distribution grid operators, the cost of self-consumption and net-metering-driven installations requires to highlight their precise penetration. Figure 28 shows the real penetration of these compensation measures in European markets. In addition it also shows the breakdown between self-consumed and net-metered electricity from PV systems.

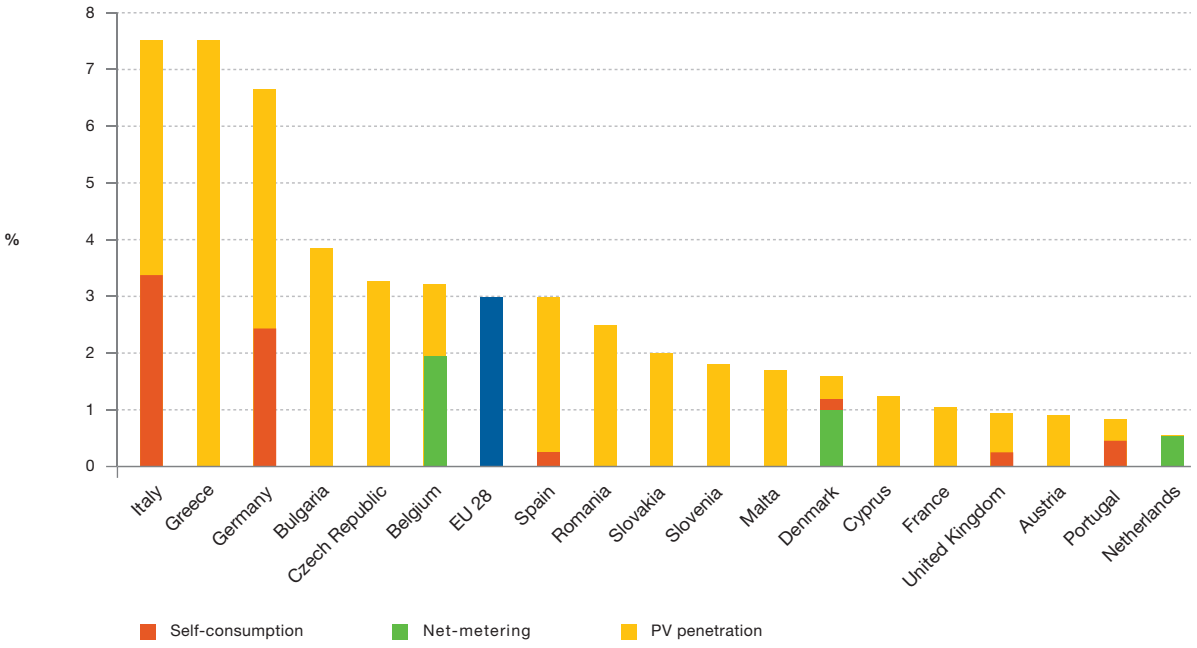
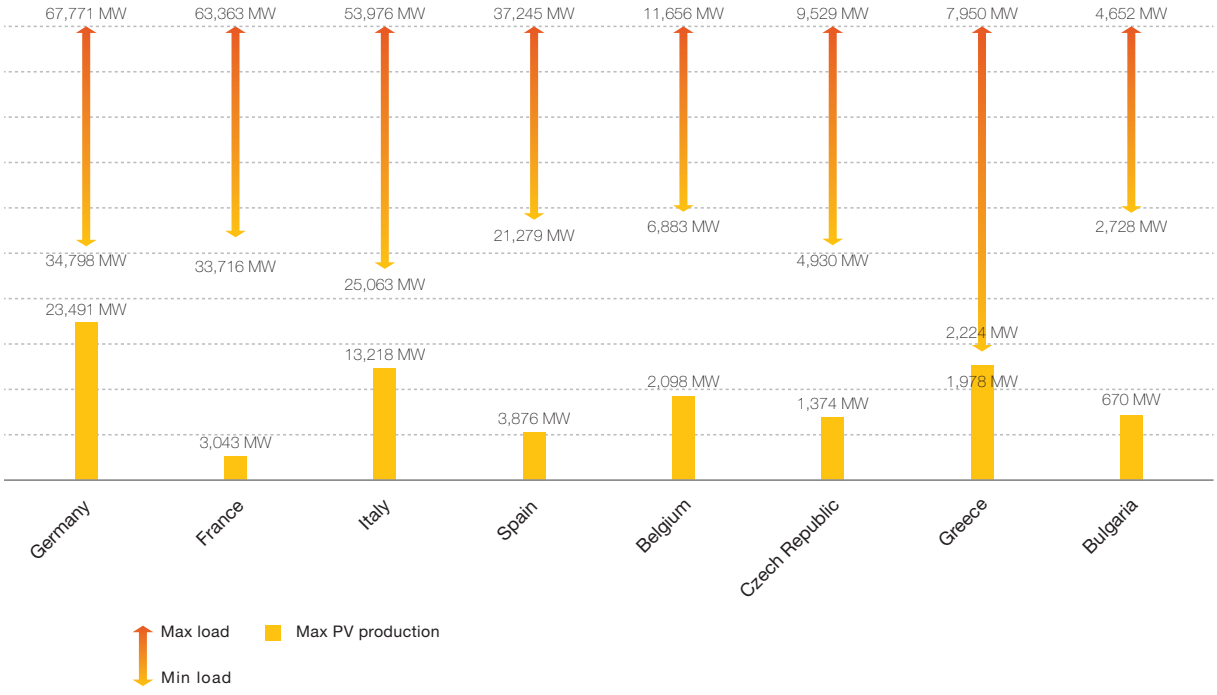


Figure 28 - PV contribution to the electricity demand in the EU 28 in 2013

4. PV and the electricity system

The speed at which PV had developed up to now has introduced new challenges for the management of the electricity system. Figure 29 looks at the maximum instantaneous penetration for a set of countries. The maximum power provided by PV is compared to the load between May and September. In Germany, as much as 49% has been already reached while numbers above 20-25% have been recorded in several countries. Greece reaches a level of PV maximum instantaneous contribution of 77%.

While not all PV systems are producing at full capacity at the same time, mainly due to orientation and weather, the maximum power production from the installed capacity close to the minimum load (which often occurs in Europe in the summer, during sunny weekends) is the signal that power system operators, regulators and also the PV industry have to work together to integrate large amounts of PV electricity into the grids. The challenges, opportunities and solutions for such large-scale integration of PV have been developed in detail in the “Connecting the Sun” study.



Maximum and Minimum country load profile are considered during mid-day peak between May and September.

Figure 29 - Comparison of PV maximum production and country load profile in 2013

5 CONCLUSION

5. CONCLUSION

After many years of growth and innovation, the PV industry is again going through a challenging period, with shifting market dynamics and a different geographical focus. In Europe, changing political support has created a climate of uncertainty that will hamper the re-development of the PV market. But outside Europe, the potential for growth remains intact and the various projects appearing in dozens of countries could transform into real market take-off.

Going forward, the key issues that will play a role in determining how market evolution takes place include:

- Policy: The PV market remains in most countries **a policy-driven market**, as shown by the significant market decrease in countries where harmful and retrospective political measures have been taken. However, **with the right decisions creating smart and sustainable support schemes for PV, markets can continue to grow in a number of countries**
- Competitiveness: In some countries in some segments, PV is already competitive with other power sources in terms of levelised cost of electricity. **In other countries, it is rapidly moving towards cost-competitiveness**. Grid and market integration challenges should be addressed without delay in order not to further hamper future PV development
- Industry consolidation: With a global PV modules overcapacity that is less acute than one or two years ago, prices have stabilised in 2013 and the return to profitability should allow companies to invest again. This could in return lead to **prices of new technology declining in the coming years and new markets opening for PV**

The enormous potential of solar PV and its benefits for society are more obvious than ever. PV is becoming a mainstream player within the power system. Under all scenarios, PV will continue to increase its share of the energy mix in Europe and around the world, increasingly delivering clean, safe, affordable and decentralised electricity to people.

GLOSSARY

Alternating Current (AC): Electric current that periodically reverses its direction of flows - 50 times per second (Hz) for Europe, China, East Japan among others and 60 times per second for the USA, West Japan, Brazil. Solar PV power must be converted from DC (see below) to AC using a power inverter.

Connected capacity: Refers to generating power systems (e.g. PV generators) that have been installed and allowed to inject electricity into the grid. The connected capacity can be expressed in AC or DC according to the country.

Direct Current (DC): Electric current that flows only in one direction. Solar PV power starts as DC and is normally converted to AC using a power inverter.

Feed-in Tariff (FiT): Policy mechanism created and regulated by government to promote investment in RES (e.g. PV technology). Under FiT schemes renewable electricity producers are offered long-term contracts under which a guaranteed fixed amount of money is paid to them, usually by the utility provider (national or local), for the energy fed into the grid. The FiT rate is typically set above market rates, offsetting inherent risks in renewable energy production.

GDP: Gross Domestic Product

Green Certificate (GC): Tradable certificate that represents the environmental or social benefits of (green) electricity generated from RES such as PV. Green certificates can be purchased both from electricity producers and consumers as a proof of producing or consuming renewable electricity.

Installed capacity: Refers to generating power systems put in place but awaiting the approval of the grid operator to inject electricity into the grid. It should not be confused with connected capacity (see above).

LCOE: Levelised Cost of Electricity. It represents the cost per kWh of electricity and covers all investment and operational costs over the system lifetime, including the fuels consumed and replacement of equipment.

Load: Amount of electric power delivered or required at a specific point or points on a system.

Maximum load: The highest amount of electric power delivered or required at any specific point or points on a system.

Minimum load: The lowest amount of electric power delivered or required at any specific point or points on a system.

Net metering: Compensation scheme that allows electricity consumers to reduce their electricity bills by giving them credit for the electricity produced by their PV system over a certain period of time (usually one year).

Self-consumption: Possibility for any kind of electricity producer to directly use/consume part or all of the electricity produced at the same location (on-site consumption), instantaneously.

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