Photovoltaic module production at Thalheim, Germany.

ANDRÉ FORNER/HANWHA Q CELLS

78 798 MWp

in the European Union at the end of 2013

PHOTOVOLTAIC BAROMETER

A study carried out by EurObserv'ER

The global solar photovoltaic market enjoyed a strong revival in 2013. Preliminary estimates put it in excess of 37 GWp, compared to 30 GWp in 2012 and 2011. The solar photovoltaic sector led the annual installed capacity ratings for renewable energies, taking worldwide capacity up to 137 GWp by the end of the year ... a 35% year-on-year increase. At global level the high growth markets – China, Japan and America – contrast sharply with the contracting European Union market.

80.2 TWh

Photovoltaic electricity generated in the EU in 2013

9 922.2 MWp

Photovoltaic capacity connected in the EU in 2013

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The Nanatsujima photovoltaic plant at Kagoshima, Japan.

The headline news on the global solar photovoltaic market is that the Asia-Pacific region markets have eclipsed the European market. According to China's National Energy Association, 11.3 GWp were connected to its national grid during 2013, which breaks all records for photovoltaic capacity installation in a twelve month period. The METI (Japanese Ministry of Economy, Trade and Industry) reports that Japan installed 5.17 GWp over the first nine months of the country's fiscal year, which equates to 6.9 GWp for a comparable European year. These two countries now account for more than half the global market. The United States is in third place with 4.7 GWp in 2013 (3.4 GWp in 2012), according to US Solar Market Insight Reports, of the SEIA (Solar Energy Industries Association), i.e. 12.1 GWp of installed capacity to date. New markets are emerging, such as India, whose Ministry of Renewable and New Energies announced it had crossed the one-GWp (1 115 MWp) threshold for the first time. South Korea chalked up ›442 MWp and Thailand ›317 MWp. In Chile (with an additional 103 MWp), Solar Sunrise – a 100-MWp solar plant developed by the American company SunEdison Inc., was installed in the Atacama region. The South African market also picked up speed. Its Renewable Energy Independent Power Producer Programme (REIPP) plans to install solar plants for a total capacity of 1.5 GWp by the end of 2014 and 8.2 GWp in 2030. So many other large-scale solar power development programmes are being implemented around the world (South America, North Africa, Sub-Saharan Africa, the Middle-East ...) that the list of them is too long to quote here.

The Chinese market should stay on a high over the next few years. A Chinese Council of State press release published last July announced that the government is now planning for 35 GWp of total installed capacity by 2015, practically doubling its base in the space of two years, which EPIA (the European Photovoltaic Industry association) put at 18.1 GWp at the end of 2013. The Chinese government aims to reduce its industry's dependency on PV panel exports and solve part of the country's overcapacity issues. However some analysts note that photovoltaic is still a heavy burden on public expenditure with a 0.42 CNY/kWh (€0.05/kWh) subsidy, which is high considering the price of electricity in China.

The Japanese market should also soar for the next few years, driven by the construction of high-capacity solar photovoltaic power plants. Quoted in an *Energías Renovables* magazine article, Pierre-Pascal Urbon, spokesman for SMA (the German specialist inverter manufacturer for solar installations), stated: *"Japan will replace Germany as the top global market where large-scale solar projects are negotiated"*. The analysts predict that despite the lower Feed-in Tariffs in 2014 (32 yen/kWh (€0.23/kWh) for business customers, 11% less and 37 yen/kWh (€0.26/kWh) for residential customers, 26% less), in 2014, the market should increase significantly. Thus Japan seems to have entered a forced solar march to replace its nuclear power plant base.

The US market has not been side-lined. According to SEIA, solar is now runner-up to gas for newly-installed capacities in the US electricity sector with a 29% share (equating to an investment of $13.7 billion, 9.9 billion euros). Analyst Jigar Shah predicts steady American growth precipitated by the expiry of the 30% federal Investment Tax Credit (ITC), programmed for the end of 2016. Market sales could even rise to 16 GWp in 2016.

The 2014 world PV market should continue to expand. IHS puts the growth figure at 40-45 GWp, compared to 49 GWp by an NPD Solarbuzz analyst, while Mercom Capital Group predicts 43 GWp and Bloomberg New Energy Finance reckons 44-51 GWp on the basis of the significant reduction in panel prices. In November 2013, Navigant Research made a longer term annual installed capacity forecast of up to 73.4 GWp in 2020, which is twice the current market volume, including more than 100 GWp deployed in China alone. The analysts at NPD Solarbuzz are even more optimistic about the global market's growth prospects. The market survey company's statistical trends indicate 100 GWp of annual deployment by 2018, with total installed capacity worldwide reaching 500 GWp. The same source puts estimated volume sales of PV panels at $50 billion per annum (36 billion euros). By 2018, the average sales price for modules should fall to about $0.51 (€0.39) per W.

PARADIGM SHIFT

The strong recovery of the global PV market, after twelve months of stagnation, is due to the drop in module prices, which in some zones has dropped below the conventional electricity price. This new parameter is everything but anodyne since it has dragged the global energy market into an uncertain situation as to what type of investments will be made in generating capacities across all sources, moreover it undermines the current utilities model.

Last year, "Disturbing challenges", a document published by the Edison Electric Institute (EEI) association of American utility shareholders, detailed the challenges facing the electricity sector as follows: the rapid decline in decentralized production costs, fast developments in energy storage and electricity flow management technologies, government programmes that in certain countries (such as the US, Japan and China) continue to favour renewable energies, the drop in the price of gas (in the US) and the investments to be made in grid infrastructures that have become obsolete. The European utilities hold the same view. RWE's CEO, Peter Terium, interviewed by Reuters in August 2013, admits that the shift from conventional power plants to decentralized generating methods and renewable energies is a fundamental change: *"We have to adjust to the fact that, in the longer term, earning capacity in conventional electricity generation will be markedly below what we've seen in recent years."*

In June 2013, Gérard Mestrallet, the GDF Suez CEO said during the Ateliers de la Terre- organized "Global Conference" (an international conference that brings together the decision makers committed to sustainable development): *"The emergence of decentralized systems, with smaller, highly localized units, with the development of consumer production, is a total revolution because some of the consumers will become self-producers!* (...) *The energy model will be more radically transformed as energy production is increasingly decentralized. The writing is on the wall for the utilities ... the era of monopolies is over."*

Geert De Clercq, the Reuters analyst, continues by explaining that the timing of the renewable energies wave could not have been worse for the utilities. European energy market liberalization has led to the consolidation of the highly indebted energy companies, and this has been compounded by the drop in electricity demand since the euro crisis, spurred by the energy efficiency drive.

De Clercq claims that the utilities are the big losers in this game while the main winners are the solar panel and wind turbine manufacturers, as well as the hundreds of small solar system installers and the thousands of consumers who want to convert their roofs into photovoltaic plants. The other winners will be the energy management specialists such as Schneider and Alstom and the energy efficiency specialists, primarily the building materials manufacturers like Saint-Gobain, heating system manufacturers such as Viessmann, BBT and Vaillant and the chemical companies like Recticel. Europe's companies have a particularly good foothold in this new major global market.

20-MWp photovoltaic plant at Xuzhou City (Jiangsu province, Northeast China).

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SOLAR PHOTOVOLTAIC... A COMPETITIVE ENERGY FORM

The key issue is how much it costs to produce a photovoltaic kWh. These area-dependent costs are around €100 /MWh, making PV power competitive around the world. A Fraunhofer Institute study published in November 2013 on the reference market, Germany, established that ground-mounted plants with solar insolation of 1 200 kWh (m2 and per annum), i.e. sunshine level in the Southern Germany, fell in the range 79-98 euros per MWh (LCOE). The cost of a small roof-mounted plant varied from 98-121 euros per MWh. Naturally,costs are much lower in Southern Europe and the Southern hemisphere in general because they are also dependent on the irradiation index.

Yet the cheapest solar per kWh costs are to be found in the USA. SunEdison has just clinched a sales contract at a price of less than $50 per MWh over 25 years ($47 according to another bidder, Solairedirect). The contract entered into with Austin Energy (Texas) includes the construction of two power plants – one 100-MWp and the other 50-MWp – which currently makes the latter the plant offering the world's cheapest solar kWh. If we factor in American investment aid at 30%, the real production is $0.741 per kWh over 25 years (€53.8 per MWh). The price of land and taxes are lower in the USA and they must be taken into account if an objective cost comparison exercise is to be made for a similar European PV plant. Austin Energy reckons that in the USA, the cost of nuclear power is about $130 per MWh, coal-fired electricity $100/MWh and gas-fired electricity $70 per MWh (primarily shale gas in Texas). This plant, which is eligible for ITC, will thus produce a solar kWh for almost three times less than a nuclear kWh and at almost half the cost if the ITC amount is subtracted.

The currently high growth in the global market should enable the manufacturers to continue their cost cutting on a healthier basis. This is because the manufacturing mode entails mass-production of identical modules and so makes photovoltaic technology extremely sensitive to economies of scale. Another factor, this time financial, could also result in lower costs. Thierry Lepercq, the CEO of Solairedirect, feels that the downward

Tabl. n° 1

Photovoltaic capacity installed and connected in European Union in 2012 and 2013 (MWp)*

	2012			2013		
	On grid	Off grid	Total	On grid	Off grid	Total
Germany	7 604.0	5.0	7 609.0	3 305.0	5.0	3 310.0
Italy	3 368.0	1.0	3 369.0	1 461.0	1.0	1 462.0
Greece	912.0	0.0	912.0	1 042.5	0.0	1 042.5
United Kingdom	713.0	0.0	713.0	1 031.0	0.0	1 031.0
Romania	46.4	0.0	46.4	972.7	0.0	972.7
France**	1 136.0	0.0	1 136.0	613.0	0.0	613.0
Netherlands	219.0	0.0	219.0	300.0	0.0	300.0
Austria	234.5	0.0	234.5	268.7	0.0	268.7
Belgium	717.8	0.0	717.8	214.9	0.0	215.0
Denmark	360.0	0.0	360.0	155.0	0.2	155.2
Czech Republic	109.0	0.0	109.0	110.4	0.0	110.4
Bulgaria	702.6	0.0	702.6	104.4	0.0	104.4
Spain	226.5	1.3	227.8	102.0	0.4	102.4
Lithuania	6.1	0.0	6.1	61.9	0.0	61.9
Portugal	56.2	0.1	56.4	52.2	0.5	52.7
Slovenia	121.1	0.0	121.1	33.3	0.0	33.3
Luxembourg	35.7	0.0	35.7	23.3	0.0	23.3
Sweden	7.5	0.8	8.3	17.9	1.1	19.0
Cyprus	7.1	0.0	7.1	17.5	0.1	17.6
Croatia	3.6	0.0	3.6	17.2	0.0	17.2
Malta	12.1	0.0	12.1	6.0	0.0	6.0
Hungary	9.5	0.1	9.6	3.0	0.1	3.1
Poland	0.1	1.3	1.4	0.4	0.2	0.6
Ireland	0.1	0.2	0.2	0.0	0.1	0.1
Finland	0.0	0.0	0.0	0.0	0.0	0.0
Latvia	0.0	0.0	0.0	0.0	0.0	0.0
Estonia	0.0	0.0	0.0	0.0	0.0	0.0
Slovakia	55.8	0.0	55.8	0.0	0.0	0.0
European Union	16 663.6	9.9	16 673.5	9 913.5	8.7	9 922.2

*Estimate. **Overseas departments included for France. **Source: EurObserv'ER 2014.**

Tabl. n° 2

Connected and cumulated photovoltaic capacity in the European Union countries at the end of 2012 and 2013 (MWp)*

	2012			2013		
	On grid	Off grid	Total	On grid	Off grid	Total
Germany	32 643.0	60.0	32 703.0	35 948.0	65.0	36 013.0
Italy	16 141.0	11.0	16 152.0	17 602.0	12.0	17 614.0
Spain	4 578.5	24.6	4 603.1	4 680.5	25.0	4 705.5
France**	4 060.0	24.6	4 084.6	4 673.0	24.6	4 697.6
Belgium	2 768.4	0.1	2 768.4	2 983.3	0.1	2 983.4
United Kingdom	1 706.0	2.3	1 708.3	2 737.0	2.3	2 739.3
Greece	1 536.3	7.0	1 543.3	2 578.8	7.0	2 585.8
Czech rep	2 022.0	0.4	2 022.4	2 132.4	0.4	2 132.8
Romania	49.3	0.0	49.3	1 022.0	0.0	1 022.0
Bulgaria	914.1	0.7	914.8	1 018.5	0.7	1 019.2
Austria	417.2	4.5	421.7	685.9	4.5	690.4
Netherlands	360.0	5.0	365.0	660.0	5.0	665.0
Slovakia	543.0	0.1	543.1	537.0	0.1	537.1
Denmark	375.0	1.2	376.2	530.0	1.4	531.4
Portugal	225.0	3.3	228.4	277.2	3.8	281.0
Slovenia	221.4	0.1	221.5	254.7	0.1	254.8
Luxembourg	76.7	0.0	76.7	100.0	0.0	100.0
Lithuania	6.1	0.1	6.2	68.0	0.1	68.1
Sweden	16.8	7.3	24.1	34.7	8.4	43.1
Cyprus	16.4	0.8	17.2	33.9	0.9	34.8
Malta	18.7	0.0	18.7	24.7	0.0	24.7
Croatia	3.9	0.5	4.4	21.2	0.5	21.7
Hungary	11.8	0.5	12.3	14.8	0.6	15.4
Finland	0.2	11.0	11.2	0.2	11.0	11.2
Poland	1.4	2.2	3.6	1.8	2.4	4.2
Latvia	1.5	0.0	1.5	1.5	0.0	1.5
Ireland	0.2	0.8	0.9	0.2	0.9	1.0
Estonia	0.0	0.1	0.2	0.0	0.1	0.2
European Union	68 713.7	168.3	68 882.0	78 621.2	177.0	78 798.2

*Estimate. **Overseas departments included for France. According to provisional data from the Slovakian regulator URSO, PV capacity contracted slightly in 2013. **Source: EurObserv'ER 2014.**

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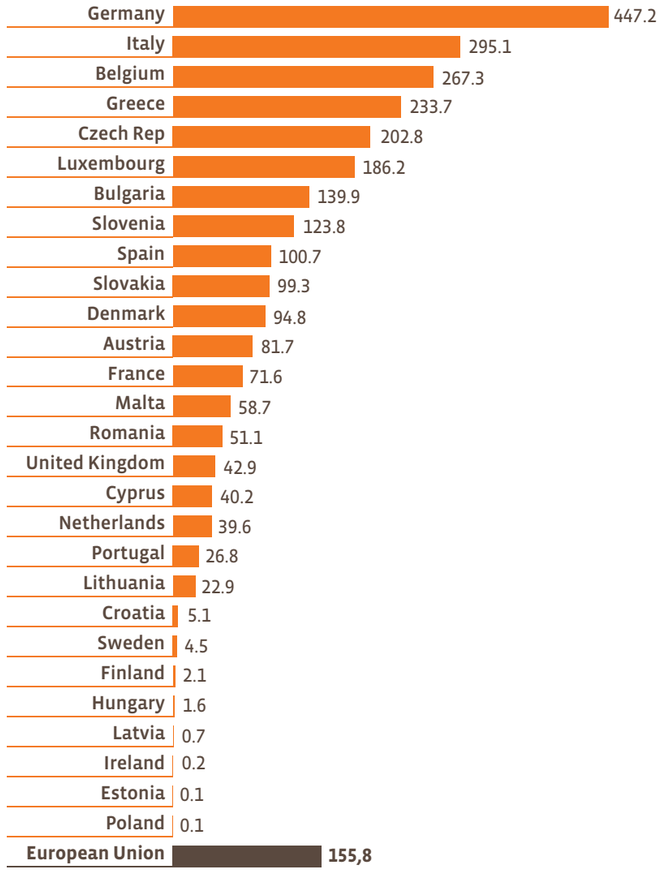
spiral of costs is currently driven by investors' confidence in the fundamentals of solar power production: *"Investors now acknowledge that as solar becomes cheaper than the other energy sources, financial risk is perceived* as *lower, which makes these same investors less greedy. In a new development, solar infrastructures have been financed by bond instruments (primarily what have come to be known as "YieldCos"), which leads to a virtuous spiral of risk and cost reductions." "On the contrary,"* he adds, *"most of the complex and centralized technologies such as nuclear are in a cost and risk increase spiral that frightens off investors other than individual states, which are the only investors able to take them on."* He feels that there is a true energy alternative to these technologies, that can meet power grid needs in full. *"It is based on hybrid solutions that combine a cheap base supplied by solar or onshore wind power with flexible gas- or hydropower-based top-up generation for example. In certain zones, solutions of this kind could reduce production costs by up to 20%* (Editor: compared to conventional energy sources) *with the same service to the grid, down to €70 per MWh for example in Chile where we are actively working on developing offers of this kind."*

Graph. n° 1

Photovoltaic capacity per inhabitant (Wp/inhab.) for each EU country in 2013



Source: EurObserv'ER 2014.

THE EUROPEAN UNION DIVIDED OVER ITS ENERGY STRATEGY

The European Union, whose global market share was 73.6% in 2011, is now only 26.5%, with installed capacity of about 10 GWp. EurObserv'ER notes that newly-installed capacity in the EU was 9.9 GWp in 2013 down from 16.7 GWp in 2012 **(table 1)**, i.e. a 40.5% decline. Europe's installed PV capacity now stands at 78.8 GWp **(table 2)**. For various reasons, the European market is now clearly shrinking and no longer leads the world. Most of the EU Member States have either withdrawn or sharply reduced their incentive systems to wrest back control of their sector's development and curb the speculative mindset largely responsible for market growth, which has had dire consequences on a number of countries' electricity bills. At the same time it has accelerated the drop in photovoltaic installation investment costs through economies of scale.
However this argument does not hold true for the countries that have really invested in the development potential of their renewable sectors. We can quote Germany, Italy, Belgium, Greece and the Czech Republic whose per capita solar photovoltaic capacity ratios are in excess of 200 Wp **(graph 1)**. Other countries have put more funding into increased competitiveness in onshore and offshore wind energy (Spain, Denmark, the UK and once again, Germany).
The European Commission has called for incentives to be reduced, as it now considers that financial assistance should be limited to the minimum. It suggests that as renewable energy technologies mature they should be exposed to market forces and in the final analysis that support should be abolished once and for all. The Commission's announcement to this effect marks a major seachange in the European Union's energy strategy because it puts polluting or high greenhouse gas-emitting energies on an equal footing with renewable energies.
Incidentally the American, Chinese and Japanese strategies are diametrically opposed to the European Commission's current strategy. The top three global markets' leaders are still financing solar sector productivity gains to fast-forward and prime energy transition in their home markets (see "Accelerated transition instigated by China" insert). The issue of these three countries' energy dependence is particularly sensitive and far-removed from the market regulation policy currently being implemented in Europe. Yet even within the European Union, countries are highly divided on which strategies they should roll out (see News from around the main countries).
More informally, we can also add that by the conventional electricity producers, who still cover the viability and security of the electricity system, are putting pressure on the public authorities. These players are now hard hit by the dwindling profits of their production facilities. Any in further state subsidies in productivity gains by renewable energies, and solar power in particular will be very harmful to them.
Last but not least, the European Commission decision to introduce anti-dumping measures, banning Chinese manufacturers from selling their PV modules below a certain price threshold has limited the prospects of developers' earnings. Some informal sources (the price has not been made public) say that the Commission has decided to be a little more accommodating on this point by slightly lowering the per watt threshold from €0.56 to €0.53 as from 1 April 2014. According to pvXchange, the prices of modules sold in China and South-East Asia were still 18-25% lower in 2013 than in Europe.
Given the market trend and the continued drop in solar kilowatt-hour costs, the European Union market decline should not last. A number of analysts are already counting on a slight recovery as early as 2014. NPD Solarbuzz claims that the scales tipped in the fourth quarter of 2013. They are expecting the market to stabilize at 2.5 GWp in the first and second quarters, followed by modest growth over the following two quarters driven by Germany, the UK, Italy and France.


DENNIS SCHROEDER/NREL

SolarTAC PV plant in the USA.

EUROPEAN SOLAR POWER OUTPUT SURGES

The slowdown in installation pace has not percolated through to electricity production because of inertia. EurObserv'ER puts solar power output at 80.2 TWh in 2013 (a 18.8% year-on-year increase) **(table 3)**, or the equivalent of Belgium's total electricity output. However it should be borne in mind that Germany (30 TWh) and Italy (22.1 TWh) between them account for 65% of EU output. Solar power in all its forms only accounts for 2.4% of the European Union's electricity output, but for the countries committed to this sector, the proportion is already in excess of 7% in Italy and 5% in Germany, in a configuration prior to grid parity.

NEWS FROM AROUND THE MAIN COUNTRIES

Germany negotiates its energy transition

In 2013, the German market contracted to less than half its size in 2012. AGEE-Stat claims that capacity hooked up to the grid dropped from 7.6 GWp in 2012 to 3.3 GWp in 2013. A number of analysts, like EuPD Research, expect the market to shrink further in 2014, potentially to 2.8 GWp and the monthly installation figures for January (193 MW against 275 in 2013) and February (110 MW against 211 in 2013) seem to confirm that observation.
Yet that is not the crux of the matter. What is more important is that Germany

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is re-negotiating its energy transition (Energiewende) and, despite wide-scale public acceptance of the transition as such, renewable policy came under increasing pressure from various sides: new governmental priorities, industrial bodies, consumer associations, grid integration issues and above all the narrowed debate of rising electricity costs and the distribution of additional costs to societal groups The whole of 2013 was dominated by the election campaign and the re-shuffling of competences, with renewable energy policy having shifted to the Ministry of Economics (BMWi). The new Conservative (CDU) and Social Democrat (SPD) government coalition has found common ground over the country's energy transition and drafted a new renewable energy act which has passed the cabinet.

The new and less ambitious aim is to increase the renewable energy share of electricity consumption to 40-45% by 2025 and to 55-60% by 2035. The percentage will serve as the basis for rolling out conventional and renewable infrastructures and production capacities. Electricity cost and price trends are another major issue. The Agora Energiewende think tank puts the total cost of wind and PV power installations in 2015 at €70-100/MWh, which means that a system comprising wind turbines, photovoltaic panels and back-up capacities will come at a similar cost to those of new gas- and coal-fired power plants, whose costs are set to increase. These estimates are in line with the November 2013 Fraunhofer Institute estimate for 2012. The government publicly announced that it was disappointed that the European Commission had not lifted its antidumping sanctions on imports of Chinese cells and modules, which would have resulted in limiting the drop in solar power prices and thus limiting the possibilities of lowering the country's electricity bill.

By July, the government announced that the current system (EEG law) would be amended to concentrate on the most promising technologies such as solar, onshore and offshore wind power, at the expense of biomass plants. The support system in place will also introduce more market mechanisms as already permitted by the current renewable energy law.

One central bone of contention unites the consumers and some industrial associations, the environmental promotion association, the German Energy Agency and the new government. It revolves around the allocation of the EEG levy (EEG Umlage) whose income finances renewable energy incentives, and in particular the mechanism for redistributing this burden to consumers. The German government wants to continue to exempt energy-intensive industries and those in hard international competition from all or part of the energy tax. And for 2014, 2 379 companies have applied for this exemption for a sum put at around 5 billion euros. The European Commission has already opened an enquiry into these exemptions which could be potentially deemed as illegal aid. A compromise with the EU Commission was reached in that around 500 companies will lose their privilege whereas overall firms from 65 industrial sectors maintain their exemption, which in turn means that private

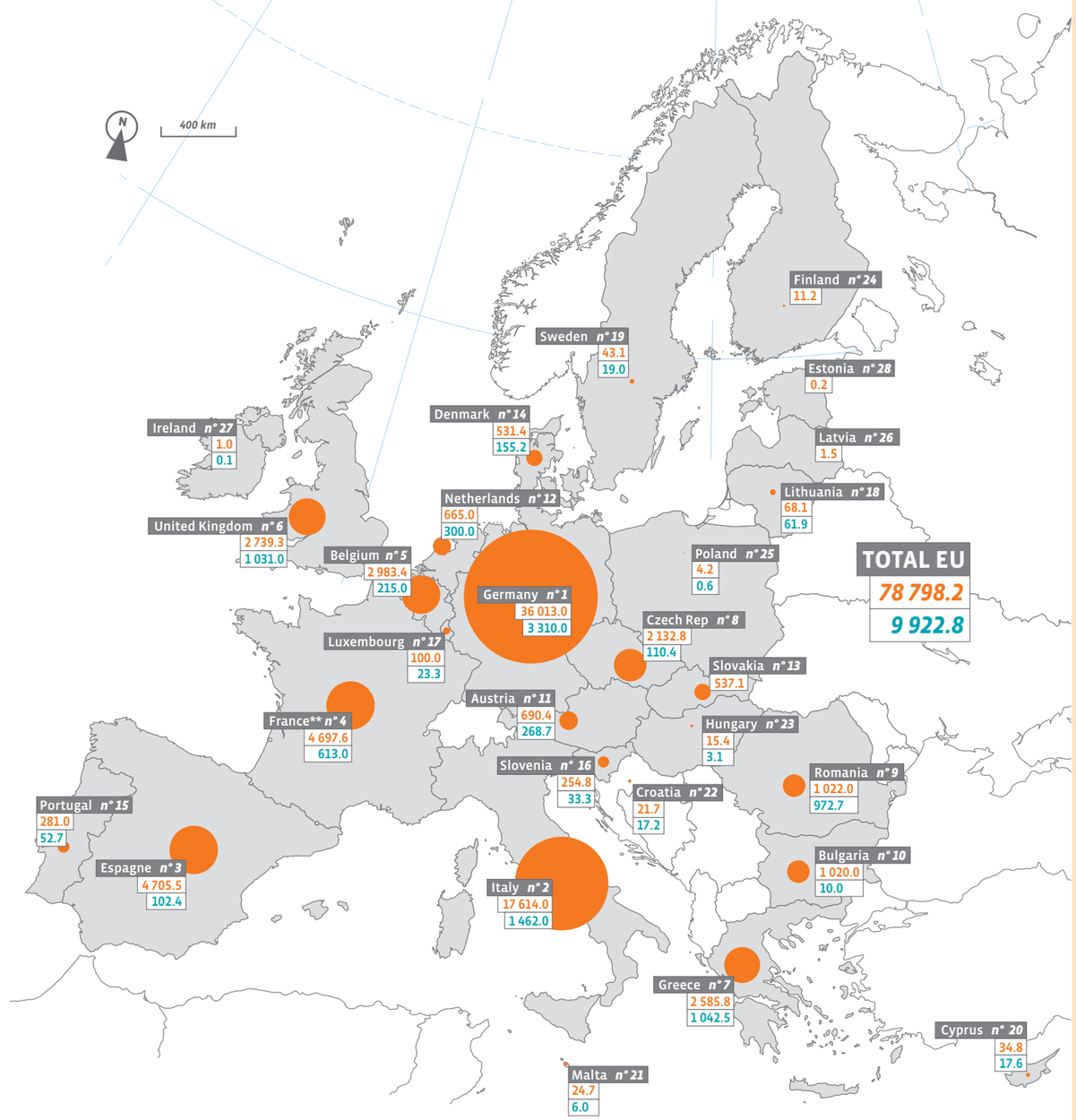
Tabl. n° 3

Electricity production from Solar photovoltaic power in European Union in 2012 and 2013 (GWh)*

	2012	2013
Germany	26 380.0	30 000.0
Italy	18 862.0	22 146.0
Spain	8 193.0	8 289.0
France	4 446.0	4 900.0
Greece	1 232.0	3 648.0
Belgium	2 149.0	2 352.0
Czech Republic	2 149.0	2 070.0
United Kingdom	1 187.9	1 800.0
Bulgaria	754.0	1 348.5
Austria	337.5	686.0
Slovakia	561.0	600.0
Netherlands	253.8	582.0
Denmark	338.0	490.0
Portugal	393.0	446.0
Romania	7.5	397.8
Slovenia	162.8	240.0
Luxembourg	38.3	50.0
Lithuania	2.0	45.0
Cyprus	19.8	45.0
Sweden	21.4	38.8
Malta	13.6	30.1
Croatia	3.7	12.3
Hungary	7.9	9.3
Finland	5.4	5.4
Poland	3.4	4.0
Ireland	0.7	0.7
Estonia	0.6	0.6
European Union	67 523	80 236

Estimate. **Overseas department included for France.* ***Source: EurObserv'ER 2014.*

Photovoltaic capacity connected in the European Union in 2013 (MWp)*



Key

78 798.2 Cumulated photovoltaic capacity in the European Union countries in 2013* (MWp).

9 922.2 Photovoltaic capacity connected in the European Union countries during the year 2013* (MWp).

Estimate. **Overseas departments included for France.* ***Source: EurObserv'ER 2014.*

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households and SMEs will bear the major costs of the energy transition.
Self-consumption is another important issue. The self-consumption feed-in tariff was discontinued for installations commissioned from April 2012 onwards as the government considered that grid parity had been achieved, In May 2013, it adopted a 25 million-euro subsidy programme for storage dedicated to PV self-consumption. The maximum pay-out is € 600 per kW provided that producers undertake to reduce the capacity of their installation connected to the grid by 40%. More recently still, the reform of the EEG law that will come into effect on 1 August 2014, ruled that self-consumption output will be subject to the EEG levy (the contribution to public electricity supply services electricity tax). In doing so Germany would become the first EU country to tax PV self-consumption. The Solar Association BSW-Solar has announced to go to court and challenge this approach, the solar industry considers as a violation of investor confidence. Hard political and societal conflicts lie ahead of the German energy transition.

The UK ... major European Union solar market of the future

There are unmistakable signs and this one is particularly significant. Although the UK has one of Europe's lowest irradiation levels, it has announced that it installed more than 1 000 MWp during the twelve months of 2013. To be more precise, DECC claimed that 1 031 MWp of capacity went on-grid in 2013, raising on-grid PV capacity to date to 2 737 MWp. According to consultants PricewaterhouseCoopers (PwC), the UK is likely to install up to 2 000 MWp more this year. The country has committed to maintaining its aid mechanisms through to 2020 with no limit on project size in contrast to the strategy rolled out by most of its European neighbours. According to Bloomberg, investors raised at least 750 million euros in 2013 to back "multi-megawatt projects". Daniel Guttmann, a PWC expert explains, "*The boom in large-scale solar started much later in the U.K. than in most of Europe, so the country has been able to learn from others. Projects are developed at much lower cost than earlier ones abroad. This right level of support, along with policy stability, is driving fast growth*". The Minister of State for Energy says that the UK could install up to 20 GWp of solar capacity by 2020. He claims that the UK is the most promising European market and confirms that he will submit a solar photovoltaic roadmap in the spring of 2014. Solar parks will be eligible for Renewable Obligation Certificates until 2017, which bind energy suppliers to supplying a minimum share of renewable electricity. From 2014 onwards, developers can opt for the Contracts for Difference system. In the case of solar power, new reference prices will apply from 2015 onwards. The rates are £120 (€145) per MWh for tax years 2015/16, £115 (€139) per MWh for 2016/17, and £110 (€133) per MWh for 2017/18, dropping to £100 (€121) per MWh for 2018/19.

France at its nadir

The French market cannot fall any lower than it already has done. The latest official statistics to be published by the Service of Observation and Statistics (SOeS) show that 613 MWp of capacity (the figure is provisional) went on-grid in 2013, which is a 45% year-on-year slide. Total French on-grid capacity to date stood at 4 673 MWp at the end of December 2013. Nonetheless, the connection level over the last quarter of 2013 (which will exceed 161 MWp in the end) is much higher than the level recorded in Q4 of 2012 (95 MWp), suggesting a return to growth in 2014. However the Ministry of the Environment's 800-MWp threshold has been missed.
Matters are now critical for some of the developers with nationwide presence who are disappearing in fast succession. The latest to fold is Solar Ener Jade, which was one of the main solar system installers in the West of France. The future French market for large-scale plants should basically be controlled by the utilities and a handful of players such as Voltalia and Solairedirect who have trained their sights on the international market. It is in this context that the new Ecology minister will have to address the undertakings made by her predecessor to implement energy transition.
Thus, the current working document, presented on 10 December 2013, calls for diversifying the electricity mix to include renewables but also for maintaining a 50% share for nuclear to the 2025 timeline and lower fossil fuel consumption by 30% by 2030. However no GHG emission reduction target has been set for 2030.
The sector's future has become even more uncertain as a result of the mid-September decision to launch a consultation on the renewable energy support mechanisms to examine the new European policy of exposing the renewable sectors to market mechanisms. By the same token, a "concerted self-consumption analysis" working party has been formed and while its aim is to prepare a draft bill, there is no doubt as to its intentions, namely to limit and regulate the development of self-consumption as far as possible. It is made up of representatives of the public authorities, grid managers, renewable energy players (such as EDF, GDF Suez, Total, Saint Gobain, and Solairedirect), trade unions, electricity storage and system management players (Alstom and Schneider), research bodies and competitiveness clusters. Associations for the promotion of renewable energies are outraged by the fact that there no local councillors, mayors or MPs or any solar sector SME have been co-opted into this working party – who according to them are in the front line – nor has any environmental support association been co-opted. The latest item of bad news affects the last remaining French and European manufacturers operating in the French market. On 12 March 2014, the French Higher Council for Energy adopted the draft decree terminating the premiums for installations comprising European-manufactured panels, as the European Commission feels that these bonuses acted as an obstacle to free competition.

Spain seeks to limit self-consumption

The issue of developing self-consumption has become fraught with problems. The government is working on implementing a law that would tax PV self-consumption heavily, to ensure that the small producers, who bring down the number of grid users, share in the costs of the electricity grid. In a press release pubished on January 4 2014, Anpier (the national association of photovoltaic producers) recognized the handiwork of the main electricity operators in the bill and asked the Ministry of Industry to investigate


Aerial view of the Rochefort-du-Gard photovoltaic plant (France).
PAUL-LOUIS FERRANDE/ENERTIS PHOTOTHÈQUE

the close relations between the electricity utilities and the authorities.
The same press release indicated that a probe conducted by the newspaper *El Mundo,* published on 13 December 2013, revealed that the utilities had a habit of drafting the contents of legislation adopted by the MPs. Anpier had already delivered a response strategy and asked the government to hold a referendum on the energy transition issue. According to the IDEA, just one hundred megawatts or so went on-grid in 2013, taking total on-grid capacity to 4 680.5 MWp at the end of 2013.

THE LIGHTS CHANGE TO GREEN FOR THE GLOBAL PHOTOVOLTAIC INDUSTRY

A turning point was reached in 2013. The experts now all agree that the photovoltaic industry is enjoying strong, stable growth, fuelled not only by project developers' profits but particularly by the outlook that the photovoltaic industry will return to positive operating margins, which some of them (see further on) are already enjoying. According to IHS, these growth prospects have already led to renewed investments in capital expenditure to manufacture silicon (ingots, sheets), cells and modules, which increased by 42% in 2014 (2.5 billion euros). In 2015, investments should increase by a further 25%, to about 3 billion euros. The lights have changed to green and at last the real solar power race can kick off.
Finlay Colville, vice-president at Solarbuzz comments: "*With a more stable environment and the prospect of faster market globalization, we forecast a 30% return to growth per annum.*" Thus in 2014 the global photovoltaic industry entered a new phase in which the market is supply-driven and no longer curbed by the lack of demand. This has not come too soon, for over the past three years, module manufacturing costs, their prices and those of solar systems have been more than halved. During the consolidation phase a host of European players have perished (such as Isofotón, Scheuten Solar, Bosch, Avancis, Solibro to name just a few) and the survivors should have their slice of the action that is building up on a huge scale.
Despite being debt-ridden (see the "Accelerated transition instigated by China" insert) the Chinese manufacturers are far and away in the best position. NPD Solarbuzz reports that as every day passes, Chinese industry's tight grip on the global photovoltaic market becomes even firmer. Yingly, Jinko Solar and Haeron are the unassailable market leaders in China, but other players such as Jinko, Renesola, JA Solar and Hanwha Q Cells,

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Tabl. n° 4

Main photovoltaic module manufacturers in 2013

Company	Technologies	Country	Production lines in	Production capacity modules 2013 (MW)	Production/ Sales/ Shipment of modules 2012 (MW)	Production/ Sales/ Shipment of modules 2013 (MW)	Turnover 2013 (M€)
Yingli Green Energy	Wafers, mono and multi crystalline cells, modules	China	China	**2 450**	**2 300**	**3 234**	**1 600**
Trina Solar	Wafers, Crystalline (mono) cells, modules	China	China	**n.a.**	**1 590**	**2 580**	**1 270**
Sharp Corporation	Crystalline (mono, multi)/Thin Film (a-Si, mc-Si)	Japan	Japan, USA	**2 200**	**1 319**	**2 100**	**1 950**
First Solar	Thin film modules (CdTe)	USA	Malaysia, USA	**<2 000**	**1 875**	**2 000**	**2 420**
Canadian Solar	Ingots, wafer, cells, modules, PV systems	Canada	Canada, China	**2 400**	**1 543**	**1 894**	**1 650**
Jinko Solar	Crystalline ingots, wafers, cells, and mono- and multi-crystalline PV	China	China	**2 000**	**912**	**1 765**	**840**
Hanwha Q Cells	Mono and multicrystal-line cells, modules	Korea/ Germany	China, Germany (Q-Cells)	**1 500**	**830**	**1 280**	**560**
JA Solar	Mono-Crystalline Silicon Module Poly-Crystalline Silicon Module	China	China	**1 800**	**1 700**	**1 200**	**862**
SunPower	Crystalline (mono, multi) cells, modules	USA	USA, Philippines	**n.a.**	**936**	**1 134**	**1 800**
Suntech Power	Crystalline (mono, multi)/Thin Film (a-Si, mc-Si) cells, modules	China	China, Germany, Japan, USA	**2 000**	**1 750***	**n.a.**	**n.a.**

Full year guidance.* ***Source: EurObserv'ER 2014.*

have been picking up markets shares in other regions of the global market. America's First Solar is very well positioned in the (much more profitable) American and also the Indian markets. The same goes for Sharp on the Japanese market. Western manufacturers (such as Conergy and REC) and their Japanese counterparts (Sharp and Kyocera) are still making inroads into the emerging markets (Latin America, the Middle-East and Africa).

The IHS consultancy points out that during this consolidation phase, the global manufacturers have increased their manufacturing capacity to boost their dominance of the international market. The second tier Chinese players with run-of-the-mill technologies are leaving the scene, further strengthening the major Chinese players who make higher-technology modules.

The paradigm shift that is taking place opens up a whole host of massive possibilities for the surviving manufacturers of the consolidation phase.

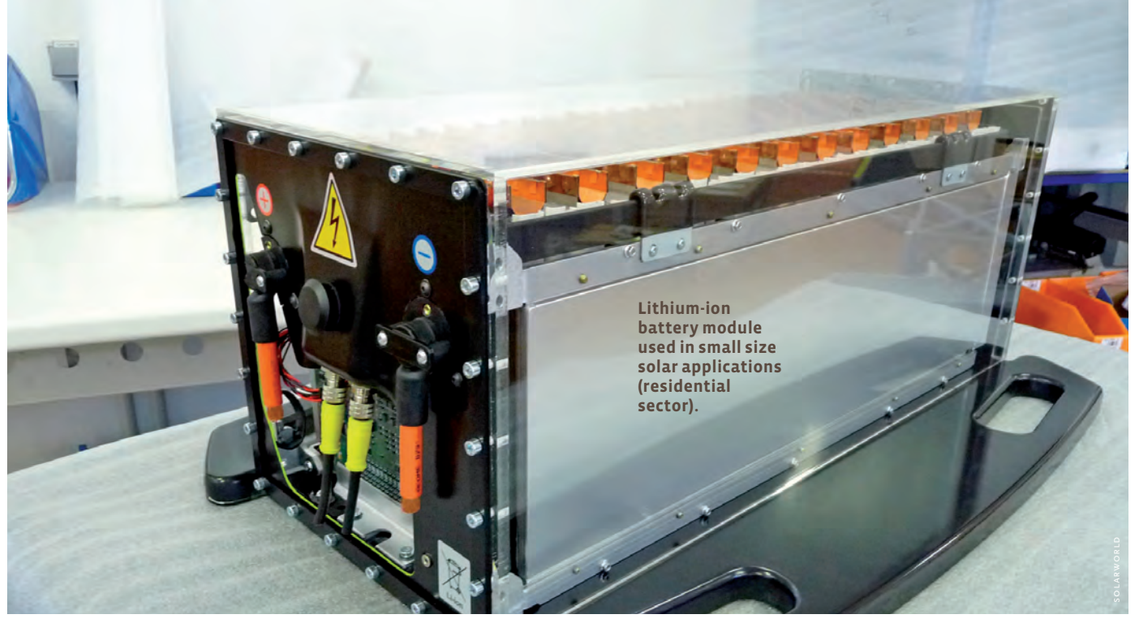
Solar power expert Alain Ricaud commented in his January 2014 *La lettre du solaire* editorial: *"We will look back on 2013 as a transitional year in which the photovoltaic industry restructured on sounder financial bases through the fading of tariffs by adjusting to the consequent slowdown in the European markets... The prices of installed systems continued to fall and improve photovoltaic competitiveness in regions where a high price has to be paid for electricity and that suffer from shortages in domestic supply."*

NEWS FROM AROUND THE MANUFACTURERS

Yingly Solar, still in the red

Yingly Solar may have been the world's leading photovoltaic module manufacturer in 2013 **(table 4)**, but it paid a very high price for the privilege and its very strong position in the Chinese market (which is one of the least profitable). It delivered 40.8% more modules than in 2012, for 3.23 GWp (2.3 GWp in 2012) with sales (net income) of $2 216.5 million. It failed to make a profit in 2013, and announced a net loss of $321.2 million (231.6 million euros). Nonetheless its situation is improving as its loss was 36.5% lower than in 2012 and its prospects are brighter.

It forecasts that it will supply 4-4.2 GWp of modules in 2014 in view of the expanding Chinese, American, Japanese and emerging markets such as Africa, South America and South-East Asia.



Lithium-ion battery module used in small size solar applications (residential sector).

Trina Solar moves up into second place

Trina Solar has made spectacular progress. In 2013, its deliveries totalled 2 580 MWp of modules, which is about 1 000 MWp more than in 2012 (1 590 MWp). Its annual sales figure rose by 36.9% to $1.77 billion (€1.28 billion) while its net annual losses dropped sharply to $77.9 million (70.8% less than in 2012). This enabled the company to post a slight return to profitability over the last two quarters.

First Solar swings back into profit

In 2013, American thin film manufacturer First Solar slipped down a rank to third place in the PV module manufacturers' league with 1.8-2.2 GWp of output, equating to (net income) sales of $3 309 million in 2013, on a par with its 2012 sales figure ($3 369 million). Nonetheless the manufacturer went back into the black in 2013 with $353 million in net profit compared to a $96 million loss in 2012. It also made technological progress by increasing the mean energy yield of its cells yet again from 12.9% in Q4 of 2012 to 13.4% in Q4 of 2013, and set a new laboratory efficiency record of 20.4%. It also announced a significant drop in its module production costs from $0.64 per watt in Q4 2012 to $0.53 in Q4 2013.

First Solar forecasts it will make $3.7-4 million in sales (net income) in 2014 and generate $250-450 million of gross operating surplus.

SunPower also makes a comeback

In 2013 SunPower passed the 1 000 MWp output mark with 1 134 MWp in 2013 for the first time, up from the previous year's 936 MWp. The sales of the manufacturer owned by French oil company Total, were stable in 2013 at $2 507 million ($2 417 million in 2012). However after having lost a little more than $800 million in two years, the American company made a comeback in 2013 and reported a positive operating income of $159 million (as against losses of $288 million in 2012 and $534 million in 2011). According to SunPower, the company's survival was secured by the financial strength of its oil group backer and its cost-reducing capacity.

The American manufacturer that specia-

Accelerated transition instigated by China

According to the analyst, Keith Bradsher, an economic journalist working for the New York Times, China is counting heavily on renewable energies to solve its major air pollution problems and its heavy reliance on energy imports from the politically unstable countries of Africa and the Middle-East. Another reason for this choice is the fact that China is highly exposed to climate warming on its heavily populated coast.

It is highly likely that it also saw PV as a great opportunity for industrial development judging by the huge financial resources that it poured into photovoltaics to achieve its ends. The public banks provided $18 billion (13 billion euros), in the form of loans on attractive terms to the Chinese solar panel manufacturers that financed an almost tenfold production capacity increase from 2008-2012, which triggered a 75% reduction in panel prices over the period, leading to losses of almost $1 for every $3 of sales in 2012 ! You can't make an omelette without breaking eggs. Some of China's manufacturers who jumped in with both feet ended up hopelessly bankrupt. But it has to be admitted that this is how China dominated half of the global top 10 league slots (see table 4). Boosted by its cheap labour force, and practising unqualified dumping, it "endorsed" mass production that led to a spectacular drop in costs all around the world. Looking impartially, the chain reaction (that any normal photovoltaic specialist had been praying for) enabled solar power to take its rightful place in the current energy transition.

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Tabl. n° 5

Major European utility-scale project developers in 2013

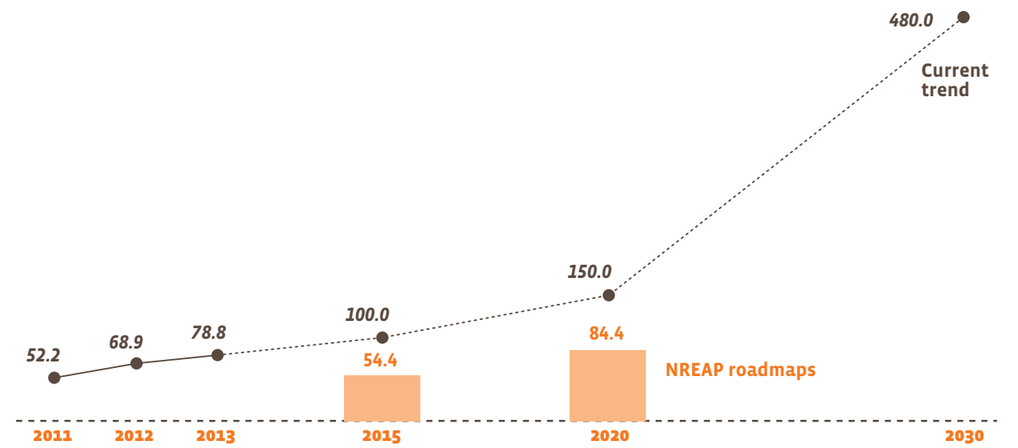
Company	Country	Installed PV capacity (MW)	Employees 2013
Juwi AG	Germany	1 350	1 540
Enerparc	Germany	1 000	n.a.
Belelectric	Germany	1 000	2 000
Saferay	Germany	700	n.a.
EDF Énergies Nouvelles	France	636	2 750
Activ Solar	Austria	524	1 600
Martifer	Portugal	500	3 000
M+W Group (incl. Gehrlicher Solar)	Austria	300	8 000
GP Joule	Germany	250	n.a.
Elecnor/Enerfin	Spain	250	12 500

Large energy companies and major manufacturers (such as First Solar, Yingli, Hanwha Q Cells) because of their size and ability to raise capital may also plan, construct, own or operate substantial renewable energy portfolios. This is not a ranking table but displays a representative view on specialized European PV project developers (EPC). ***Source: EurObserv'ER 2014 (based on Wiki-Solar project developer data base and updated company information).***

lizes in very high yield monocrystalline modules puts its success down to its position in the market. SunPower's strategy is to offer slightly higher priced systems of greater quality (24% yield rate) and better withstand over time, combined with performance warranties (SunPower claims that the modules deliver 105% of their expected energy production). This strategy is generally the same as the one adopted by the European industry. SolarWorld, which has just acquired most of Bosch Solar's manufacturing capacity, guarantees the linear performance of its panels for 25 years and also for 30 years on some models, which enables developers to write off their investments over a longer period.

Graph. n° 2

Comparison of the current trend of photovoltaic capacity installed against the NREAP (National Renewable Energy Action Plans) roadmap (GWp)



Source: EurObserv'ER 2014.

HOW MUCH CAPACITY WILL EUROPE HAVE INSTALLED BY 2020 AND 2030?

In the current European context, any attempt to make reliable projections of European Union capacities installed by 2020 and 2030 would be foolhardy **(graph 2)**. Yet one thing is certain, the photovoltaic sector roadmaps drawn up by each Member State for the National Renewable Energy Action Plans no longer reflect the situation in the market. This is easily explained by the fact that production costs have been slashed since the NREAPs were published (in June 2010). However, no illusions should be made about the European market making a fast turnaround, for it is clear that the European Union governments involved in this technology have adopted a much more controlled and gradual growth strategy.

It is the growth of the global market outside Europe that will tip the grid parity scales permanently (and make the paradigm shift) for solar photovoltaic.
Subsequently, the European market's future growth rate will depend on different parameters, such as the political decision not to interfere with the development of self-production (which runs counter to the utilities' interests) and local and regional community commitment to the development of local loops (smart-grids) combined with the roll-out of electricity storage and electricity flow management systems. A more ambitious, but investment-hungry solution, which can only come about in the context of a co-ordinated European energy policy, would be better interconnection of the main European grids between the North and South and East and West, which is a pre-requisite if the solar and wind power (onshore and offshore) mix exchange is to be harnessed. The Inelfe (Energy for the future) project, co-financed by the European Union as part of the European Energy Program for Recovery (EEPR), will open a new 2 000-MW interconnection between France and Spain (entailing the construction of a tunnel) by 2015, to receive solar electricity during midday consumption peaks. A new cross-Channel energy link between France and the United Kingdom will also be commissioned at the end of 2016. The 1 000-MW interconnection will go through the Channel. On completion, cross-Channel capacity will total 5 400 MW bearing in mind the two RTE projects led in parallel by RTE.
The interconnections recently set up as part of the Noordpool market will also enable the complementary inputs of Northern Europe's (primarily Denmark and Norway) hydropower and (onshore and offshore) wind power to be optimised.
In a similar vein the introduction of the European exchange for the power spot markets (EPEX SPOT) that manages the French, German, Austrian and Swiss markets, has encouraged the development of renewable electricity exchanges between these countries. The new interconnexions will concern also the eastern countries of the EU. The key electricity players in Austria, Czech Republic, Germany, Hungary, Poland, Slovakia and Slovenia have signed, together with the EU Agency for Cooperation of Energy Regulators (ACER), a Memorandum of Understanding (MoU). The MoU is aimed to couple the countries' markets by using a flow-based method for calculating the capacities on the cross-border electricity interconnectors.
Lastly there are strategic fits during the year, as wind power output is higher in winter while solar power output is higher in summer.
The PV Parity project[1] has already demonstrated the technical possibilities of improved penetration by solar by the 2020 and 2030 timelines. The survey indicates that total capacity of 480 GWp in 2030 (15% of the European Union's electricity) would call for the relatively minimal integration cost of €26/MWh, which could be reduced by 20% by setting up a storage system. This intermediate target looks like a good working basis for embarking on energy transition realistically, before talk turns to Europe being 80% supplied by renewable energy in 2050. □

(1) PV Parity EU is a grid parity monitoring project funded by the European Commission through its Intelligent Energy Europe programme. It confirms that photovoltaic grid parity has already been achieved in several European states, including Germany where PV Feed-in Tariffs are paid at 12 to 18 euro cents/kWh (depending on the type of installation) whereas electricity is sold to consumers at 26 euro cents/kWh. Grid parity has also been achieved in the Netherlands, Southern Italy, and in Spain and will soon be achieved in France and Austria.

Source tables 1 and 2: AGEE-Stat (Germany), ENEA (Italy), IDAE (Spain), SOeS (France), APERE (Belgium), Ministry of Industry and Trade (Czech Rep.), DECC (United Kingdom), Helapco (Greece), Hellenic Electricity Market Operator and Greek Electricity Distribution network, APEE (Bulgaria), Slovak energy regulator URSO, Photovoltaic Austria, PA Energy Ltd (Denmark), zonnestroomnl.nl (Netherlands), EDP (Portugal), Jozef Stefan Institute-Energy Efficiency Centre (Slovenia), ministère de l'Économie (Luxembourg), Uppsala University (Sweden), MECW (Malta), Cyprus Institute of Energy, AHK Rumaenien (Romania), litgrid (Lithuania), University of Miskolc (Hungary), The Institute for Renewable Energy (Poland), SEAI (Ireland Rep.), FER (Croatia).

The next barometer will cover concentrated solar power and solar thermal sector.

Download

EurObserv'ER is posting an interactive database of the barometer indicators on the www.energies-renouvelables.org (French-language) and www.eurobserv-er.org (English-language) sites. Click the "Interactive EurObserv'ER Database" banner to download the barometer data in Excel format.

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