THE STATE OF RENEWABLE ENERGIES IN EUROPE

EDITION 2014

14th EurObserv'ER Report

Barometer prepared by Observ'ER (FR) in the frame of the "EurObserv'ER 2013-2016" project with the following consortia members: Renac (DE), Institute for Renewable Energy (IEO/EC BREC, PL), Jožef Stefan Institute (SI), ECN (NL), Frankfurt School of Finance & Management (DE).

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Co-funded by the Intelligent Energy Europe Programme of the European Union

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This action benefits from the financial support of Ademe, the Intelligent Energy – Europe Programme and Caisse des Dépôts.

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VINCENT BERRUTTO,
Vincent Berrutto is the Head of the Energy Unit in the European Commission's Executive Agency for Small and Medium-sized Enterprises (EASME).

With some hindsight, we can now look back at 2014, a year of quite significant changes in the renewable energy scene.

In January 2014, the European Commission adopted '*A policy framework for climate and energy in the period from 2020 to 2030*' which led to constructive debates. Then endorsed by the European Council in October, a binding renewable energy target of at least 27% was set for the share of renewable energy consumed in the EU in 2030. Also the feed-in tariffs have been under the spotlight in recent years and are subject to review.

For the last 16 years, the EurObserv'ER consortium has been monitoring the renewable energy sector and presenting the data in a very clear manner together with an objective analysis. The report 'State of renewable energy in Europe 2014' covers the 28 member states and all renewable energy technologies.

Despite the not so encouraging prospects, between 2012 and 2013, the renewable energy market has grown, even substantially. Wind energy has increased by almost 14% and solar energy by nearly 20% from one year to the next. Concerning electricity, an impressive figure is that just over one quarter of electricity consumption in the EU was produced by renewables in 2013. Overall, the share of renewable energy in the final EU energy consumption reached 15% in 2013 compared to 14.2% in 2012.

A recent feature of this publication is the focus on investments in renewables. The chapter explores the trends in each technology and country. Contrary to the energy indicators, the decrease in investments has been sharp. Likewise employment figures linked to renewables have followed a downward trend, now for the 3rd year in a row. Interestingly, the UK has overtaken Italy, Spain and Denmark to join the top ranking countries for job offers (together with Germany and France).

A thorough explanation of the above and a lot more information on renewable energy, related jobs and investments, can be found in the pages of this publication. The Intelligent Energy Europe programme, managed at the EASME, is supporting this high quality work, already well known in the sector, read by thousands of stakeholders across Europe and beyond.

RÉMI CHABRILLAT,
Director of sustainable production and energies, Ademe

The 14th annual EurObserv'ER barometer shows the new progress made by renewable energies in 2013, for they contributed more than 25% of all the electricity generated in the EU. In the run of positive news, we should add that five Member States have already achieved their 2020 targets and that a further eight, with more than 90% of their targets attained, have only a little more ground to make up. France and Germany have accomplished 62.5 and 67.8% of their targets respectively.

This contrasts with the marked reduction in investment from 25.3 billion euros in 2012 to 19.8 billion in 2013. The main falls have been recorded in the major photovoltaic facility (33%), biofuel (70%) and biomass (21%) sectors. Related employment contracted by 4.7%.

So the green growth engine is running out of steam. How has this come about? Thinking on renewable energies is increasingly considering them as competitive energies that must take on the competition in the energy markets. If we take this further, the support mechanisms are ripe for revision, which calls for adaptations. This has triggered a slowdown of sorts and is also compounded by today's exceptionally low oil price, which mechanically undermines the competitiveness of renewables.

Several conditions must be met if Europe's on-going energy transition is to be pulled off. First of all we need a situation in which renewables compete on equal terms with fossil energies. That implies an end to subsidies and overhauling the European emission exchange system. Secondly, the national transposition of the European 2030 renewable energies target should be at least 27%. Lastly, and we are in no doubt about this… if climate warming is to remain well below 2°C, all the countries across the globe must adopt renewable energies wholesale and as quickly as possible.

The December 2015 COP 21 conference in Paris will provide the venue for the emergence of the political will required to do this. An ambitious international climate agreement should galvanize all the stakeholders into action.

EUROPE... HIDING BEHIND A SMOKESCREEN?

Vincent Jacques le Seigneur, President of Observ'ER

The barometer findings that EurObserv'ER is releasing in these despondent, downcast times hold out a glimmer of hope, for in 2013 more than a quarter of Europe's electricity consumption was covered by renewables. Some countries such as Austria, Sweden and Portugal chalked up records by renewably sourcing more than 50% of their electricity and while hydropower holds the high ground, wind and solar power were the only sources to make significant headway in the electricity mix.

However, there are two considerations that should put a stop to any euphoria. To start with, the slowdown in the investment pace caused firstly by the recession but primarily by the European politicians' procrastinations will take the shine off this achievement in coming years. Secondly, while the electricity consumption results look good for renewables, the same does not go for overall energy consumption. Only 15% of it was renewably sourced, so we still have much ground to make up if we are to reach the 20% target set by the 2009 European directive.

The analysis made in this barometer demonstrates the gaping difference between the Member States. Europe has its model pupils – 13 states that have achieved more than 90% of their set targets – and its tail draggers that, with the notable exception of Italy, are those very countries that in 1957 championed and founded Europe in Rome! Furthermore, their responsibility is even greater because they happen to be the biggest energy consumers.

President Juncker has his work cut out for him in this context if the European Energy Union that he announced turns out to be more than a smokescreen. Yet his declared ambition is unequivocal: "We owe it to future generations to limit the impact of climate change and to keep energy affordable – by using more energy from renewable sources and becoming more energy efficient." These words may have gone down on record, but he will have to beat the drum because the new European target (27% by 2030) is not binding and falls short of the Commission's demand (30%). Nonetheless he will be able to count on renewed efforts from the camps of major nations like France whose draft energy transition bill has set a 32% energy mix target (with with 40% of the electricity), and Germany which intends to produce 45% of its electricity from renewable sources by the 2030 timeline. For now, the day hasn't even dawned, let alone been won.

ENERGY INDICATORS

For fifteen years now, EurObserv'ER has been collecting data on European Union renewable energy sources to describe the state and thrust of the various sectors in its focus studies or barometers. The first part of this assessment is an updated and completed summary of the work published in 2014 in *Systèmes Solaires* (*Journal de l'Éolien* no 14, *Journal du Photovoltaïque* no 11 and *Journal des Énergies Renouvelables* nos 221, 222 and 224).

This publication provides a complete overview of the twelve renewable sectors. Their performances are compared against the stated goals set out by each country in its National Renewable Energy Action Plan (NREAP). Additionally, for the fifth year running, the EurObserv'ER consortium members have published their annual renewable energy share estimates of overall final energy consumption for each Member State of the European Union. These figures provide preliminary indication of how the various countries are faring along their renewable energy paths and whether their individual trends point to successful achievement of the targets set by European Directive 2009/28/EC.

Methodological note

The tables present the latest figures available for each sector. Therefore some of the country data on the wind power, photovoltaic, solar thermal, biofuels, biogas and renewable urban waste sectors has been updated, and may differ from the figures published in the bimonthly barometers for those countries that had data available. Data for the small hydro, geothermal and heat pumps, which were not focus study topics in 2014, has been updated for this edition.

Some country data updates have also been made for solid biomass, which was the subject of a barometer at the end of the year for countries that consolidated their data at the very end of the year. The latest version of the annual comparison of the data published by Eurostat against that of EurObserv'ER can be downloaded from: ***www.eurobserv-er.org***

WIND POWER

The European Union internal market slowed down in 2013 yet managed to keep above the 11-GW threshold... the sector's second best performance for annual installations. According to EurObserv'ER, the EU, which now includes Croatia, connected 11 188.5 MW to the grid compared to about 12 375.4 MW in 2012, i.e. a 9.6% drop. The market was much more concentrated than of recent years, because in 2013 the two main European markets, namely Germany and the UK, accounted for more than half of the additional installed capacity in the EU. This trend gives cause for concern because it is at odds with that of the past few years that tended to indicate wind power capacity build-up across a growing number of countries. This level of concentration has not been seen since 2007, when the German, Spanish and Danish markets were the sole drivers of European growth.

GERMANY AND THE UK SHOW THE WAY

The momentum in Germany and the UK differ. AGEE-Stat reports that wind power capacity at the end of 2013 stood at 34 660 MW, setting a new installation record in 2013 (3 356 MW over the year). Much of the credit for the German market's exceptionally good year should be put down to the developers' resolve to exploit the best wind power purchasing terms before the new renewable energies law (EEG) reform came into force in August 2014.

In 2013 the level of UK offshore activity was high with more than 1 out of every 3 MW connected being offshore. According to DECC (Department of Energy and Climate Change), the country connected 2 314 MW (1 614 MW onshore and 701 MW offshore). However the market declined slightly on its 2012 level, when 2 437 MW was connected to the grid. The UK's aim, restated by the Energy Ministry in November 2013, is to install 39 000 MW of offshore capacity by 2030.

They are the only two countries to have exceeded the one gigawatt threshold for newly-installed capacity, because Spain and Italy which shared this distinction in 2012 stalled badly in 2013. The French market is also struggling as

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in 2013 it contracted for the third year in a row and its installation level was half that of 2010. On a more positive note, the Northern European markets (Denmark, Finland and Sweden) and some of the Eastern European countries such as Poland, Romania and Croatia held up well. However the situation is causing alarm because of the announced overhaul of the incentive systems. Some of the region's markets such as Bulgaria, Hungary, the Czech Republic and Estonia, are already practically on hold.

The size of the European sector becomes clearer when we examine how the installed capacity is tied to the number of inhabitants, and this indicator creates a new hierarchy. It amounted to 232 kW per 1 000 inhabitants in the European Union.
The top three EU countries are Denmark (859 kW/1 000 inhabitants), Spain (491 kW/1 000 inhabitants) and Portugal (451 kW/1 000 inhabitants). Sweden, Germany and Ireland can be associated with this group of leaders, as they are pulling away from the other Member States on this indicator.

The build-up of the European offshore market was also confirmed. EurObserv'ER reports grid connections from offshore capacity rising to 1 816.9 MW over the year, which takes the European Union offshore fleet's capacity to 6 993.2 MW out of the total installed capacity of 117 740.9 MW. In 2013, more than 1.6 MW of every 10 MW was installed offshore. The UK leads Europe thanks to the finalization of the connection of its London Array, Lincs, Gunfleet

1

Installed wind power capacity in the European Union at the end of 2013 (MW)*

	Cumulative capacity at the end of 2012	Cumulative capacity at the end of 2013*
Germany	31 304.0	34 660.0
Spain	22 795.0	22 964.0
United Kingdom	8 895.0	11 209.0
Italy	8 102.0	8 542.0
France**	7 622.0	8 202.0
Denmark	4 162.8	4 810.0
Portugal	4 531.0	4 731.0
Sweden	3 607.0	4 194.0
Poland	2 564.0	3 429.0
Netherlands	2 433.0	2 713.2
Romania	1 822.0	2 459.0
Ireland	1 764.0	1 896.0
Greece	1 753.0	1 809.0
Austria	1 377.0	1 684.0
Belgium	1 365.0	1 653.0
Bulgaria	669.6	676.7
Finland	257.0	447.0
Hungary	331.0	331.0
Lithuania	225.0	279.0
Czech Republic	258.0	270.0
Croatia	179.6	254.3
Estonia	266.0	248.0
Cyprus	146.7	146.7
Latvia	59.0	67.0
Luxembourg	58.3	60.6
Slovakia	3.1	3.1
Slovenia	2.3	2.3
Malta	0.0	0.0
Total EU 28	**106 552.4**	**117 740.9**

** Estimate. ** Overseas departments not included. **Source: EurObserv'ER 2014***

Sands 3 and Teesside wind farms and the partial connection of its Welsh wind farm, Gwynt y Môr. The DECC put British capacity to date at the end of 2013 at 3 696 MW, which equates to 52.9% of the European Union's offshore wind turbine capacity.
Denmark holds on to its number two rank in the European league with 1 271.1 MW of capacity to date thanks to the full connection of the Anholt offshore wind farm.
According to the Deutsche WindGuard offshore report, Germany connected 468 MW of capacity over the twelve months, by practically doubling its offshore fleet to 903 MW. The main project is the Bard Offshore 1 wind farm (400 MW). The country's offshore fleet is due to increase sharply in 2014, as construction of the Borkum Riffgat wind farm is complete and is just waiting to be connected to the grid. The first wind turbines of the Meerwind Süd/Ost and Borkum West II wind farms have also been installed and are awaiting connection. The DanTysk foundations were finished at the end of 2013, and likewise the first foundations of the EnBW Baltic 2 wind farm – the only wind farm currently under construction In the Baltic Sea.

Belgium has completed full connection of its Thorntonbank 2 and 3 offshore wind farms and

2

European Union installed offshore wind power capacities at the end of 2013 (MW)*

	2012	2013*
United Kingdom	2 995.0	3 696.0
Denmark	921.9	1 271.1
Germany	435.0	903.0
Belgium	379.5	625.2
Netherlands	228.0	228.0
Sweden	163.7	211.7
Finland	26.0	26.0
Ireland	25.2	25.2
Spain	0.0	5.0
Portugal	2.0	2.0
Total EU 28	**5 176.3**	**6 993.2**

** Estimate. **Source: EurObserv'ER 2014***

partial connection of the Northwind wind farm, which takes its offshore capacity to 625.2 MW. Sweden added the 48 MW of the Kårehamn wind farm to take its total to 211.4 MW, and Spain is now ranked tenth for offshore wind power in the European Union with its 5-MW demonstration wind turbine on the Arinaga Quay site.

The increase in onshore and offshore production capacities made itself felt by the increase in the wind power share of electricity production in the European Union electricity mix. EurObserv'ER estimates this increase at 13.8% between 2012 and 2013, with a total of 234.4 TWh. Thus wind power accounts for roughly 7.2% of Europe's electricity production (of the 3 276 TWh total) compared to 6.2% in 2012. In Denmark, it already covers more than 31% of total electricity production, more than 22% in Portugal, 20% in Spain and 16% in Ireland.

2020 AND 2030 TARGETS ON HOLD

2015 will be pivotal for the future development of wind energy and its share of the energy mix by the 2030 timeline. The current debate on the European Union's climate and energy policy, geared to the forthcoming climate/energy package, will largely dictate the sector's development prospects for the next 15 years. Investors must be convinced that the European Union's renewable energies policy is a long-term policy that will make for more effective and less costly growth. To do that, the 2020 targets must be fulfilled and the 2030 targets need to be both ambitious and binding.

3

Gross electricity production from wind power in the European Union in 2012 and 2013 (TWh)*

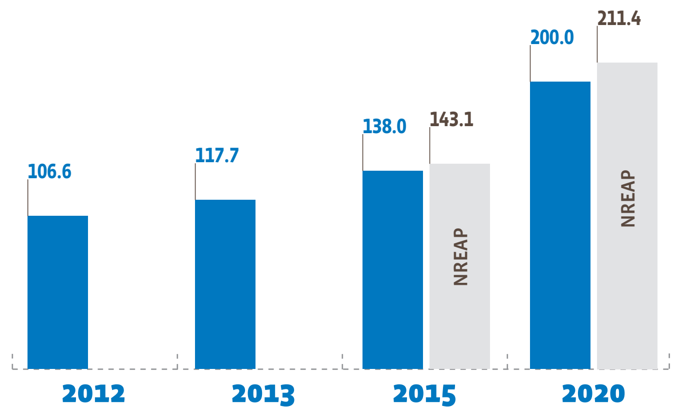
	2012	2013*
Spain	49.472	53.903
Germany	50.670	51.700
United Kingdom	19.661	28.434
France**	15.048	16.034
Italy	13.407	14.897
Portugal	10.259	12.015
Denmark	10.270	11.123
Sweden	7.165	9.842
Poland	4.747	6.004
Netherlands	4.999	5.603
Ireland	4.010	4.542
Greece	3.850	4.139
Romania	2.640	4.047
Belgium	2.750	3.635
Austria	2.463	3.151
Bulgaria	1.221	1.240
Finland	0.494	0.774
Hungary	0.770	0.717
Lithuania	0.540	0.600
Estonia	0.434	0.529
Croatia	0.329	0.517
Czech Republic	0.416	0.478
Cyprus	0.185	0.231
Latvia	0.114	0.120
Luxembourg	0.075	0.081
Slovakia	0.006	0.006
Slovenia	0.000	0.004
Malta	0.000	0.000
Total EU 28	205.996	234.365

** Estimate. ** Overseas departments not included.* ***Source: EurObserv'ER 2014***

The current momentum surrounding the 2020 targets is less propitious than it has been in the past. In view of the recession and their budget deficits, most of the Member States are much less inclined to subsidize the development of their renewable energies at a high price. It is now clear that much tighter control will be wielded over wind energy development to minimize the cost overruns stemming from excessively fast-paced development. Despite the fact that it has long been ahead of target, current momentum is not enough to reach the intermediate Europe-wide target of 143.1 GW for 2015 set by the National Renewable Energy Action Plans (NREAP). It is already clear that the 42.1-GW European offshore target for 2020 will be missed. In contrast, if the onshore wind energy sector stays on course, it may still be able to exceed 160 GW by 2020 (168.8 GW planned in the NREAPs). While the short-term growth prospects look poor, the market still has the second half of the decade to turn around, provided there is a clearly defined legal framework. EurObserv'ER feels that the 200-GW threshold is still attainable, even if it is on the high side. □

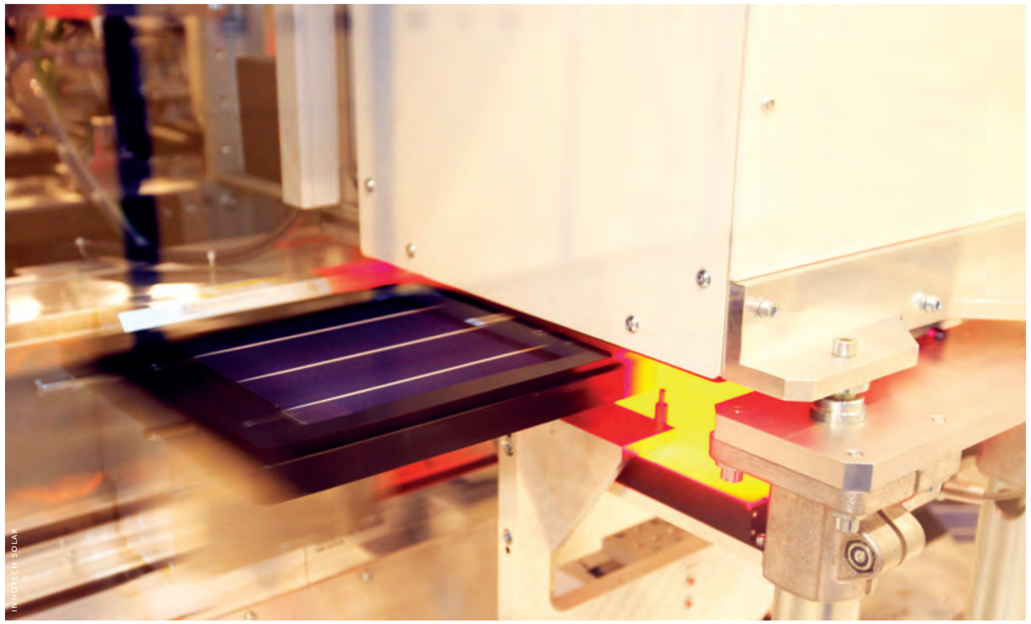
4

Comparison of the current trend against the NREAP (National Renewable Energy Action Plans) roadmap (GW)



Source: EurObserv'ER 2014

PHOTOVOLTAIC



THE EUROPEAN UNION DIVIDED OVER ITS ENERGY STRATEGY

The European Union no longer leads the world solar photovoltaic market. Although it accounted for three-quarters of the world market as recently as 2011 (73.6%), it was down to just 26.7% of the market two years later with about 10.7 GWp of installed capacity compared to the global total of 40 GWp (39 953 MWp according to IEA PVPS data). In 2013. the major world markets were China (12 920 MWp), Japan (6 968 MWp) and the United States (4 751 MWp). EurObserv'ER notes that newly-installed capacity in the EU was 10 672.6 MWp in 2013 down from 17 519.4 MWp in 2012. i.e. a 39.1% decline. Europe's installed PV capacity stood at 79.622.8 MWp at the end of 2013.

EUROPEAN SOLAR POWER PRODUCTION SURGES

The slowdown in installation pace in 2013 has not percolated through to electricity production because of inertia. EurObserv'ER puts solar power production at 80.8 TWh in 2013 (a 19.9% year-on-year increase), or the equivalent of Belgium's total electricity production. However it should be borne in mind that Germany (31 TWh) and Italy (21.6 TWh) between them account for about two-thirds of EU production. Spain, which only installed 120 MWp in 2013, is still in third place for PV production with 8.3 TWh at the end of 2013, which is roughly the same amount as in 2012 (8.2 TWh).

GERMANY'S NEW EEG LAW COMES INTO FORCE

The German market kept its top slot in Europe with 3 310 MWp installed in 2013, despite the sharp drop in newly installed capacity (56.4% less than in 2012). This slide will continue through 2014. According to data from the German grids, only 1 685 MWp of new capacity was installed over the first ten months of 2014 (compared to 2 919 MWp over the same period in 2012). Yet 2015 should be better as the new EEG law will have set the sector's development rules and thus given investors the vision they need. Since 1 August 2014, only small installations (with installed capacity of ≤500 kWp) have been eligible for the Feed-in Tariff. From 1 January 2016, the Feed-in Tariff will only apply to installations with installed capacity of ≤100 kWp. Small plant operators will have the choice between the FiT system or direct sales combined with a market premium, whereas high-capacity plant operators will have to sell on the market. From 2017 onwards, the renewable energy support level will be defined through tenders. A pilot call for tender for 600 MWp of ground-based PV installed capacity will be made during 2015. Another specific feature of the German market is that most of the low- and medium-capacity plants operate a self-consumption regime. Thus according to R2B Consulting, 95% of the <10-kWp systems installed in 2013 operated in self-consumption regime (selling off their surplus) 85% for those in the 10–40 kWp and 70% for those in the 40–1 000 kWp range. This can be explained by the fact that the PV power costs less to produce than purchasing electricity from the grid.

THE UNITED KINGDOM... 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 1 033 MWp of capacity went on-grid in 2013, raising on-grid PV capacity to date to 2 780 MWp. According to consultants PricewaterhouseCoopers (PwC), the UK is likely to install up to 2 000 MWp more this year. The trend seems to be borne out. According to DECC, 1 321 MWp of capacity was installed over the first six months of the year. The Minister of State for Energy says that the UK could install up to 20 GWp of solar capacity by 2020.
Solar parks will be eligible for Renewable Obligation Certificates until 2017, which bind energy suppliers to supplying a minimum share of renewable electricity.

1

Photovoltaic capacity installed and connected in the 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	3 467.0	1.0	3 648.0	1 999.0	1.0	2 000.0
Greece	912.0	0.0	912.0	1 042.5	0.0	1 042.5
United Kingdom	713.0	0.0	713.0	1 033.0	0.0	1 033.0
Romania	46.4	0.0	46.4	972.7	0.0	972.7
France**	1 150.0	0.0	1 150.0	672.0	0.0	672.0
Belgium	1 190.0	0.0	1 190.0	331.0	0.0	331.0
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
Denmark	385.0	0.0	385.0	169.0	0.2	169.2
Spain	269.1	1.3	270.4	119.7	0.5	120.3
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
Lithuania	6.1	0.0	6.1	61.9	0.0	61.9
Portugal	68.0	0.1	68.1	57.0	0.5	57.5
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	4.0	0.0	4.0	15.0	0.0	15.0
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
Finland	1.0	0.0	1.0	1.0	0.0	1.0
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
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
Total EU	**17 509.5**	**9.9**	**17 519.4**	**10 663.8**	**8.8**	**10 672.6**

** Estimate. ** Overseas departments not included.* ***Source: EurObserv'ER 2014***

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	16 409.0	11.0	16 420.0	18 408.0	12.0	18 420.0
Spain	4 621.1	24.6	4 645.7	4 740.8	25.2	4 766.0
France**	3 942.3	10.7	3 953.0	4 614.3	10.7	4 625.0
Belgium	2 581.0	0.1	2 581.1	2 912.0	0.1	2 912.1
United Kingdom	1 747.0	2.3	1 749.3	2 780.0	2.3	2 782.3
Greece	1 536.3	7.0	1 543.3	2 578.8	7.0	2 585.8
Czech Republic	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
Denmark	402.0	1.2	403.2	571.0	1.4	572.4
Slovakia***	543.0	0.1	543.1	537.0	0.1	537.1
Portugal	242.0	3.3	245.3	299.0	3.8	302.8
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	4.0	0.0	4.0	19.0	0.0	19.0
Hungary	11.8	0.5	12.3	14.8	0.6	15.4
Finland	0.2	9.0	9.2	0.2	10.0	10.2
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
Total EU	**68 804.4**	**151.8**	**68 956.2**	**79 461.1**	**161.7**	**79 622.8**

** Estimate. ** Overseas departments not included. *** According to the Slovak regulator URSO. photovoltaic power declined by 6 MW between 2012 and 2013.* ***Source: EurObserv'ER 2014***

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 per MWh for tax years 2015/16, £ 115 per MWh for 2016/17, and £ 110 per MWh for 2017/18, dropping to £ 100 per MWh for 2018/19.

FRANCE AT ITS NADIR

The French market cannot fall any lower than it did in 2013. The latest official statistics to be published by the Service of Observation and Statistics (SOeS) show that 672 MWp of capacity went on-grid in 2013 in mainland France, which is a 41.6% year-on-year slide (1 150 MWp installed in 2012). The market will return to growth in 2014. Thus the installation level was 703 MWp (provisional figures) over the first three quarters, compared to 504 MWp for the same period in 2013. The minimum 800-MWp threshold set by the Environment Minister which was missed in 2013 will be fulfilled in 2014. Total French on-grid capacity in mainland France stood at 4 625 MWp at the end of 2013, compared to 3 953 MWp at the end of 2012.

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. 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 prerequisite if the solar and wind power (onshore and offshore) mix exchange is to be harnessed. □

3

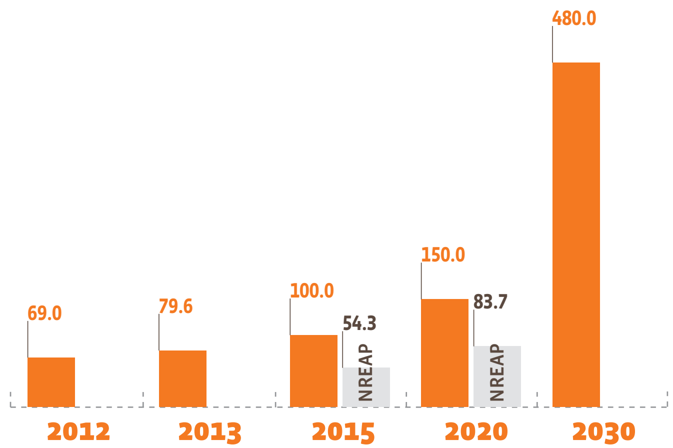
Gross electricity production from solar photovoltaic power in the European Union in 2012 and 2013 (GWh)*

	2012	2013*
Germany	26 380.0	31 000.0
Italy	18 861.7	21 588.6
Spain	8 193.0	8 297.0
France**	4 016.2	4 660.6
Greece	1 694.0	3 648.0
Belgium	2 148.3	2 640.0
Czech Republic	2 149.0	2 070.0
United Kingdom	1 350.6	2 035.6
Bulgaria	814.0	1 348.5
Slovakia	424.0	601.0
Austria	337.5	582.2
Denmark	103.9	517.5
Netherlands	253.8	504.0
Portugal	393.0	479.0
Romania	7.5	397.8
Slovenia	162.8	215.0
Luxembourg	38.3	51.0
Lithuania	2.0	45.0
Cyprus	22.0	45.0
Sweden	19.0	35.0
Malta	13.6	30.1
Hungary	7.9	24.0
Croatia	2.0	11.3
Finland	5.4	5.9
Poland	3.4	4.0
Ireland	0.7	0.7
Estonia	0.6	0.6
Latvia	0.0	0.0
Total EU	67 404.5	80 837.3

** Estimate. ** Overseas departments not included.* ***Source: EurObserv'ER 2014***

4

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



Source: EurObserv'ER 2014

SOLAR THERMAL

The European Union solar thermal sector for hot water and heat production has been suffering from development problems for several years. In 2013, the market slipped for the fifth time in a row, with installed collector surface down to just 3 021 482 m^2 (equating to 2 115.0 MWth of capacity). i.e. 13.3% less than in 2012. The EurObserv'ER survey finds that in 2013 flat-plate collectors accounted for almost 90% of the glazed collectors (89.3% to be precise), completely outstripping vacuum tube collectors. The flexible collector (unglazed) market is basically geared to heating local authority and private swimming pools, but is under-represented because the market is not so closely monitored.

The 2013 installation figures for solar thermal collectors now resemble those of 2007, and are drifting further away from the annual installation record set in 2008 when more than 4.6 million m^2 were installed.

FOCUS ON SOME OF THE EUROPEAN UNION'S KEY MARKETS

The severe market contraction witnessed in 2013, was even sharper than the previous year's, and can be explained by declines in the key solar thermal markets – France, Germany, Austria, Italy, Portugal and even Greece, which is most unusual. The slowdown in the UK can be mainly attributed to the delay in implementing the RHI (Renewable Heat Incentive) for private individuals. This fall-off has to be viewed from the perspective of low economic growth and the moribund construction market, compounded by other politically-inspired factors. The solar thermal industry players feel that the sector's image has been tainted by a particularly bad press over the financial costs of the renewable energy incentives and their impact on state budgets. As the public authorities have always played a pivotal role in guiding consumers' choices in the area of heating, another complaint of theirs is that the information and public recommendation campaigns for installing renewable heating and hot water production systems enjoy a much lower profile... which consumers have clearly interpreted as lukewarm official endorsement. According to EurObserv'ER, the surface area of solar thermal collectors in service was about 44.8 million square at the end of 2013 in the European Union, namely 31.4 GWth of capacity. The top three countries remain unchanged – Germany, Austria and Greece. If we take into account a per capita surface indicator, Cyprus sets the European benchmark with 0.787 m^2/p.c., followed by Austria (0.598 m^2/p.c.) and Greece (0.376 m^2/p.c.).

THE GERMAN MARKET SLIDING EXCEPT IN NEW BUILD

Despite a slight surge in 2011, the German solar thermal market is still sliding. According to AGEE-Stat it managed to stay above the one million square-metre mark (at 1 040 000 m^2) in 2013, which is 130 000 m^2 less than in 2012. BSW Solar (the German solar industry association) feels the situation is not alarming, as it is shifting. The proportion of new builds equipped with solar systems is tending to rise, as the new build market picks up thanks to low interest rates. The BSW explains that the poor performance of solar themal hybrid system sales using a second energy source in the replacement market is reponsible for this downward trend.

In May 2014 Germany enacted new legislation on energy savings (the EnEV law), which stipulates that from 2015 onwards, oil- and gas-fired heating systems over 30 years old must be replaced by new systems. The law is likely to increase solar system sales, because the new fossil-fuel heating systems tend to be sold coupled to solar thermal collectors, to improve system performance and efficiency.

UK... THE DOMESTIC RHI IS NOW IN PLACE

The Renewable Heat Incentives programme for homeowners (Domestic RHI scheme) finally kicked into play on 9 April 2014, after a series of false starts and three years after the RHI was rolled out for the other sectors (industry, businesses and the public sector). The "domestic" RHI is the world's first long-term financial incentive support programme for renewable heat production that targets householders. It covers

1

Surface areas (m²) by collector type and corresponding capacities (MWth) installed over the year 2012

	Glazed collectors		Unglazed collectors	Total (m²)	Corresponding capacities (MWth)
	Flat plate collectors	Vacuum collectors			
Germany	977 500	172 500	20 000	1 170 000	819.0
Italy	290 400	39 600	0	330 000	231.0
Poland	216 168	85 906	0	302 074	211.5
France*	268 236	8 150	6 000	282 386	197.7
Greece	241 500	1 500	0	243 000	170.1
Spain	213 060	12 623	3 591	229 274	160.5
Austria	200 800	5 590	2 410	208 800	146.2
Denmark	133 122	0	0	133 122	93.2
Czech Republic	37 000	13 000	50 000	100 000	70.0
Portugal	90 896	0	0	90 896	63.6
Netherlands	42 470	0	26 000	68 470	47.9
Belgium	50 500	11 500	0	62 000	43.4
United Kingdom	47 893	11 382	0	59 275	41.5
Hungary	44 200	5 800	1 650	51 650	36.2
Ireland	18 803	8 284		27 087	19.0
Cyprus	22 373	1 544	166	24 083	16.9
Romania	20 000	0	0	20 000	14.0
Croatia	17 000	2 000	0	19 000	13.3
Slovenia	10 596	2 897	0	13 493	9.4
Sweden	8 251	3 006	910	12 167	8.5
Slovakia	6 500	1 000	500	8 000	5.6
Bulgaria	8 000	0	0	8 000	5.6
Luxembourg	6 835	0	0	6 835	4.8
Malta	5 980	0	0	5 980	4.2
Finland	3 000	1 000	0	4 000	2.8
Latvia	3 000	0	0	3 000	2.1
Lithuania	600	1 200	0	1 800	1.3
Estonia	900	900	0	1 800	1.3
Total EU 28	2 985 583	389 382	111 227	3 486 192	2 440.3

** Overseas departments included.* ***Source: EurObserv'ER 2014***

2

*Surface areas (m²) by collector type and corresponding capacities (MWth) installed over the year 2013**

	Glazed collectors		Unglazed collectors	Total (m²)	Corresponding capacities (MWth)
	Flat plate collectors	Vacuum collectors			
Germany	907 800	112 200	20 000	1 040 000	728.0
Italy	267 000	30 000	0	297 000	207.9
Poland	199 100	75 000	0	274 100	191.9
Spain	222 552	6 169	3 794	232 515	162.8
France**	216 185	6 300	6 000	228 485	159.9
Greece	210 000	1 000	0	211 000	147.7
Austria	175 140	4 040	1 460	180 640	126.4
Denmark	104 000	0	0	104 000	72.8
Czech Republic	32 306	12 225	35 000	79 531	55.7
Netherlands	30 054	2 694	27 396	60 144	42.1
Belgium	48 500	10 500	0	59 000	41.3
Portugal	57 234	0	0	57 234	40.1
United Kingdom	36 000	9 000	0	45 000	31.5
Ireland	17 022	10 679	0	27 701	19.4
Romania	9 000	14 850	180	24 030	16.8
Hungary	10 580	7 170	250	18 000	12.6
Croatia	15 700	1 750	0	17 450	12.2
Cyprus	16 652	472	34	17 158	12.0
Slovenia	7 089	1 949	0	9 038	6.3
Sweden	6 124	2 487	351	8 962	6.3
Slovakia	5 200	1 000	500	6 700	4.7
Luxembourg	6 179	0	0	6 179	4.3
Bulgaria	5 600	0	0	5 600	3.9
Finland	3 000	1 000	0	4 000	2.8
Latvia	2 700	0	0	2 700	1.9
Lithuania	600	1 200	0	1 800	1.3
Estonia	900	900	0	1 800	1.3
Malta	1 223	493	0	1 715	1.2
Total EU 28	2 613 440	313 078	94 965	3 021 482	2 115.0

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

3

Cumulative capacity of thermal solar collectors installed in the European Union in 2012 and 2013***
(m² and MWth)

	2012		2013**	
	m²	MWth	m²	MWth
Germany	16 309 000	11 416.3	17 222 000	12 055.4
Austria	4 926 348	3 448.4	5 054 698	3 538.3
Greece	4 121 025	2 884.7	4 164 025	2 914.8
Italy	3 400 000	2 380.0	3 700 000	2 590.0
Spain	2 964 864	2 075.4	3 197 379	2 238.2
France***	2 415 000	1 690.5	2 575 000	1 802.5
Poland	1 211 500	848.1	1 485 000	1 039.5
Portugal	966 770	676.7	1 024 004	716.8
Czech Republic	892 768	624.9	972 299	680.6
Netherlands	864 641	605.2	879 423	615.6
Denmark	712 823	499.0	786 000	550.2
Cyprus	693 999	485.8	681 157	476.8
United Kingdom	650 497	455.3	678 897	475.2
Belgium	477 115	334,0	534 628	374,2
Sweden	482 000	337,4	488 000	341,6
Ireland	252 677	176.9	280 379	196.3
Slovenia	202 537	141.8	211 574	148.1
Hungary	178 974	125.3	196 109	137.3
Slovakia	154 350	108.0	161 050	112.7
Romania	133 355	93.3	157 385	110.2
Croatia	119 600	83.7	137 050	95.9
Bulgaria	83 000	58.1	83 600	58.5
Malta	48 293	33.8	50 008	35.0
Finland	42 713	29.9	46 413	32.5
Luxembourg	32 952	23.1	39 131	27.4
Latvia	14 650	10.3	17 350	12.1
Lithuania	9 150	6.4	10 950	7.7
Estonia	6 120	4.3	7 920	5.5
Total EU 28	42 366 721	29 657	44 841 429	31 389,0

** All technologies included unglazed collectors. ** Estimate. *** Overseas departments included.* ***Source: EurObserv'ER 2014***

solar thermal technologies, heat pumps and biomass boilers installed since 1 July 2009, provided certain energy efficiency criteria are met. In the case of solar thermal, the incentive amounts to 19.2p/kWh (€ 0.23/kWh), paid quarterly for seven years. The incentive aims to bridge the cost gap compared to a 100% fossil-fuel heating system. The production incentive applies to both, solar thermal hot water production systems and combined hot water and heating systems.
Once the seven-year term has expired, no further production incentive will be paid out to the family but they will benefit from the savings made by the installation throughout its lifetime (put at 25 years). The government and the Solar Trade association (STA) aim to install a million solar roofs by 2015. According to the STA, there are already more than 200 000 solar thermal systems installed in the UK. An STA survey indicates that solar thermal system prices could come down by 29.2% if the market takes off, noting that the current mean price of a solar hot water heater for a 4-bedroom house is about £ 4 500 (€ 5 500).

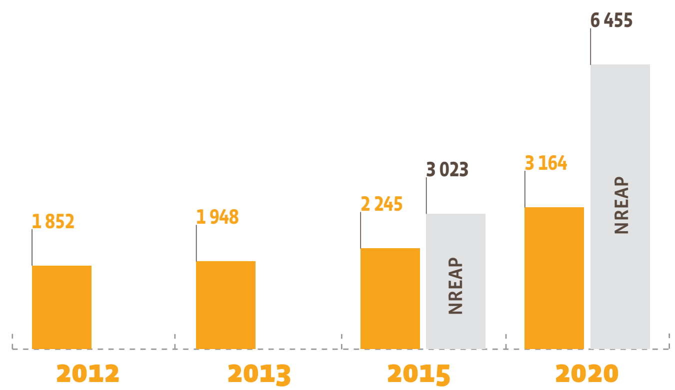
A QUESTION OF POLITICAL CHOICE FOR 2020 AND 2030

The solar thermal sector seems to be in the throes of another crisis and it is hard to imagine the sector finding the path to strong, sustainable growth if it has to rely solely on its own financial resources. The blood-letting should end this year. The sector's new-year forecasts indicated that it expected the 2014 market to stabilize or show a slight upswing. But it is clear that full-blown solar thermal market recovery will be contingent on an all-out renewable heat development policy that combines incentives to produce with promotional campaigning.

The European Commission has not stood idle. On 6 September 2013, the regulation on the eco-design requirements of boilers and hot water heaters was published in the Official Journal of the European Union. From September 2015 onwards these appliances will be allocated energy labels to enable consumers to gauge the energy efficiency and consumption differences between the various systems. The label will indicate an energy category ranging from A+++ to F, where the best score will be awarded to… solar thermal systems that benefit from the only technology eligible for category A+++! Category G will be abolished to withdraw the worst-performing appliances from the market. The system will naturally benefit sales of renewable energy-fuelled appliances.
While the implementation of specific, bold measures reaffirmed by the national and European decision-makers is awaited, EurObserv'ER reckons that the European Union will achieve half of its combined NREAP targets. According to EurObserv'ER, heat production from the solar thermal sector reached near 2 Mtoe in 2013, i.e. 30.2% of the NREAP 2020 target. □

4

Comparison of the current trend (ktoe) against the NREAP (National Renewable Energy Action Plans) roadmap



Source: EurObserv'ER 2014

SMALL HYDROPOWER

SÜDTIROL MARKETING/MAX LAUTENSCHLÄGER

For about a decade, the development of small hydro, which covers plants up to 10 MW of capacity, has struggled under the effects of environmental legislation such as the Water Framework Directive and the setting-up of Natura 2000 protected areas. According to ESHA (European Small Hydropower Association), this legislation halves the economic development potential of small hydro in a number of countries. Small hydro still has an important role to play within the electricity system. Apart from the fact that it is a renewable energy, as the plants are designed to react immediately to fluctuations in the demand for electricity it is also a competitive energy that contributes to grid stability.

SMALL HYDRO PASSES THE 14 000-MW MARK

The survey conducted at the end of 2014 on the European Union of 28, counted the net installed capacity of small hydro, defined as the capacity that can be used by the turbine generator shaft. EurObserv'ER,

OEBMV/DERSCHMID

found that net capacity in 2013 exceeded 14 000 MW in 2013 for the first time, or exactly 14 050 MW. It has thus increased by 2.3% in the space of 12 months. The top three countries for net installed capacity are Italy (3 034 MW), France (2 021 MW) and Spain (1 948 MW). The two countries that made the greatest input to the increase in European capacity in 2013 were Italy (130 MW) and Romania (104 MW).

The year 2013 was a good year for both large- and small-scale hydropower. EurObserv'ER reports that the former (≥10 MW) recorded 320.1 TWh of production in 2013 (increasing 28.5 TWh), excluding pumped storage. The latter (<10 MW) increased to 49.5 TWh, i.e. 5.9 TWh more than in 2012... a 13.5% rise). Thus small hydro accounts for 13.4% of "pure" hydraulic production put at 369.6 TWh in 2013.

The European Union's small hydro production is concentrated in a handful of countries. The top six (Italy, Germany, France, Austria, Spain and Sweden) actually account for 82.8% of EU production and the top three 54.5% between them. The five countries whose small hydro production increased the most are Italy (by 2.6 TWh), Spain (2.3 TWh), France (1.4 TWh), Germany (0.6 TWh) and Portugal (0.6 TWh). There was less demand for small hydro in northern Europe in 2013. Swedish production slipped by 1.3 TWh and that of Finland by 0.7 TWh.

THE MOMENTUM IS RIGHT FOR 2020

As it stands, the small hydropower sector is in line with the NREAP targets, both in terms of installed capacity and production. However its expansion is not assured over the next decade because sector development is increasingly falling foul of the implementation of the Water Framework Directive, which must be transposed into national law before 2015. The EurObserv'ER projections may have to be downsized if the deadlocks continue, yet the industry views that there is considerable potential for development. A very comprehensive roadmap has been drawn up that makes allowance for the sector's potential as part of the European Stream Map project coordinated by ESHA. The Stream Map report reckons that installed small hydropower capacity could rise to 17.3 GW by 2020 yielding 59.7 TWh of energy, which is higher than the NREAP forecasts. The most promising countries are Italy, France, Spain, Austria, Portugal, Romania and Greece.

However it points out that the sector's growth by this timeline will be heavily dependent on the ability of industry, public authorities and the decision makers to take appropriate steps to deal with current and future challenges. The public authorities should set up financial or administrative arrangements for new incentive mechanisms. The industry must also persevere with investing in technologies that preserve the ecological continuity of watercourses and protect fish populations and should also continue its standardisation efforts across the European Union. Thus much progress remains to be made if the sector is to continue to develop smoothly. □

1

Net capacity of small hydro (<10 MW) in the European Union by country in 2012 and 2013 (MW)*

	2012	2013*
Italy	2 904	3 034
France	2 025	2 021
Spain	1 942	1 948
Germany	1 780	1 774
Austria	1 184	1 233
Sweden	953	992
Romania	426	530
Portugal	380	373
Czech Republic	311	326
Finland	315	318
Bulgaria	285	285
Poland	273	277
United Kingdom	254	258
Greece	218	220
Slovenia	160	161
Belgium	65	64
Slovakia	71	43
Ireland	41	41
Luxembourg	34	34
Latvia	26	30
Croatia	28	28
Lithuania	26	26
Hungary	14	17
Estonia	8	8
Denmark	9	9
Total EU 28	**13 732**	**14 050**

Source: EurObserv'ER 2014

2

Gross electricity production from small hydropower (<10 MW) in the European Union (GWh)

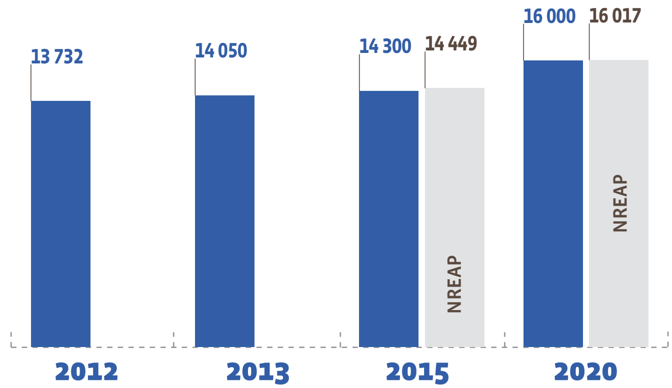
	2012	2013
Italy	9 409	11 986
Germany	7 206	7 819
France	5 756	7 196
Austria	5 774	5 721
Spain	2 934	5 241
Sweden	4 366	3 020
Portugal	627	1 195
Czech Republic	917	1 094
Finland	1 733	1 077
Poland	938	994
United Kingdom	868	802
Greece	669	772
Bulgaria	731	715
Romania	540	603
Slovenia	297	363
Belgium	206	233
Croatia	77	122
Luxembourg	99	119
Slovakia	109	115
Lithuania	97	92
Ireland	108	75
Hungary	39	62
Latvia	80	60
Estonia	42	26
Denmark	17	13
Total EU 28	**43 641**	**49 513**

Source: EurObserv'ER 2014

EUROBSERV'ER – THE STATE OF RENEWABLE ENERGIES IN EUROPE – 2014 EDITION

3

Comparison of the current small hydropower capacity installation trend (MW) against the NREAP (National Renewable Energy Action Plans) roadmap



Source: EurObserv'ER 2014

GEOTHERMAL ENERGY

Geothermal energy can be recovered either as heat or electricity, with different technologies and for different applications for each type. Geothermal heat can supply district heating networks or alternatively used to heat pools, greenhouses or aquafarms.

ELECTRICITY PRODUCTION

Growth of geothermal electricity capacity in all the countries of the European Union continued to increase in 2013 producing 11.0 MW more than in 2012, with 951.5 MW of installed capacity. Only part of this capacity is actually in service as the rest is on shutdown or undergoing maintenance. EurObserv'ER puts the net capacity of these geothermal plants in 2013 at 794.9 MW. Gross electricity production picked up momentum and passed the 6-TWh mark (6 026.1 GWh to be precise), recording 3.6% growth.

Italy's geothermal capacity is concentrated in two main production areas – Larderello, Travale-Radicondoli and Monte Amiata. Terna (the Italian grid transmission operator) says that net capacity rose slightly from 728.1 to 729 MW, when the new Bagnore plant on the Monte Amiata site, a 1-MW binary cycle plant, was commissioned. Terna points out that geothermal electricity production increased 1.2% year-on-year, rising from 5 591.7 to 5 659.2 GWh.
Two new plants – Dürrnhaar, (5.5 MW) and Kirchstockach (5.5 MW) went on stream in Germany, taking the country's installed geothermal capacity to 28.5 MW in 2013 and to third place in the EU behind Italy and Portugal. It now has 7 plants... the latest have joined Bruchsal, Insheim, Landau, Unterhaching and Sauerlach and thus boosted geothermal electricity production. AGEE-Stat claims it reached 80 GWh in 2013 – a 55 GWh increase over 2012.

1

Capacity installed and net capacity of EU geothermal power plants in 2012 and 2013 (MWe)*

	2012		2013*	
	Capacity installed	Net capacity	Capacity installed	Net capacity
Italy	875.5	728.1	875.5	729.0
Portugal	29.0	25.0	29.0	25.0
Germany	17.5	12.0	28.5	24.0
France**	17.1	16.2	17.1	16.2
Austria	1.4	0.7	1.4	0.7
Total	940.5	782.0	951.5	794.9

Note: net capacity is the maximum capacity presumed harnessable that can be supplied continuously at the outlet point to the network when the entire plant is running.
** Estimate. ** Overseas departments included.* ***Source: EurObserv'ER 2014***

Portugal's geothermal resources have been harnessed to produce electricity in the Azores volcanic archipelago, on San Miguel Island. According to the DGGE (Directorate General for Energy and Geology), net operable capacity remained stable at 25 MW. However, now that maintenance operations on a number of sites have been completed, Portuguese geothermal electricity production has recovered (increasing by 34.9%) to roughly 200 GWh.

Most of France's high-temperature geothermal energy potential is in the overseas territories comprising two plants at Bouillante, Guadeloupe, with 14.7 MW of capacity. The DGEC (Directorate General for Energy and Climate) estimates 2013 production from these plants at 89.6 GWh. France also has a 1.5-MW pilot plant on the Soultz-sous-Forêts site that uses hot dry rock geothermal energy.

MORE THAN 10 TWH OF PRODUCTION EXPECTED IN 2020

The European Union's geothermal capacity is set to rise in the next

2

Gross geothermal electricity production in the European Union in 2012 and 2013 (GWh)*

	2012	2013*
Italy	5 591.7	5 659.2
Portugal	146.0	197.0
France**	56.1	89.6
Germany	25.0	80.0
Austria	0.7	0.3
Total	5 819.5	6 026.1

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

3

*Direct uses of geothermal energy (excluding ground-source heat pumps) in the European Union by country in 2012 and 2013**

	2012		2013*	
	Capacity (MWth)	Energy tapped (ktoe)	Capacity (MWth)	Energy tapped (ktoe)
Italy	778.7	133.8	784.7	134.6
France	287.4	112.5	287.4	129.5
Hungary	714.0	105.1	774.0	117.0
Germany	170.3	66.1	220.3	73.1
Slovenia	66.8	34.6	66.8	38.4
Bulgaria	n.a.	33.4	n.a.	33.4
Austria	97.0	27.6	97.0	28.4
Netherlands	51.0	11.8	51.0	23.7
Sweden	33.0	23.2	33.0	23.2
Romania	176.0	21.6	176.0	21.6
Poland	115.4	15.8	119.2	18.6
Greece	104.9	13.1	101.0	11.5
Croatia	45.3	7.0	45.3	6.8
Denmark	21.0	6.9	33.0	5.5
Slovakia	14.2	3.6	14.2	3.8
Czech Republic	4.5	2.1	4.5	2.1
Belgium	6.1	1.5	6.1	1.7
Lithuania	48.0	3.8	48.0	1.7
Portugal	1.5	1.6	1.5	1.6
United Kingdom	2.8	0.8	2.8	0.8
Total EU 28	2 737.9	625.8	2 865.7	677.0

* Estimate. *Source: EurObserv'ER 2014*

few years. In Germany, the EGEC (European Geothermal Energy Council) says that 15 projects are under development that could potentially provide the country with 80-90 MW as early as 2017. A further 28 projects are on the drawing board, which would increase capacity by more than 100 W. France also intends to harness its geothermal potential via the development of deep geothermal energy in the mainland and through its volcanic potential in the overseas territories. On the mainland, 11 exploration permits have been granted to private companies (8 in Alsace, two in the Massif Central and one in the Pyrenees) and 9 further applications are in the pipeline. One of the projects given the go-ahead that stands out from the others is carried by Fonroche Énergie in Strasbourg, for mining work for four geothermal boreholes. A prospective study conducted by AFPG (the French association of geothermal professionals) suggests that electricity-generating capacity could rise to 202 MW by 2025 (40 MW in mainland France and 145 MW in the overseas territories). In Italy, four plants, including the 40-MW Bagnore 4 project, are being developed and should come on stream by 2017. EGEC has already identified 28 projects at development stage in 11 countries across the EU that will contribute at least 205 MW of additional capacity. The National Renewable Energy Action Plans forecast 10.9 TWh of geothermal production for electrical applications by 2020 on the basis of 1 613 MW of installed capacity.

HEAT PRODUCTION

LOW- AND MEDIUM-ENERGY APPLICATIONS

The capacity of applications linked to direct uses of heat (excluding heat pumps) in the European Union, namely geothermal heat used by district heating networks, agriculture, industry, balneology and other uses, is put at 2 865.7 MW for 677.0 ktoe in 2013. The figures are based on official data gathered during the December 2014 EurObserv'ER survey, and from additional information from the 2013-2014 ECEG annual market report that focused on the connection of new geothermal heat networks in particular.

The EGEC reports that 8 new geothermal heating networks were commissioned in 2013, with combined capacity of 122 MWth. The 8 sites are in Denmark (Sonderborg, 12 MWth), Germany (Sauerlauch, 40 MWth, and Waldraikburg, 10 MWth), Hungary (Miskolc 55 MWth, Mako 5 MWth and Szolnok, 1.2 MWth), Poland (Poddebice, 3.8 MWth) and Italy (Monteverdi Marittimo, 6 MWth). New boreholes were also drilled to boost supplies to existing heating networks in France. The EGEC data puts geothermal capacity for heating networks at the end of 2013 across 17 countries of the European Union at 1 198 MW.

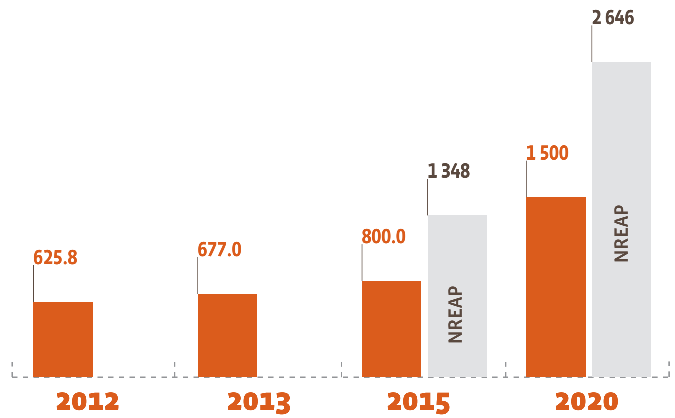
If all the low- and medium-energy geothermal applications are taken into account, Italy remains in the lead for these applications in 2013, while France has the highest number of geothermal heating networks in service in the EU – 42 – with 287.4 MW of combined capacity. More than half these networks are located in the Paris basin and heat 150 000 dwellings. The DGEC says that they produced about 129.5 ktoe of geothermal energy in 2013.

THE 2020 TARGET WAY BEHIND SCHEDULE

The gap is widening all the time between geothermal heat's current trajectory and the target set out in the National Renewable Energy Action Plans, which provided for 2 646 ktoe in 2020 and an intermediate target of 1 348 ktoe in 2015. If it is to be narrowed, the Member States must introduce much bolder incentive policies to promote geothermal heat as a matter of urgency. The new Energy Efficiency Directive (2012/27/EU) should encourage them to redouble interest in their geothermal potential, for article 14 requires each Member State to give the Commission a full assessment of the potential for applying high yield cogeneration and efficient heating networks prior to 31 December 2015. Geothermal energy has its own role to play, but once again it is up to the politicians to introduce the statutory and incentive mechanisms required to develop renewable heat. □

4

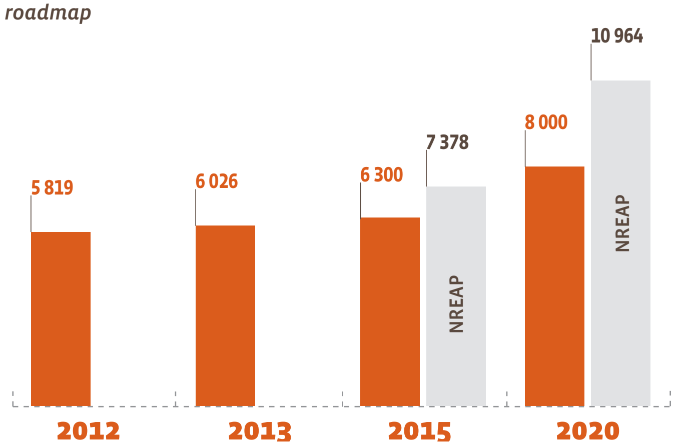
Comparison of the geothermal heat generation trend (ktoe) against the NREAP (National Renewable Energy Action Plan) roadmap



Source: EurObserv'ER 2014

5

Comparison of the current geothermal electricity generation trend (GWh) against the NREAP (National Renewable Energy Action Plan) roadmap



Source: EurObserv'ER 2014

HEAT PUMPS

Awareness of heat pump technologies has shot up by leaps and bounds, especially since the mid-2000s. Heat pumps have claimed their place in the sphere of renewable energy production technologies through major innovations to their energy efficiency, and particularly to their compressors. Generally three major types of heat pump (HP) are distinguished – ground-source HPs [GSHP], that include the technologies using the ground's energy, namely all the ground-water and ground-air heat pumps, hydrothermal HPs include those that use water as their heat source; namely water-water HPs and water-air HPs and air-source HPs [ASHP] that cover the technologies said to be air-air, air-water, exhaust air-air and exhaust air-water that use air as their heat source. These last two use the exhaust air (indoor air) of dwellings whereas the first two use ambient air (outside the building). Methodological note: this study does not include thermodynamic hot water heaters whose unit sales are soaring, because according to the European Commission their performance coefficients only meet the European Renewable Energy Directive's requirements (i.e. a seasonal performance factor in excess of 2.5) as a matter of exception. The annual European Heat Pump Market and Statistics Report for 2014 published by EHPA (European Heat Pump Association), states that 79 122 units were sold in 2013 in 19 countries of the European Union compared to 61 405 in 2012, which equates to 28.9% growth. France leads the field with 45 950 units sold in 2013, ahead of Germany, with 12 100 and Poland with 7 800 units sold. This study also ignores industrial-sized HPs and those used by heating networks.

Notwithstanding, the EurObserv'ER statistics factor in all HPs and reversible systems (that produce both heat and refrigeration), including those used mainly for cooling, provided that they meet the Directive's requirements. It is left up to the Member States whether or not to include this type of system in their renewable energy accounting of heat pumps.

Air-source technologies are popular in hot climates, while in countries with cold climates; more stable temperatures are required for systems to run properly. This explains why GSHP markets perform better than average in colder climate countries. The ASHP (air-water) to GSHP distribution is more equitable in the underfloor heating systems market where air-water type ASHPs account for 65% and GSHPs for 35%.

A MARKET DOMINATED BY AIR-SOURCE HPS

The end-of-year EurObserv'ER survey confirms that the ASHP market share is increasing fastest

1

Air-source heat pump[1] market in 2012 and 2013 (units sold)*

	2012		2013*	
	Air-source HPs	of which air-water	Air-source HPs	of which air-water
Italy[2]	1 071 600	*14 600*	1 042 900	*16 900*
France	130 569	*52 779*	133 148	*53 899*
Sweden	70 587	*6 384*	71 650	*6 635*
Spain	49 625	*1 374*	51 738	*2 464*
Finland	45 954	*954*	43 742	*1 227*
Germany	38 476	*38 476*	39 983	*39 983*
Netherlands	30 849	*3 224*	28 138	*4 633*
Denmark	24 745	*2 113*	24 689	*3 429*
United Kingdom	15 505	*14 455*	15 656	*15 656*
Estonia	12 295	*790*	13 260	*800*
Portugal	8 008	*721*	9 197	*437*
Austria	7 977	*7 843*	8 549	*8 416*
Slovenia	4 950	*n.a.*	6 151	*n.a.*
Czech Republic	5 576	*5 180*	4 666	*4 209*
Belgium	5 135	*5 135*	4 167	*4 167*
Poland	1 995	*1 680*	2 119	*2 119*
Ireland	905	*886*	1 190	*1 169*
Slovakia	508	*392*	648	*500*
Hungary	383	*177*	273	*226*
Lithuania	195	*195*	230	*110*
Luxembourg	128	*128*	n.a.	*n.a.*
Total EU	**1 525 965**	**157 486**	**1 502 094**	**166 979**
Total EU without Italy	***454 365***	***142 886***	***459 194***	***150 079***

** Estimate.*
1) Designed for heating with or without cooling function.
2) The Italian market data is not strictly comparable with the other European Union markets because they include very low-capacity reversible systems (of the split or multi-split type) that are generally used for cooling.
Source: EurObserv'ER 2014

with just over 1 500 000 units sold in 2013 compared to just under 1 526 000 in 2012. This slight market contraction is of no importance as it stems from the Italian market's performance which is not strictly comparable with the other European Union markets because the Italian Ministry of Economic Development's statistics calculations include very low-capacity reversible systems (of the split or multi-split type) that are generally used for air-conditioning. Without the Italian market in the equation, the European Union market data more accurately represents the HPs mainly used for producing heat. Its figures are positively upbeat with more than 459 000 units sold in 2013, compared to just over 454 000 in 2012.
The GSHP market is dwindling inexorably. EurObserv'ER finds that the sector contracted by a further 7.5% from 96 748 units sold in 2012 to 89 526 in 2013. One of the main reasons underlying the GSHP market plunge is that it is so closely tied to the new build market, which in many European Union countries is now at its nadir. The opposite holds true for the ASHP market which is strongly bolstered by the renovation market. Furthermore, the new insulation requirements resulting from the latest thermal regulations reduce heating requirements. As a result, ASHPs are much more competitive than GSHPs in the new build market, for in a passive or positive-energy dwelling, a home can be heated by a simple low-kW HP running on exhaust air (thermodynamic dual flow ventilation system), making it unnecessary to install a higher-capacity heating system.

POSITIVE OUTLOOK

The renovation market and the full effect of the new thermal regulations will boost the HP market's growth prospects for 2014. The industry is expecting sales volumes to increase by about 5%, which brings hope for sustainable recovery in the EU's HP market. This return to growth, which seems to be taking shape, is in line with the national targets set in the National Renewable Energy Action Plans. A summary of these plans was made by ECN (Energy Research Center of the Netherlands). It showed that the Member States put the total contribution of renewable energy captured by HPs at 7 252 ktoe in 2015 and 12 290 ktoe in 2020. The contri-

2

Ground-source heat pump market in 2012 and 2013 (units sold)*

	2012	2013*
Sweden	24 520	24 900
Germany	22 257	21 157
Finland	11 789	11 257
Austria	6 669	6 023
Poland	5 121	5 142
France	6 448	4 924
Netherlands	5 786	3 052
Denmark	3 191	2 681
Czech Republic	2 501	2 340
United Kingdom	2 294	1 976
Estonia	1 200	1 400
Belgium	1 418	1 336
Italy	1 050	1 030
Hungary	293	510
Lithuania	450	470
Slovenia	475	441
Slovakia	245	312
Ireland	479	305
Spain	511	246
Portugal	39	24
Luxembourg	12	n.a.
Total UE**	**96 748**	**89 526**

** Estimate. ** In those countries where a market exists.* ***Source: EurObserv'ER 2014***

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3

Total number of heat pumps in service in 2012 and 2013 in the European Union*

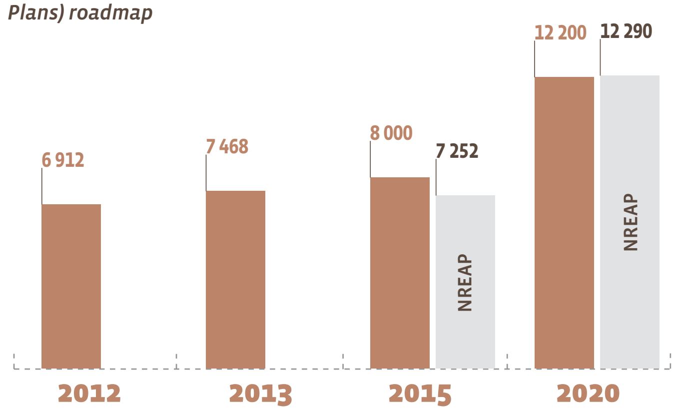
	2012			2013*		
	Air-source HPs	Ground-source HPs	Total base in service	Air-source HPs	Ground-source HPs	Total base in service
Italy[1]	15 972 000	10 500	15 982 500	16 900 000	11 530	16 911 530
France	777 259	123 045	900 304	910 407	127 969	1 038 376
Sweden	654 233	243 058	897 291	725 883	267 958	993 841
Germany	223 000	272 200	495 200	261 000	297 191	558 191
Finland	445 787	72 420	518 207	466 463	83 677	550 140
Denmark	308 119	36 335	344 454	332 808	42 824	352 816
Spain	195 989	898	196 887	247 727	1 144	248 871
Netherlands	147 815	41 257	189 072	174 515	43 882	218 397
Bulgaria	149 962	3 749	153 711	149 962	3 749	153 711
Portugal	111 374	691	112 065	120 571	715	121 286
United Kingdom	68 645	17 760	86 405	84 301	19 736	104 037
Austria	34 044	55 805	89 849	42 593	55 805	98 398
Estonia	59 097	5 955	65 052	72 357	7 355	79 712
Czech Republic	24 234	25 766	50 000	28 604	30 667	59 271
Poland	5 445	20 621	26 066	6 699	25 763	32 462
Belgium	12 595	4 046	16 641	16 762	5 382	22 144
Slovenia	7 473	4 669	12 142	13 624	5 110	18 734
Slovakia	4 590	2 215	6 805	5 238	2 527	7 765
Ireland	2 532	2 303	4 835	3 722	2 608	6 330
Hungary	2 207	1 049	3 256	2 480	1 559	4 039
Lithuania	690	1 623	2 313	920	2 093	3 013
Luxembourg	742	106	848	742	106	848
Total EU	19 207 832	946 071	20 153 903	20 567 378	1 039 350	21 606 728
Total EU without Italy	*3 235 832*	*935 571*	*4 171 403*	*3 667 378*	*1 027 820*	*4 695 198*

** Estimate. 1) The Italian market data is not strictly comparable with the other European Union markets because they include very low-capacity reversible systems (of the split or multi-split type) that are generally used for cooling.*
Source: EurObserv'ER 2014

bution of each HP category by the 2020 time line is about 56.4% for ASHPs, 38.1% for GSHPs and 5.5% for hydrothermal HPs. This breakdown is just a magnitude of scale because some countries did not specify the breakdown between the three categories.
According to EurObserv'ER, the current market trend is in line with the National Renewable Energy Action Plan targets and thanks to better accounting and more accurate reporting of the number of HPs in service in the Member States, is even ahead of the intermediate targets for 2015. □

4

Comparison of the current trend of the renewable energy from heat pumps (ktoe) against the NREAP (National Renewable Energy Action Plans) roadmap



Source: EurObserv'ER 2014

BIOGAS

MICHIGAN STATE UNIVERSITY BOARD OF TRUSTEES

Anaerobic digesters specially designed to recover energy produce most of the biogas across the European Union. The plants come in different types and sizes ranging from small anaerobic digesters on farms, larger co-digestion (or multi-product) plants and household waste methane production plants. Their feedstock (raw materials) is typically slurry, farming waste, green waste, food-processing waste and domestic refuse but the facilities can also use cultivated farm crops such as intermediate crops (crucifers, grasses, etc.), and other energy crops (maize, etc.), to optimize the methanization reaction. The umbrella term "other biogas" covers the production of these installations for the sake of convenience, to distinguish it from the biogas produced by wastewater treatment plants that produce methane from sewage sludge only and from landfill biogas whose production is directly captured inside the landfills rather than being produced by an industrial plant.

THE EU PRODUCED 13.5 MTOE

In 2013, biogas energy production, put at 13.5 Mtoe, again enjoyed two-digit growth (11.9% up on 2012). However the sector expanded at a slower pace than in previous years, because the European Union's top two producer countries, Germany and Italy, have made changes to their biogas policies.

For a number of years now, most of the distribution of the EU's primary biogas energy production has been of the "other biogas" category. According to EurObserv'ER this category accounted for about 69.8% of EU production in 2013, clearly outstripping landfill biogas at 20.7%, and wastewater treatment biogas at 9.5%. This distribution varies across the Member States and the "other biogas" category" does not always come out on top. It performs particularly well in countries that have opted to develop methanization on an industrial scale, such as Germany, Italy, Austria and the Czech Republic. The breakdown may also favour landfill biogas (as happens in the UK, Spain, Portugal and Ireland), while wastewater treatment biogas seldom has the upper hand (Sweden and Poland).

Biogas is a renewable energy that can be recovered in different ways. More often than not it is in the form of electricity and heat in cogeneration plants. Electricity production, regardless of whether it is produced in cogeneration plants is now the main biogas energy recovery channel. In 2013, production reached about 52.7 TWh (4.5 Mtoe), which is a 13.7% year-on-year rise. In 2013 the amount of heat sold to heating networks increased by 33.7% or 469.3 ktoe. We also need to factor in unsold heat (used directly on the production sites), estimated at about 2 126 ktoe in 2013 (11.6% more than in 2012). If there are outlets close to the methanization plant, the biogas can be fully harnessed with maximum energy efficiency to produce heat. It can also be refined into biomethane so that it can be put to use in the same way as natural gas, in the form of electricity in cogeneration plants,

but also as biofuel for natural gas-powered vehicles (NGVs) or even injected into the natural gas grid.

BIOMETHANE AN EXPANDING RECOVERY CHANNEL

Biomethane production is primarily gaining in popularity with the countries of the European Union, because it enables them to reduce their reliance on natural gas imports. EurObserv'ER found at least 258 biomethane plants in service in the European Union at the end of June 2014 in just 12 member countries. The countries most involved in biomethane production are Germany (151 plants), Sweden (53 plants), the Netherlands (23 plants), Austria (10 plants), Finland (6 plants) and the small country Luxembourg (3 plants). More recently the UK (4 plants), France (3 plants), Italy (2 plants), Denmark (1 plant), Hungary (1 plant) and Croatia (1 plant) have become involved and offer considerable development potential. Most of the production from these plants is intended for grid injection but could also be used on site when required. Other countries only use their production on their sewage treatment sites to produce electricity and heat or use it as biofuel. This applies in particular to most of Sweden's sewage treatment plants (only 11 plants inject biomethane into the grid) and also to Finland, Italy, Croatia and Hungary.

Germany's biomethane production dwarfs the rest of the European Union's. According to the DENA biomethane sector barometer, Germany already had 151 biomethane plants at the end of June 2014 (146 at the end of 2013) with production capacity of around 93 650 Nm³/h (normal cubic metres per hour). The Federal grid agency (Bundesnetzagentur) says that the amount of biomethane injected into Germany's natural gas grid has practically doubled since 2011. It has risen from 275 million Nm³ in 2011 (i.e. 256 084 toe), to 413 million Nm³ in 2012 (384 591 toe), then to 520 million Nm³ in 2013 (484 230 toe). Biomethane now

1

Primary energy production from biogas in the European Union in 2012 and 2013 (ktoe)*

	2012				2013*			
	Landfill gas	Sewage sludge gas¹	Other biogas²	Total	Landfill gas	Sewage sludge gas¹	Other biogas²	Total
Germany	123.7	372.1	5 925.6	6 421.4	110.7	438.0	6 319.2	6 867.9
United Kingdom**	1 533.9	269.7	0.0	1 803.6	1 538.2	286.2	0.0	1 824.4
Italy***	364.7	42.0	772.0	1 178.8	403.2	48.6	1 363.8	1 815.5
Czech Republic	31.7	39.4	303.8	374.9	28.9	39.6	502.5	571.1
France	166.5	43.4	184.4	394.4	180.7	43.4	212.6	436.7
Netherlands	29.9	53.1	214.5	297.5	24.6	57.8	220.3	302.8
Spain	159.6	76.3	55.0	290.9	166.1	69.6	49.8	285.5
Austria	3.8	18.2	184.3	206.4	3.7	18.4	174.6	196.8
Belgium	32.4	17.2	108.0	157.7	28.4	24.0	136.5	189.0
Poland	53.7	79.3	34.9	168.0	51.5	80.1	49.8	181.4
Sweden	12.6	73.5	40.6	126.7	9.8	73.4	61.8	145.0
Denmark	5.5	21.4	77.7	104.7	5.1	23.1	82.7	110.9
Greece	69.4	15.8	3.4	88.6	67.5	16.1	4.8	88.4
Hungary	14.3	18.7	46.8	79.8	14.3	20.1	47.8	82.2
Slovakia	3.1	13.8	45.1	62.0	3.4	14.8	48.5	66.6
Portugal	54.0	1.7	0.7	56.4	61.8	2.7	0.8	65.3
Latvia	18.4	5.7	27.8	51.9	7.0	3.0	55.0	65.0
Finland	31.6	13.9	12.4	57.9	31.8	13.9	13.4	59.1
Ireland	43.0	7.5	5.4	55.9	36.8	7.9	3.5	48.2
Slovenia	6.9	3.1	28.2	38.1	7.1	2.8	24.8	34.7
Romania	1.4	0.1	25.9	27.3	1.5	0.1	28.4	30.0
Croatia	0.7	2.7	8.1	11.4	0.4	2.3	13.8	16.6
Lithuania	6.1	3.1	2.3	11.6	7.1	3.6	4.8	15.5
Luxembourg	0.1	1.3	12.0	13.4	0.1	1.3	11.4	12.8
Cyprus	0.0	0.0	11.4	11.4	0.0	0.0	12.0	12.0
Estonia	2.2	0.7	0.0	2.9	6.3	0.9	0.0	7.2
Bulgaria	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.1
Malta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total EU	**2 769.2**	**1 193.9**	**8 130.6**	**12 093.6**	**2 796.1**	**1 291.9**	**9 442.8**	**13 530.7**

1) Urban and industrial.
2) Decentralised agricultural plant, municipal solid waste methanisation plant, centralised co-digestion plant.
** Estimate. ** The official UK data did not give the production for the "other biogas" category. *** In Italy's case, the "Other biogas" figure also includes thermally-produced biogas.* ***Source: EurObserv'ER 2014***

2

Gross electricity production from biogas in the European Union in 2012 and 2013 (GWh)*

	2012			2013*		
	Electricity-only plants	CHP plants	Total electricity	Electricity-only plants	CHP plants	Total electricity
Germany	5 916.0	21 322.0	27 238.0	8 800.0	20 435.0	29 235.0
Italy	2 160.6	2 459.3	4 619.9	3 434.9	4 012.8	7 447.7
United Kingdom	5 249.2	625.0	5 874.2	5 265.7	665.0	5 930.7
Czech Republic	55.0	1 412.0	1 467.0	55.0	2 239.0	2 294.0
France	755.0	529.7	1 284.7	774.8	731.8	1 506.6
Netherlands	68.0	940.0	1 008.0	60.0	906.0	966.0
Spain	765.0	101.0	866.0	800.0	108.0	908.0
Belgium	90.4	573.1	663.5	118.9	654.9	773.8
Poland	0.0	565.4	565.4	0.0	689.7	689.7
Austria	592.0	46.0	638.0	574.0	41.0	615.0
Denmark	2.1	371.9	374.0	1.3	387.7	389.0
Latvia	0.0	223.0	223.0	0.0	287.0	287.0
Portugal	199.0	10.0	209.0	238.0	10.0	248.0
Hungary	58.0	153.0	211.0	60.0	169.0	229.0
Greece	40.0	164.3	204.3	39.2	177.2	216.4
Slovakia	88.0	102.0	190.0	94.0	110.0	204.0
Ireland	174.6	24.5	199.1	157.6	28.6	186.2
Slovenia	4.9	148.2	153.1	4.2	136.8	141.0
Finland	57.2	82.3	139.4	82.9	56.3	139.2
Croatia	1.5	55.0	56.5	19.3	58.4	77.7
Lithuania	0.0	42.0	42.0	0.0	59.0	59.0
Luxembourg	0.0	57.9	57.9	0.0	55.3	55.3
Cyprus	0.0	50.0	50.0	0.0	52.0	52.0
Estonia	0.0	15.8	15.8	0.0	30.0	30.0
Romania	0.0	19.0	19.0	0.0	25.8	25.8
Sweden	0.0	20.0	20.0	0.0	20.0	20.0
Malta	0.0	2.0	2.0	0.0	3.0	3.0
Bulgaria	0.0	0.3	0.3	0.0	0.5	0.5
Total EU	16 276.5	30 114.6	46 391.1	20 580.0	32 149.6	52 729.6

* Estimate. **Source: EurObserv'ER 2014**

3

Gross heat production from biogas in the European Union in 2012 and 2013 (ktoe) in the transformation sector***

	2012			2013*		
	Heat only plant	CHP plant	Total	Heat only plant	CHP plant	Total
Italy	0.3	138.5	138.8	0.3	200.8	201.0
Germany	33.2	47.8	81.0	45.9	70.5	116.5
Denmark	5.6	29.6	35.2	1.7	31.7	33.4
France	2.4	9.1	11.6	2.4	14.4	16.8
Latvia	0.0	11.0	11.0	0.0	14.2	14.2
Sweden	5.4	5.7	11.2	7.2	6.1	13.3
Czech Republic	0.0	8.7	8.7	0.0	11.6	11.6
Finland	6.2	1.6	7.8	7.4	1.9	9.3
Poland	0.3	4.8	5.1	0.0	9.0	9.0
Slovenia	0.0	9.3	9.3	0.0	8.8	8.8
Austria	1.9	5.2	7.1	1.9	4.4	6.3
Estonia	0.0	0.1	0.1	0.0	5.7	5.7
Belgium	0.0	6.6	6.6	0.0	5.2	5.2
Netherlands	0.0	4.4	4.4	0.0	3.7	3.7
Romania	0.9	2.4	3.3	0.9	2.4	3.3
Slovakia	0.0	2.7	2.7	0.0	2.9	2.9
Croatia	0.0	2.7	2.7	0.0	2.7	2.7
Lithuania	0.0	1.2	1.2	0.0	2.3	2.3
Hungary	0.4	0.9	1.3	0.4	0.9	1.3
Luxembourg	0.0	1.0	1.0	0.0	1.1	1.1
Cyprus	0.0	1.0	1.0	0.0	1.0	1.0
Total EU	56.7	294.4	351.1	68.1	401.2	469.3

* Estimate. ** Heat sold to the district heating network or to or to industrial plants. **Source: EurObserv'ER 2014**

accounts for 7.2% of Germany's primary biogas energy production. Now most of these plants operate using a large proportion of energy crops. According to DENA, the breakdown of materials used by quantity (tonnes of "fresh" matter) for producing biomethane in 2013 was 59.6% maize, 16.3% other energy crops, 12.3% slurry, 7.9% miscellaneous organic waste and 3.9% harvest residues.

Biomethane production is also increasing sharply in other countries. In the Netherlands, Statistics Netherlands claims that it increased by 70.3% between 2012 and 2013 to reach 35 600 toe, or 11.8% of the country's primary bio-

gas energy production. In Austria, biomethane production reached 4 729 toe in 2013 (55 GWh), according to the Association of gas suppliers and heating networks, and the connection of two new plants drove production up to 3 009 toe (35 GWh) over the first 4 months of the year. In Finland, the biogas sector is almost purely driven by transport. According the Finnish biogas association, Biomethane consumption in transport increased by 168% in 2013 compared the previous year, to 2 820 toe (32.8 GWh). In France, a specific Feed-in Tariff for biomethane injection has been introduced and a tendering system is soon to be rolled out, raising expectations for the fortunes of its fledgling injected biomethane sector.
One of the biogas sector's ambitions is to form a European biomethane market that would stimulate the production, exchange and use of biomethane. Six national biomethane registers (in Austria, Denmark, France, Germany, Switzerland and the UK), that can provide biomethane grid injection flow traceability right through to its end use (quality, injected volume), are cooperating to set up common standards and strengthen the European statutory framework to set up this market. They aim to harmonize the national registers and create the conditions for mutual acceptance and recognition of biomethane guarantees of origin.

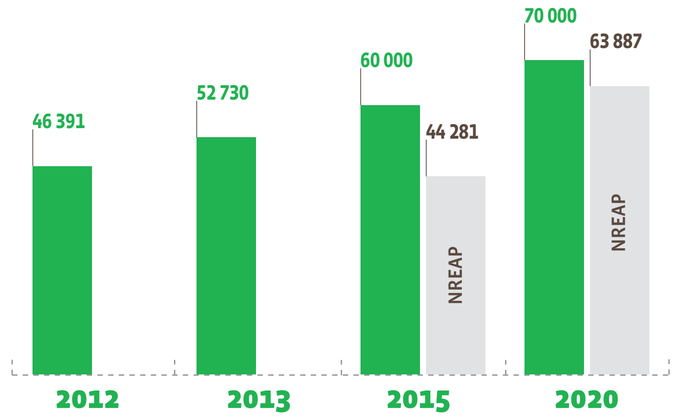
HOW MUCH WILL BIOGAS CONTRIBUTE IN 2020 AND 2030?

Today methanization is fully recognized as an exemplary process for treating waste and recovering energy and that can reduce energy reliance on natural gas. However the development potential of the biogas sector now hangs in the balance as the very fast growth in production of the leading countries for agricultural methanization has been achieved by wholesale recourse to energy crops. The growth pattern has been recently challenged by the European Commission that insists that biogas production should be primarily based on the use of by-products and organic waste. Perforce, current uncertainties about forthcoming European legislation on biomass sustainability and limiting the use of energy crops have and will have an impact on the biogas sector's growth potential.
On the other hand, the countries of the EU are also under obligation to organize recovery circuits for the various types of organic waste and set up sorting systems to collect them, through European waste regulations (Directive 2008/98/EC).

The application of this directive, and discussions are currently going on to strengthen its criteria (a draft directive has been filed along these lines), will contribute new fermentable waste to the sector that should make up in part for the decreased use of energy crops. In order to recover, the biogas sector requires fast decisions about the environmental requirement levels for biogas and biomethane production with regard to GHG emissions, so that they can be included in the European renewable energy target calculations. Thus the future development of the biogas sector is essentially a political issue.
Accordingly, the best estimates for 2020 are those defined by each Member State in the national renewable energy action plans (NREAPs) for the EU of 28, which forecast that the biogas sector will contribute up to 63.9 TWh (equivalent to 5 493 ktoe) of electricity production and 4 520 ktoe of heat production, equating to combined final energy consumption of 10 013 ktoe. The European Biogas Association (EBA) reckons that 28 billion m³ of biogas (natural gas equivalent) will have to be produced to achieve the NREAP targets, which could equate to 1.5% of the European Union's primary energy mix and 5% of its natural gas consumption.

4

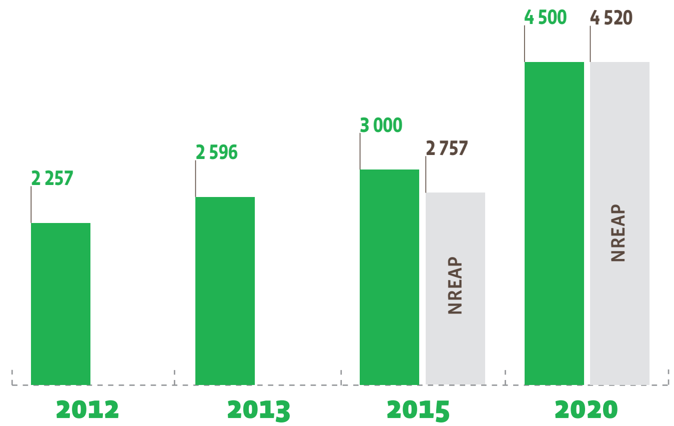
Comparison of the current trend of electricity biogas generation against the NREAP (National Renewable Energy Action Plans) roadmap (GWh)



Source: EurObserv'ER 2014

5

Comparison of the current trend of biogas heat consumption against the NREAP (National Renewable Energy Action Plans) roadmap (ktoe)



Source: EurObserv'ER 2014

BIOFUELS

European Union biofuel consumption for transport suffered a downturn in 2013 put at 9.3% year-on-year by EurObserv'ER, which equates to a fall from 14.5 to 13.2 Mtoe. If we look at historical data published by Eurostat, the European Union's statistics office, the fall marks the first drop in consumption since the industrial expansion of biofuel sought by the European Union.

THE EUROPEAN UNION AT SIXES AND SEVENS

After an analysis of the individual country consumption trends our conclusion is that the European Union no longer has an overall trend, our first observation being that the decline in biofuel consumption in 2013 is essentially down to the drop in consumption of a single country, Spain, which cut its incorporation targets. Germany's biofuel consumption also declined in 2013 to a lesser extent, prompted by its decision to abolish the last tax exemptions enjoyed by the biodiesel sector from 2013 onwards. In contrast, a number of countries – the UK, Sweden and Denmark – significantly increased their incorporation rates, while others such as France, Austria and Belgium, kept steady incorporation rates in 2013 with slight upward or downward variations in biofuel consumption in line with total fuel consumption (fossil and non-fossil).

BIOETHANOL DOING A LITTLE BETTER

Bioethanol consumption is on the rise if we look at the breakdown of consumption between the various biofuel types within the European Union (on the basis of energy content rather than volume). Its market share, be it in direct blends with petrol or converted into ETBE (Ethyl tertiary butyl ether), rose from 19.2% in 2012 to 20.2% in 2013, while the biodiesel share shed 1.1 of a percentage point, from 79.6% in 2012 to 78.5% in 2013. The other types of biofuel shares increased by 1.3% essentially represented by biogas fuel (121.1 ktoe in 2013) used in Germany, Sweden and Finland. The year-on-year decline in bioethanol consumption was much less (5.0%) than that of biodiesel

(10.5%), within the overall drop in consumption of these two types of biofuel.

87% OF CONSUMPTION CERTIFIED AS SUSTAINABLE

Another turning point came in 2011, the year in which biofuel consumption was tied to the implementation of binding sustainability criteria for eligibility for inclusion in the calculation of the 2009/28/EC directive on renewable energies targets. Certified biofuel consumption is slightly lower and slipped from 11.6 Mtoe in 2012 to 11.4 Mtoe in 2013 according to EurObserv'ER. If we bear in mind the overall sharp drop in consumption, its share of total biofuel consumption is therefore surging and now accounts for 87% in 2013 up from 80% in 2012. Just a handful of EU countries, including Spain, Finland, Bulgaria, Greece, Cyprus and Malta were in the throes of setting up an effective system for certifying their biofuel consumption in 2013. Some of them have

1

Biofuel consumption for transport in the European Union in 2012 (toe)

	Bioethanol	Biodiesel	Biogas fuel	*Other biofuels**	Total consumption	% certified sustainable
Germany	805 460	2 190 767	30 266	22 093	3 048 587	100%
France	417 014	2 268 977	0	0	2 685 992	100%
Spain	201 445	1 899 294	0	0	2 100 739	0%
Italy	79 597	1 262 972	0	0	1 342 568	100%
United Kingdom	388 220	497 349	0	0	885 570	100%
Poland	139 900	644 974	0	0	784 874	100%
Sweden	207 244	330 588	82 230	0	620 063	100%
Austria	68 174	389 670	0	0	457 844	92%
Netherlands	124 463	210 328	0	0	334 790	95%
Belgium	48 578	281 300	0	0	329 879	100%
Portugal	2 833	284 187	0	0	287 020	2%
Czech Republic	59 965	221 169	0	0	281 134	100%
Denmark	0	223 818	0	0	223 818	100%
Finland	94 501	88 994	347	22 853	206 696	0%
Romania	36 268	156 287	0	9 989	202 544	88%
Greece	0	124 606	0	0	124 606	19%
Hungary	45 787	76 885	0	0	122 671	100%
Slovakia	23 789	76 566	0	688	101 042	94%
Bulgaria	0	85 899	0	0	85 899	0%
Lithuania	8 707	51 810	0	0	60 517	100%
Ireland	29 184	30 990	0	0	60 174	100%
Slovenia	5 290	46 337	0	0	51 627	100%
Luxembourg	1 286	45 582	0	163	47 031	100%
Croatia	0	33 468	0	0	33 468	0%
Latvia	6 703	12 514	0	0	19 217	100%
Cyprus	0	16 136	0	0	16 136	0%
Malta	0	4 419	0	0	4 419	0%
Estonia	0	0	0	0	0	0%
Total EU 28	**2 794 410**	**11 555 883**	**112 843**	**55 786**	**14 518 923**	**80%**

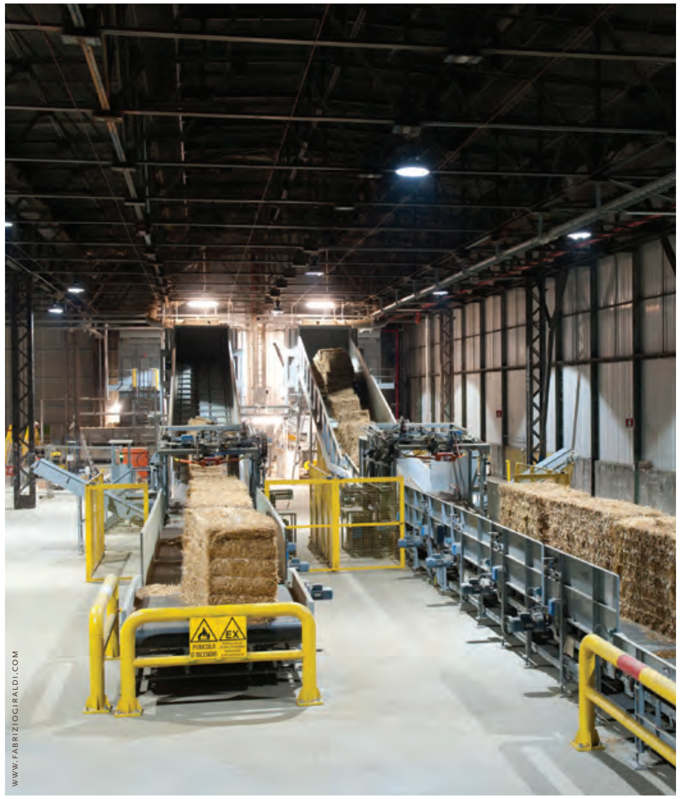
** Vegetable oils used pure and unspecified biofuel.*
Source: EurObserv'ER 2014

2

Biofuel consumption for transport in the European Union in 2013 (toe)*

	Bioethanol	Biodiesel	Biogas fuel	*Other biofuels***	Total consumption	% certified sustainable
Germany	777 730	1 954 811	34 909	884	2 768 334	100%
France	393 541	2 293 324	0	0	2 686 865	100%
Italy	56 220	1 177 790	0	0	1 234 009	100%
United Kingdom	410 791	603 755	0	0	1 014 546	100%
Spain	170 249	729 077	0	0	899 327	0%
Poland	145 946	583 552	0	0	729 498	100%
Sweden	181 208	453 071	85 223	0	719 501	100%
Austria	55 259	425 112	0	0	480 372	92%
Belgium	48 228	282 620	0	0	330 849	100%
Netherlands	125 108	194 421	0	0	319 528	96%
Portugal	4 725	273 582	0	0	278 307	3%
Czech Republic	51 765	221 007	0	0	272 772	100%
Finland	69 936	132 920	930	27 538	231 325	0%
Denmark	0	223 616	0	0	223 616	100%
Romania	36 885	159 413	0	10 059	206 356	89%
Greece	0	138 746	0	0	138 746	18%
Slovakia	55 872	79 570	0	0	135 442	76%
Hungary	23 723	66 457	0	16 526	106 705	85%
Bulgaria	0	85 899	0	0	85 899	0%
Ireland***	28 232	44 211	0	0	72 443	100%
Lithuania	6 769	51 907	0	0	58 675	95%
Slovenia	5 589	51 353	0	0	56 942	100%
Luxembourg	647	52 721	0	137	53 504	100%
Croatia	0	29 804	0	0	29 804	100%
Latvia	6 449	12 372	0	0	18 821	100%
Cyprus	0	15 907	0	0	15 907	0%
Malta	0	4 419	0	0	4 419	0%
Estonia	0	0	0	0	0	0%
Total EU 28	**2 654 873**	**10 341 434**	**121 062**	**55 143**	**13 172 512**	**87%**

** Estimate. ** Vegetable oils used pure and unspecified biofuel*
Source: EurObserv'ER 2014



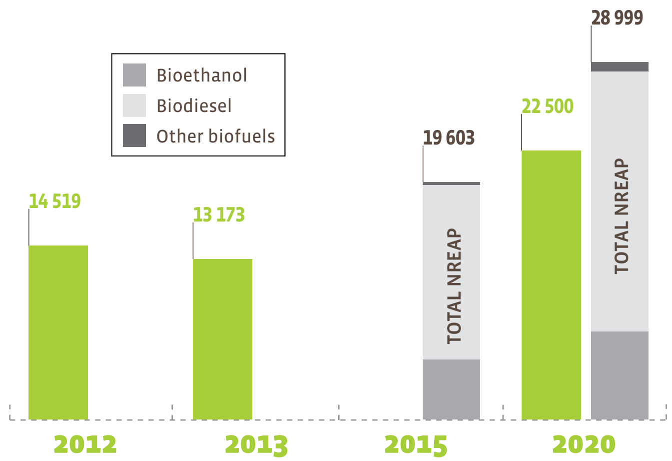
reported modest consumption of biofuel compliant with the sustainability criteria. This biofuel is produced from waste and residue that can be counted as sustainable yet it is not submitted to the same certification procedure. Finland's biofuel and liquid biomass sustainability law was adopted in 2013 and came into force at the start of 2014. Cyprus is at a similar stage. Uncertainty still surrounds the enforcement date of Spain's certification mechanism, whose system had not been set up when EurObserv'ER carried out its survey in June 2014.
It should be stressed that any production that has not yet been submitted to the certification process may still comply with the Directive's sustainability criteria, but is not taken into account because the administrative certification control system has not been set up.

Three generations of biofuel

Biofuel is a liquid or gaseous fuel used for transport and produced from biomass. Three types of biofuel are generally distinguished:
*• **First-generation biofuel** (said to be "conventional") which includes bioethanol and biodiesel productions from the conversion of food crops (rapeseed, soy, beets, cereals, etc.). The category also includes the production of vegetable oil that can be used pure and directly by specific engines.*
The production of biogas fuel (generally in the form of biomethane) obtained by the anaerobic digestion process followed by purification is a somewhat special category because it can be produced both from fermentable waste and energy and food crops.
*• **Second-generation biofuel** – sectors totally devoted to energy that do not rely on agri-food crops (no ILUC effect). They offer better yields and are more environmentally-friendly in terms of GHG emissions because they recover all the plant lignocellulose contained in the plant cells. The raw materials range from straw, green waste (tree cuttings, etc.) or even fast-growing energy plants such as miscanthus. They enable alcohol to be produced and thus bioethanol. Additionally some of the processes produce biodiesel.*
*• **Third-generation biofuel** which includes biofuel produced from algae (also known as algofuel) that present the advantage of not competing with food or energy crops (plants and forestry). Recovery is through an oil sector and thus produces biodiesel.*

3

Comparison of the current biofuel heat consumption trend (ktoe)* against the NREAP (National Renewable Energy Action Plans) roadmap



** Consumption of certified sustainable and unsustainable biofuel.*
Source: EurObserv'ER 2014

TARGETS FOR 2030?

Since the European Commission decided to submit a draft directive to the European Parliament on indirect land use changes two years ago, the task of projecting biofuel consumption has become very difficult. According to the data gathered by EurObserv'ER, biofuel accounted for a 4.6% share of fuel consumption in European Union in 2013 road transport (not allowing for double-counting), yet the share was put at 5.1% in 2012. If we take account of certified biofuel alone, the share would drop to 4.0% in 2013, which suggests that it is stable when compared to 2012. This figure will rise mechanically when the remaining countries have implemented their certification systems. For 2020, the share devoted to biofuel should amount to about 8 of the 10 percentage points of the Directive's target. Yet it is still difficult to gauge the energy content of this percentage accurately without knowing what precise proportion will be allocated to double-counted biofuel.

The EurObserv'ER projection is partly based on the draft directive that is subject to a political agreement within the Energy Council – the incorporation, in energy content, of conventional types of biofuel up to 7% and 0.5% of advanced types of biofuel (thus accounting for 1% of the European target). If 300 Mtoe of final energy consumption is assumed in 2020, biofuel consumption could rise to 22.5 Mtoe by 2020.
Forecasting to the 2030 timeline is even harder as the uncertainties are greater. This is because at the start of the year, on 22 January 2014, the European Commission published proposals to set up the framework for its climate-energy policy to the 2030 timeline that opens the negotiations on the implementation of the European Union's forthcoming Energy/Climate package. It suggests a 2030 target of 27% of renewable energies in energy consumption (only binding at the scale of the European Union), but the Commission did not consider it useful or relevant to set a specific transport target. This lack of visibility at European Union level is particularly detrimental to the development of advanced types of biofuel, which will be naturally called on to follow on from first-generation biofuel. Thus in the short- and medium-term, their growth prospects will depend on their nationally-defined incorporation targets. As it stands, the 2030 Energy/Climate package is taking the form of an economic compromise with no state roadmaps. Each country is free to keep pace with or lag behind the most advanced countries. International current events involving the inter-religious conflicts in the Middle-East and the Ukraine-Russia crisis could prompt the EU to adopt a more proactive policy to reduce its reliance on hydrocarbons.

RENEWABLE URBAN WASTE

The production of primary renewable energy recovered by household refuse incineration plants in the countries of the European Union increased by 3.6% between 2012 and 2013 to reach almost 9 million tonnes oil equivalent (Mtoe). As a result, EurObserv'ER increased its first estimates published in November 2014 in the Renewable Municipal Waste barometer (see www.eurobserv-er.org). Heat sales to networks surged in 2013, increasing by 9.3% over the 2012 level to reach 2.3 Mtoe, reflecting better synergy between the incineration plants and heating networks. The electricity production qualified as renewable from these plants increased only by 0.6%, with a total of 18.7 TWh in 2013.

The increase in the number of heat outlets demonstrates the increased energy efficiency of the incineration plants that is stimulated by European legislation, primarily through the transposition of the framework directive on waste (2008/98/EC) that encourages operators to optimize the energy efficiency of their plants, primarily by looking for new outlets for heat production. The Directive stipulates that the incinerators can only be classed as waste-to-energy recovery units if they meet minimum yield criteria, which in the case of plant constructed since 31 December 2008 must be at least equal to 65%. The energy efficiency of those constructed prior to 2008 must be at least 60%.

NEWS FROM AROUND THE COUNTRIES

HEAT RECOVERY MAKES NEW GROUND IN THE NETHERLANDS

The Netherlands, which produces 51 toe of renewable energy per thousand inhabitants, is one of the most active EU players pursuing energy recovery from household waste by incineration. Statistics Netherlands claims

1

Primary energy production from renewable municipal waste in the European Union in 2012 and 2013 (ktoe)*

	2012	2013*
Germany	2 595.6	2 926.6
France	1 252.9	1 173.1
Netherlands	849.7	855.3
Italy	806.8	827.6
Sweden	769.5	820.2
United Kingdom	691.0	683.7
Denmark	490.1	494.0
Belgium	333.1	294.8
Finland	193.0	222.0
Spain	175.7	157.2
Austria	143.7	129.9
Portugal	86.0	96.7
Czech Rep.	83.7	82.9
Ireland	44.4	48.7
Hungary	45.0	40.7
Poland	32.5	35.6
Bulgaria	20.8	21.0
Slovakia	18.6	19.4
Luxembourg	17.1	17.0
Lithuania	0.0	11.0
Slovenia	7.5	7.4
Malta	0.7	1.0
Total EU 28	8 657.4	8 965.9

* *Estimate.* ***Source: EurObserv'ER 2014***

2

Gross electricity production from renewable municipal waste in the European Union in 2012 and 2013 (GWh)*

	2012			2013*		
	Electricity-only plants	CHP plant	Total	Electricity-only plants	CHP plant	Total
Germany	3 118.0	1 832.0	4 950.0	3 273.0	2 141.0	5 414.0
Italy	1 201.5	961.6	2 163.2	1 229.4	976.5	2 205.9
Netherlands	0.0	2 235.0	2 235.0	0.0	2 133.0	2 133.0
United Kingdom	1 474.1	559.4	2 033.5	1 169.4	817.9	1 987.3
France	1 283.4	751.6	2 035.0	1 145.9	681.4	1 827.3
Sweden	0.0	1 662.0	1 662.0	0.0	1 702.0	1 702.0
Denmark	0.0	892.1	892.1	0.0	874.0	874.0
Belgium	537.9	167.2	705.1	249.6	406.8	656.4
Spain	715.0	0.0	715.0	0.0	595.0	595.0
Finland	63.5	270.4	333.8	58.1	337.4	395.5
Portugal	245.0	0.0	245.0	0.0	286.0	286.0
Austria	149.0	91.0	240.0	160.0	47.0	207.0
Hungary	30.0	81.0	111.0	0.0	115.0	115.0
Czech Republic	0.0	87.0	87.0	0.0	84.0	84.0
Ireland	61.2	0.0	61.2	0.0	68.9	68.9
Luxembourg	36.0	0.0	36.0	0.0	36.0	36.0
Slovakia	0.0	27.0	27.0	0.0	29.0	29.0
Lithuania	0.0	0.0	0.0	0.0	19.0	19.0
Malta	0.0	9.0	9.0	0.0	9.0	9.0
Poland	0.0	0.0	0.0	0.0	8.3	8.3
Slovenia	0.0	6.1	6.1	0.0	7.4	7.4
Bulgaria	0.0	0.0	0.0	0.0	0.0	0.0
Total EU	8 914.6	9 632.3	18 547.0	7 285.4	11 374.5	18 659.9

** Estimate.* ***Source: EurObserv'ER 2014***

that primary energy production reached 855.3 ktoe in 2013, which is relatively stable (0.7% more) compared to its 2012 production. Along with Germany, the Netherlands actually imports waste. So in 2012 (2013 figures unavailable), about 14% of the waste treated in the country's waste-to-energy plants was imported, and most of that (roughly 700 000 tonnes) came from the UK. The explanation for this import policy is that its ultra-modern incineration plants that were purpose-designed for energy recovery, were over-dimensioned, which has prompted the country to implement waste importing and source it from the UK, which currently does not have enough treatment capacity. The main trend observed is a significant increase in heat production that Statistics Netherlands puts down to the commissioning of new connections that deliver both to industry (in the form of steam) and district heating networks (hot water production). Thus heat sales increased by 18.3% between 2012 and 2013 to 215.8 ktoe, having already increased by 15.6% between 2001 and 2012. This development hit renewable electricity production, which dropped by 4.6% between 2012 and 2013.

3

Gross heat production from renewable municipal waste in the European Union in 2012 and 2013 in the transformation sector** (ktoe)*

	2012			2013*		
	Heat only	CHP	Total	Heat only	CHP	Total
Germany	270.1	367.4	637.5	288.2	431.5	719.7
Sweden	48.6	460.7	509.2	46.0	492.6	538.6
Denmark	27.8	283.8	311.5	32.3	281.5	313.7
Netherlands	0.0	182.5	182.5	0.0	215.8	215.8
France	57.0	85.7	142.7	57.0	91.4	148.5
Finland	10.3	72.2	82.5	5.9	92.8	98.7
Italy	0.0	71.0	71.0	0.0	83.3	83.3
Austria	13.9	35.3	49.2	14.4	29.4	43.8
Czech Republic	0.0	35.9	35.9	0.0	35.5	35.5
United Kingdom	23.7	0.0	23.7	30.6	0.0	30.6
Belgium	3.3	15.5	18.8	3.3	20.0	23.4
Hungaria	0.0	7.4	7.4	0.0	7.4	7.4
Lithuania	0.0	0.0	0.0	0.0	5.5	5.5
Slovenia	0.0	1.9	1.9	0.0	2.5	2.5
Slovakia	1.1	0.0	1.1	0.0	1.1	1.1
Malta	0.6	0.0	0.6	1.0	0.0	1.0
Total EU	456.5	1 619.0	2 075.5	478.8	1 790.5	2 269.2

** Estimate. ** Heat sold to heating networks.* ***Source: EurObserv'ER 2014***

TWO-DIGIT GROWTH FOR HEAT SALES IN GERMANY

Renewable energy production growth through waste-to-energy recovery remained steady in Germany. Preliminary AGEE-Stat estimates suggest that primary energy production exceeded 2.9 Mtoe, which represents a 12.8% year-on-year increase. Heat sales to networks were the main beneficiary of this growth, which rose to two-digits (12.9%) in 2013 over the previous year. This translates into production of 719.7 ktoe, while electricity production also increased by 9.4% (i.e. 5.4 TWh) over the same period. The effects of the new German Kreislaufwirtschaftsgesetz – KrWG waste management and recycling law could be responsible. The law stipulates that energy recovery must be maintained at a threshold of at least 11 000 kJ/kg, allowing a potentially lower level if a better option for environmental protection is found.

THE UK WANTS TO MAKE UP FOR LOST TIME

In the next two to three years, the UK should make up for part of its waste energy recovery shortfall. According to Ecoprog, a German consulting firm specializing in environmental markets, about 20 waste-to-energy incineration plants should be commissioned by 2017 offering 4.6 million tonnes of treatment capacity per annum. This compares to the country's current treatment capacity of 3.28 million tonnes by its 24 incineration plants. These somewhat late decisions need to be put into perspective with British legislation dating back to 1996 that increased the landfill dumping tax annually. The tax levied on "active" waste (the bulk of municipal waste) increased from £ 72 (€ 91) per tonne to £ 80 (€ 101) on 1 April 2013. To avoid paying this tax local authorities and companies prefer export their waste to the Netherlands, Germany and Sweden, which have surplus treatment capacities. In 2012, Wales and England exported about 900 000 tonnes of waste. According to the DECC (Department of Energy & Climate Change) primary energy production from renewable waste declined slightly

VINCENT-RUSTUEL-CAUX-ESTUAIRE

in 2013 (1.1% year-on-year) to 683.7 ktoe, pending the construction of new plants.

ACCELERATION PLANNED FROM 2017 ONWARDS

For the time being, primary energy production from waste-to-energy recovery is enjoying restrained growth. Nonetheless, pressure from Europe is gradually trickling through and sparking off investment decisions, primarily in Eastern Europe most of which is facing a blank canvas. It stands to reason that if these countries are to fall in line, they will have to start investing in waste-to-energy recovery in the second half of this decade and appreciably more from 2017 onwards. This should give the sector new impetus over the medium term.

Looking at prospects, CEWEP estimates that the energy contribution of waste to the renewable energy directive targets could realistically reach 67 TWh by 2020 distributed respectively between 25 TWh of electricity and 42 TWh (3.6 Mtoe) of heat. The 2020 potential is assessed at 98 TWh split between 37 TWh of electricity and 61 TWh (5.3 Mtoe) of heat. The Confederation points out that the total contribution of municipal waste, renewable and otherwise, would double those figures, namely 134 TWh by 2020, for a potential of 196 TWh.

EurObserv'ER reckons that this target would require a 1.2-Mtoe increase in final energy consumption (heat and electricity) by 2020, i.e. a mean annual increase of 3.4% up to that time line. The projection is in keeping with the sector's momentum and its current growth prospects. □

SOLID BIOMASS

Solid biomass includes all the solid organic components to be used as heat- and electricity-producing fuels ... wood, wood waste, wood pellets, black liquors, bagasse, animal waste and other plant matter and residues.

Every year the European Union increases its solid biomass consumption to produce electricity and heat. According to data gathered by EurObserv'ER, in 2013 the European Union's primary energy consumption stood at about 91.8 Mtoe, which is a 3.6% increase on 2012. Growth has been almost uninterrupted since the beginning of the millennium (53.1 Mtoe), apart from the sharp drop recorded in 2011 as a result of the exceptionally mild winter across the European Union. Most of the solid biomass consumed has been produced on European soil. EU primary energy production is put at 88.4 Mtoe, which is a 2.8% rise. The differential, that is made up by net imports has tended to increase in the last few years, mainly as a result of rising wood pellet imports from the United States and Canada.

THE EUROPEAN UNION IS FULL OF CONTRASTS

The solid biomass consumption trend was rather patchy across the European Union Member States. This year it declined in Sweden, because of lower forestry industry activity and in Poland and Nertherlands because of the drop in biomass electricity production. On the other hand, its consumption is rising sharply in countries that promote wood-fuel heating such as France and in countries like the UK that encourage electricity recovery from biomass. The UK along with Italy spearheaded the expansion in European Union biomass electricity production in 2013, and made up for the drop in Swedish, Polish and Dutch produc-

1

Primary energy production and gross consumption from solid biomass in the EU in 2012 and 2013 (Mtoe)*

	2012		2013*	
	Production	Consumption	Production	Consumption
Germany	10.931	10.931	10.902	10.902
France**	9.779	9.779	10.842	10.842
Sweden	9.563	9.563	9.211	9.211
Italy	7.249	8.387	7.448	8.848
Finland	7.937	7.963	8.117	8.146
Poland	6.988	6.988	6.834	6.834
Spain	4.964	4.964	5.443	5.443
Austria	4.806	5.021	4.749	4.971
Romania	3.795	3.655	4.233	4.233
United Kingdom	1.849	2.512	2.153	3.319
Denmark	1.478	2.465	1.503	2.492
Portugal	2.342	2.342	2.347	2.347
Czech Republic	2.153	2.057	2.293	2.173
Belgium	1.413	1.993	1.408	2.036
Hungary	1.385	1.330	1.454	1.407
Bulgaria	1.109	1.019	1.300	1.334
Latvia	1.870	1.255	1.750	1.270
Netherlands	1.112	1.350	1.118	1.125
Lithuania	0.992	1.003	1.041	1.026
Greece	1.000	1.136	0.847	0.928
Slovakia	0.801	0.786	0.818	0.813
Estonia	1.012	0.814	1.067	0.793
Slovenia	0.560	0.560	0.583	0.583
Croatia	0.694	0.497	0.704	0.472
Ireland	0.196	0.213	0.195	0.230
Luxembourg	0.047	0.043	0.055	0.049
Cyprus	0.005	0.009	0.005	0.009
Malta	0.001	0.001	0.001	0.001
Total EU	86.031	88.634	88.423	91.839

** Estimate. ** Overseas departments not included.* ***Source: EurObserv'ER 2014***

2

Gross electricity production from solid biomass in the European Union in 2012 and 2013 (TWh)*

	2012			2013*		
	Electricity-only plants	CHP plants	Total electricity	Electricity-only plants	CHP plants	Total electricity
Germany	5.288	6.803	12.091	5.199	6.444	11.643
Finland	1.220	9.485	10.706	1.490	9.968	11.457
United Kingdom	7.008	0.000	7.008	10.577	0.000	10.577
Sweden	0.000	10.507	10.507	0.000	9.609	9.609
Poland	0.000	9.529	9.529	0.000	7.924	7.924
Spain	1.587	1.809	3.396	1.703	2.086	3.789
Austria	1.365	2.400	3.765	1.124	2.635	3.759
Italy	1.558	1.024	2.582	2.142	1.537	3.679
Belgium	2.609	1.076	3.684	2.218	1.136	3.354
Denmark	0.000	3.176	3.176	0.000	3.072	3.072
Netherlands	2.383	1.577	3.960	1.699	1.230	2.929
Portugal	0.786	1.710	2.496	0.736	1.780	2.516
Czech Republic	0.468	1.348	1.816	0.015	1.668	1.683
France**	0.039	1.586	1.625	0.069	1.529	1.599
Hungary	1.218	0.115	1.333	1.377	0.093	1.470
Slovakia	0.008	0.716	0.724	0.000	0.722	0.722
Estonia	0.374	0.611	0.985	0.030	0.615	0.645
Lithuania	0.000	0.176	0.176	0.000	0.279	0.279
Romania	0.053	0.140	0.193	0.000	0.263	0.263
Ireland	0.164	0.020	0.184	0.215	0.014	0.229
Latvia	0.006	0.059	0.065	0.007	0.208	0.215
Slovenia	0.000	0.114	0.114	0.000	0.119	0.119
Bulgaria	0.000	0.065	0.065	0.000	0.065	0.065
Croatia	0.000	0.037	0.037	0.000	0.048	0.048
Luxembourg	0.000	0.000	0.000	0.000	0.002	0.002
Total EU 28	26.135	54.084	80.218	28.601	53.045	81.646

** Estimate. ** Overseas departments not included.* ***Source: EurObserv'ER 2014***

tion. At the end of the day, European Union biomass electricity production increased by 1.8% in 2013 to 81.6 TWh or about 1.5 TWh more than in 2012.

Growth in solid biomass heat was slightly higher in the European Union (3.8% up on 2012) and reached 73.2 Mtoe (2.7 Mtoe more than in 2012), and this with an increase in solid biomass sales to heating networks by 5.5%.

THE UK PUT THE PRIORITY ON CONVERTING COAL-FIRED POWER PLANTS

According to the DECC (Department of Energy & Climate Change), it was wood that made the highest contribution to the increase in UK renewable heat consumption in 2013. The reason proffered by the government is the increase in household consumption, due to a slight increase in heating requirements caused by the longer winter, the commissioning of new cogeneration plants in 2013 and the build-up of the RHI (non-domestic) incentive system. The Renewable Energy Association claims that this system has already financed 4 926 wood-fired boilers and brought capacity to date in excess of one gigawatt (the gigawatt mark was passed in August 2014). Over the course of 2013, total solid biomass heat consumption thus increased by 20.8%, to 1.1 Mtoe (0.9 Mtoe in 2012).

In 2013, the increase in solid biomass electricity production outstripped that of 2012 (by 50.9%), thanks to the conversion and start-up in June of the first of the UK's biggest power plants to biomass, Drax, North Yorkshire. A second 630-MWe biomass plant went on stream in May 2014, which should again significantly boost biomass electricity production over the year. For the time being the UK's policy is to convert existing coal-fired plants that will have to run as cogeneration plants and so limit new biomass plant construction to 400 MWe.

FRANCE USED MORE WOOD HEATING IN 2013

Primary solid biomass production, almost entirely accounted for by the wood-energy sector (97% of the total), increased by a clear 10.9% in 2013 over the previous twelve months. The only reason for this is an increase in heating


FLIEGL AGRARTECHNIK

3

Heat consumption from solid biomass in the countries of the European Union in 2012 and 2013** (Mtoe)*

	2012	of which district heating	2013	of which district heating
France**	9.087	0.434	10.186	0.530
Germany	7.862	0.555	8.022	0.534
Sweden	7.921	2.430	7.626	2.353
Italy	7.196	0.345	7.383	0.517
Finland	6.347	1.619	6.412	1.688
Poland	4.915	0.450	5.111	0.372
Austria	4.003	0.814	4.139	0.834
Spain	3.850	0.000	4.054	0.000
Romania	3.658	0.047	3.874	0.117
Denmark	2.021	0.956	2.063	1.007
Portugal	1.802	0.000	1.829	0.000
Czech Republic	1.642	0.070	1.794	0.119
Bulgaria	1.003	0.005	1.342	0.030
Belgium	1.183	0.008	1.311	0.024
Latvia	1.166	0.110	1.141	0.154
United Kingdom	0.923	0.033	1.115	0.009
Hungary	0.977	0.059	1.015	0.072
Lithuania	0.918	0.240	0.958	0.268
Greece	1.133	0.000	0.922	0.000
Estonia	0.657	0.179	0.663	0.191
Slovenia	0.537	0.020	0.556	0.020
Slovakia	0.493	0.173	0.496	0.174
Netherlands	0.459	0.043	0.460	0.040
Croatia	0.466	0.002	0.441	0.006
Ireland	0.175	0.000	0.181	0.000
Luxembourg	0.042	0.002	0.048	0.003
Cyprus	0.007	0.000	0.007	0.000
Malta	0.001	0.000	0.001	0.000
Total EU	**70.443**	**8.593**	**73.152**	**9.063**

** End-user consumption (either heat sold by the district heating network or self-consumed, either as fuels for the production of heat and cold). ** Estimate. *** Overseas departments not included.* ***Source: EurObserv'ER 2014***

requirements. The French Observation and Statistics Directorate (SOeS) explains that biomass heat requirements increased through the combined effect of colder than average winter temperatures and the continuing rise in the number of wood-fire heating appliances installed boosted by the tax credit mechanism. In 2013, 524 000 stoves were sold, compared to 489 000 in 2012 and 467 000 in 2011. Wood-energy consumption also benefitted from support mechanisms such as the Ademe heat fund (regional support mechanisms and calls for BCIAT [biomass heat industry agriculture and tertiary] projects).

ITALY'S SOLID BIOMASS CONSUMPTION UNDERSTATED

A new ISTAT (National Institute for Statistics) survey published on 15 December 2014, eloquently demonstrated that domestic wood-energy consumption was wildly underestimated in Italy. On the basis of these findings the Italian Ministry of Economic Development now puts household consumption of wood, wood pellets and charcoal for heating at 6.6 Mtoe in 2012 and 2013, as opposed to the previous estimate of 3.6 Mtoe for 2012. If the other uses of solid biomass are factored in, Italian solid biomass consumption should stand at about 8.8 Mtoe in 2013, signifying a 5.5% increase, having benefitted from a significant 42.5% increase in electricity production, to reach 3.7 TWh in 2013 (compared to 2.6 TWh in 2012).

GERMANY'S NEW EEG LAW DOES FEW FAVOURS FOR BIOMASS ELECTRICITY

Electricity production through biomass plants is no longer a priority of Germany's new renewable energy law (EEG), whose annual target for all biomass sectors taken together (including biogas plants) has been limited to 100 MW. This annual target is much lower than those set for land-based wind power (2 400-2 600 MW) and solar power (2 400-2 600 MW), because of lower production costs. The law has some more new twists to it… as from 1 August 2014, only small installations, with installed capacity of ≤500 kW are eligible for Feed-In Tariffs and from 1 January 2016, the eligibility threshold will drop to <100-kW installations.

WHAT TARGETS FOR 2030?

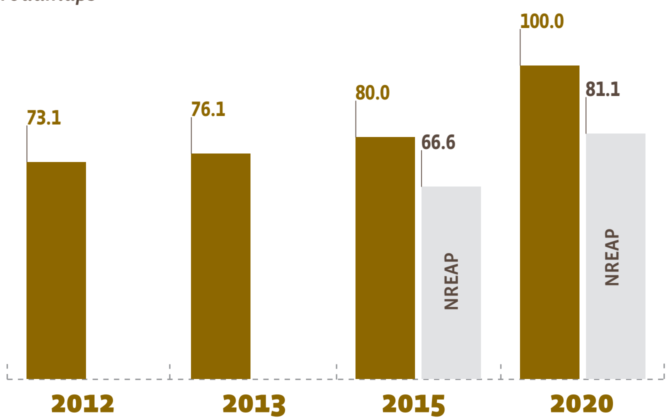
The recent publication of the working document on the State of play on the sustainability of solid and gaseous biomass used for electricity, heating and cooling in the EU recalled the European targets set in the National Renewable Energy Action Plans (NREAPs). According to the NREAPs estimates, biomass supply is projected to increase by nearly 37% to 132 Mtoe by 2020. The summary of the 28 plans indicates that by that time line the Member States intend to have increased their mobilization of wood-energy by a further 95 million m³ compared to 2006. This breaks down into 83 million m³ directly supplied by wood (logs) and 12 million m³ by wood industry residue (woodchips, sawdust). This scale is similar to the equivalent of the total wood mobilized in Finland and Sweden for energy uses in 2010.

As for electricity production achieving the 2020 NREAP targets, i.e. production of 156.2 TWh, the likelihood is looking increasingly doubtful given the current inauspicious economic and energy context for biomass electricity. One of the main curbs is the very competitive price of the per tonne coal price on the global market, which can be ascribed to massive shale gas and oil consumption in the United States. Another factor is that the European Community CO_2 emission quota exchange system is no longer playing its role because the price of emission permits is now extremely low. Europe's weak growth that reduces businesses' demand for quotas is once again the reason for this price drop. Biomass electricity plants are also in competition with the other renewable electricity production sectors that have largely outstripped the competitiveness gains made by biomass electricity over the past few years.

As for heat production, the situation is much more advantageous, as wood, woodchip, logs and wood pellets are all very competitively priced in comparison to heating oil, natural gas and electricity. This should encourage increasing numbers of households to migrate to biomass heating. Heat consumption should also benefit from some countries' clearly stated political commitment to encourage the development of heating networks. □

4

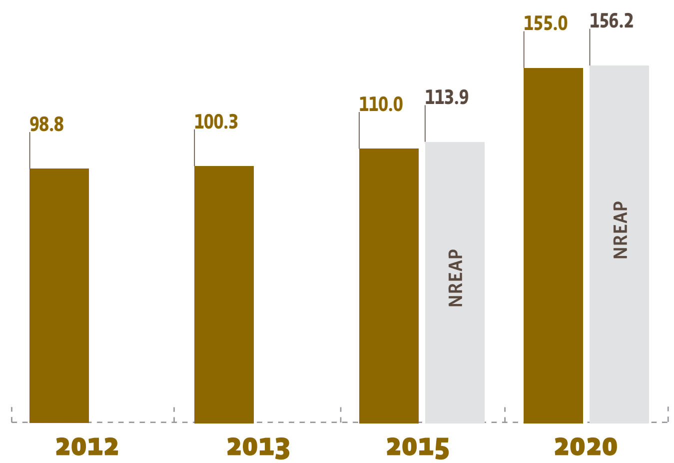
Comparison of the current solid biomass heat consumption trend (Mtoe) against the NREAP (National Renewable Energy Action Plan) roadmaps



*This data includes an estimate of renewable heat from municipal waste incineration plants. **Source: EurObserv'ER 2014***

5

Comparison of the current solid biomass electricity production trend (TWh) against the NREAP (National Renewable Energy Action Plans) roadmaps



This data includes an estimate of renewable electricity from waste incineration plants..
Source: EurObserv'ER 2014

CONCENTRATED SOLAR POWER


TORRESOL ENERGY INVESTMENTS

Concentrated solar power covers all the technologies harnessed to transform the energy radiated by the sun into very high temperature heat. This thermal energy can be used to produce electricity, by thermodynamic cycles or to supply industrial processes that require high temperature levels (up to 250°C). Concentrated solar power systems implement optical concentration devices that convert the sun's direct radiation. The four main technologies are tower plants and Dish-Stirling engines, concentrating the radiation on a given spot, and parabolic trough collectors and Compact Linear Fresnel Reflector (CLFR) technology concentrating the radiation on a linear receptor (a tube containing heat transfer fluid).

One of the particular advantages of concentrated solar power is that it passes through a heat production stage prior to being converted into electricity, which means it can be combined with other renewable energies such as biomass and waste, and also with conventional sources such as natural gas and coal. The other advantage is that the energy can be stored as heat using various processes such as molten salts – hence the plants can operate outside of sunshine periods and during peak consumption periods at the end of the day.

2 311.5 MW IN THE EUROPEAN UNION

The European concentrated solar plant market is set to mark time in 2014 following the construction of the last 350 MW of CSP capacity in Spain in 2013.

The spotlight has switched to Italy which could re-launch the European market within a couple of years. At the end of 2013, European installed CSP capacity stood at 2 311.5 MW, with Spain alone accounting for 99.7% of that amount.

NO OTHER PROJECT IN SPAIN

For the time being, Spain is the only European country to have developed a commercial concentrated solar power generating sector, but unfortunately since 2014, it has had no other project under construction or at an advanced stage of development. Spain's last seven scheduled plants, (Termosol 1, Termosol 2, Solaben 1, Casablanca, Enerstar, Solaben 6 and Arenales) all 50 MW each were completed and commissioned in 2013. They take total installed Spanish CSP capacity to date to 2 303.9 MW. For its part the IDAE (Institute for Diversification and Saving of Energy) claimed 2 250 MW (net capacity) in 2013, compared to 2 000 MW in 2012, which means that the capacity of one of the above plants has not yet been included in the official data. It will be years before this figure moves up, according to Luis Crespo, the Secretary General of Protermosolar, the Spanish concentrated solar power industry association, and Chairman of Estela, the European Solar Thermal Electricity Association. He explains that the new law enacted by the Spanish government will radically change the payment system for the existing CSP plants. The FiT and market price plus premium systems have effectively been abolished retroactively and replaced by a sum to be allocated based on the plant's installed capacity to compensate for investment-related financial outlay. Luis Crespo points out that the government will calculate this compensation directly to arrive at a theoretical 7.4% return on project investment. The incentive will be bound to a minimum plant operating period. The final legislation is due to be published imminently. He doubts that it will undermine plant operation. However a number of investors may have difficulty repaying their bank loans, because the new, less generous system is likely to endanger the financing package of some CSP plants. They may be subject to negotiations with the banks with the result that some plants may change hands.

1

Concentrated solar power plants in service at the end of 2013 (MW)

Project	Technology	Capacity	Date commissioned
Spain			
Planta Solar 10	Central receiver	10	2006
Andasol-1	Parabolic trough	50	2008
Planta Solar 20	Central receiver	20	2009
Ibersol Ciudad Real (Puertollano)	Parabolic trough	50	2009
Puerto Errado 1 (prototype)	Linear Fresnel	1.4	2009
Alvarado I La Risca	Parabolic trough	50	2009
Andasol-2	Parabolic trough	50	2009
Extresol-1	Parabolic trough	50	2009
Extresol-2	Parabolic trough	50	2010
Solnova 1	Parabolic trough	50	2010
Solnova 3	Parabolic trough	50	2010
Solnova 4	Parabolic trough	50	2010
La Florida	Parabolic trough	50	2010
Majadas	Parabolic trough	50	2010
La Dehesa	Parabolic trough	50	2010
Palma del Río II	Parabolic trough	50	2010
Manchasol 1	Parabolic trough	50	2010
Manchasol 2	Parabolic trough	50	2011
Gemasolar	Central receiver	20	2011
Palma del Río I	Parabolic trough	50	2011
Lebrija 1	Parabolic trough	50	2011
Andasol-3	Parabolic trough	50	2011
Helioenergy 1	Parabolic trough	50	2011
Astexol II	Parabolic trough	50	2011
Arcosol-50	Parabolic trough	50	2011
Termesol-50	Parabolic trough	50	2011
Aste 1A	Parabolic trough	50	2012
Aste 1B	Parabolic trough	50	2012
Helioenergy 2	Parabolic trough	50	2012
Puerto Errado II	Linear Fresnel	30	2012
Solacor 1	Parabolic trough	50	2012
Solacor 2	Parabolic trough	50	2012
Helios 1	Parabolic trough	50	2012
Moron	Parabolic trough	50	2012
Solaben 3	Parabolic trough	50	2012
Guzman	Parabolic trough	50	2012
La Africana	Parabolic trough	50	2012
Olivenza 1	Parabolic trough	50	2012
Helios 2	Parabolic trough	50	2012
Orellana	Parabolic trough	50	2012
Extresol-3	Parabolic trough	50	2012
Solaben 2	Parabolic trough	50	2012
Termosolar Borges	Parabolic trough + HB*	22.5	2012
Termosol 1	Parabolic trough	50	2013
Termosol 2	Parabolic trough	50	2013
Solaben 1	Parabolic trough	50	2013
Casablanca	Parabolic trough	50	2013
Enerstar	Parabolic trough	50	2013
Solaben 6	Parabolic trough	50	2013
Arenales	Parabolic trough	50	2013
Total Spain		**2 303.9**	
Italy			
Archimede (prototype)	Parabolic trough	5	2010
Archimede-Chiyoda Molten Salt Test Loop	Parabolic trough	0.35	2013
Total Italy		**5.35**	
Germany			
Jülich	Central receiver	1.5	2010
Total Germany		**1.5**	
France			
La Seyne-sur-Mer (prototype)	Linear Fresnel	0.5	2010
Augustin Fresnel 1 (prototype)	Linear Fresnel	0.25	2011
Total France		**0.75**	
Total EU		**2 311.5**	

Continues overleaf

* *HB: Hybrid Biomass.* ***Source: EurObserv'ER 2014***

The CSP plants are now part and parcel of the Spanish electricity mix and according to the IDEA generated 4 395 GWh in 2013 (3 775 GWh in 2012). From 2014 onwards, production should rise to around 5 TWh as the last seven plants have come on stream.

THE SPOTLIGHT HAS SWITCHED TO ITALY

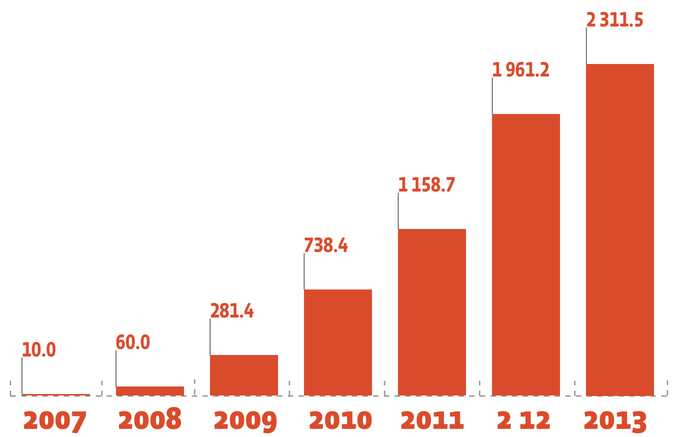
The creation of an Italian concentrated solar power sector with commercially operational plants is firming up now that the introduction of an incentive framework has enabled many projects to take off the ground. The Feed-in Tariff system in place since 31 December 2012, involves banding by total receiver surface (around the 2 500 m² threshold) and the amount of electricity from non-solar sources required to integrate the solar production. The FiT for large plants (>2 500 m²) is € 0.32/kWh where the solar fraction is over 85%, € 0.30/kWh from 50 to 85%, and € 0.27€/kWh where is it less than 50%. The Feed-in Tariff will be paid for 25 years and drop by 5% from 2016 onwards and by a further 5% from 2017 onwards. The Feed-in Tariffs for small plants (<2 500 m²) adopt the same solar fraction rules and are € 0.36/kWh, € 0.32/kWh and € 0.30/kWh respectively and apply the same sliding scale rules. Plants with more than 10 000 m² of receivers will be required to have an energy storage system.
Paolo Pasini, the Secretary General of ANEST (the Italian Association for Solar Thermal Energy), reckons that 392 MW of projects are now at development stage, mainly for sites in Sardinia and Sicily. At least five Fresnel technology projects could be on stream by 2015, including Calliope, Zeronovantuno 2, Jacomelli, Porthos and Stromboli Solar, all sited at Trapani in Sicily. Larger-scale parabolic trough and tower plant projects will be up and running in 2016 and 2017 including Flumini Mannu (50 MW, Villasor-Decimoputzu, Sardinia) Gonnosfanadiga – Guspini (50 MW, Gonnosfanadiga, Sardinia), and Mazara Solar (50 MW, Trapani, Sicily). According to ANEST, total installed concentrated solar power capacity could be 600 MW by 2020 in Italy.

WHICH TECHNOLOGIES WILL EUROPE BE SHOWCASING IN 2020?

Many countries on all continents are very interested in concentrated solar power energy storing technology possibilities. They have already expressed their interest by constructing the first commercial-size plants on their territory. However development on a very large-scale, as experienced by the PV and wind energy sectors has yet to commence. The sector is still commercially validating the various solar thermal processes. The technologies are still competing with one another and it is very hard to predict which technology will come out on top, especially as the sector needs financial support through the implementation of ambitious installation capacity and research and development programmes. The installation of new plants in the European Union market is only a preliminary stage and will enable the European players to demonstrate their capacity to export their technology to secure their share in the global market's growth.
This is where the NREAP roadmap for concentrated solar power makes perfect sense as it forecasts that installed capacity in the European Union by the 2020 timeline will stand at 6 765 MW (4 800 MW in Spain, 600 MW in Italy, 540 MW in France, 500 MW in Portugal, 250 MW in Greece and 75 MW in Cyprus), equating to 20 TWh of production.
Today the economic and political environment has cast doubt on this roadmap. Most of the countries that set objectives are way off target, and if no significant political change is announced within the next two to three years, the sector will have difficulty passing the 3 500 MW mark in 2020. Furthermore this scenario presumes the return to a new installation programme in Spain at the very least, which is not yet on the agenda. In the interim, to test their technology, European manufacturers will have to rely increasingly on international programmes.

2

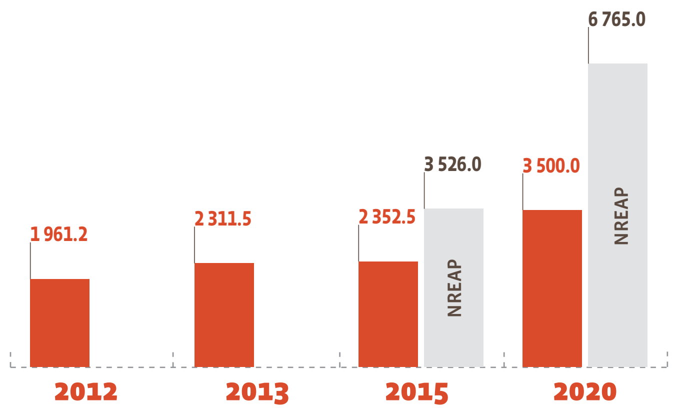
CSP plant capacity trend in the European Union (MW)



Source: EurObserv'ER 2014

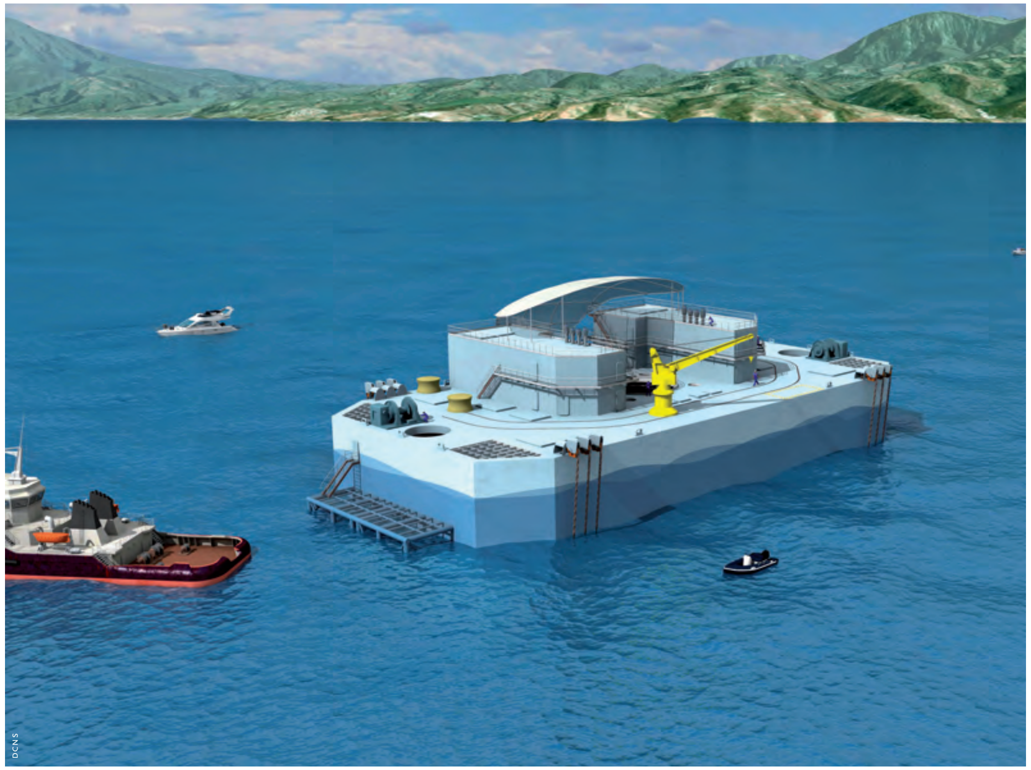
3

Comparison of the current trend against the NREAP (National Renewable Energy Action Plans) roadmap (MW)



Source: EurObserv'ER 2014

OCEAN ENERGY



In the current global marine energies market Europe is in a strong position as it leads the way in investments and installed capacity, furthermore most of the companies developing these technologies are based in Europe. The Atlantic coastline offers the best possibilities, but the Mediterranean Sea, the Baltic Sea basins and the EU's outermost regions also offer great potential.

THE FUTURE IS TAKING SHAPE

In January 2014, the European Commission published an action plan for blue energy that proposes to set up an ocean energy forum to define the framework for supporting the sector in the future. The forum is primarily based on the results obtained through the European SI OCEAN programme (Strategic Initiative for Ocean Energy), completed in June 2014, and on the TP Ocean (Technology & Innovation Platform for Ocean Energy) technology platform. It aims to define the sector's R&D requirements through to 2020. A roadmap should be produced in 2016 that should result in a potential European industrial initiative

As regards aid, the second call for proposals for European fund stakeholders NER 300 awarded three marine energy projects a total of 104.5 million euros. A NER 400 programme should shortly be launched.

The French 240-MW tidal power plant at la Rance (Ille-et-Vilaine), completed in 1966, produces most of Europe's marine power. It is the only plant of its kind on the continent. The technology is proven but the opportunities for developing similar systems are restricted by cost and environmental acceptance issues. There are considerable resources for harnessing marine currents and waves. Most of the projects are at the pre-commercial stage and are used to demonstrate the reliability and survivability of the devices being tested.

Ocean thermal energy, which exploits the temperature difference between water at different depths, also has significant potential, mainly in torrid zones. Osmotic energy technologies are going through a bad patch as pre-industrial research has fallen to a standstill but fundamental research is still being pursued.

The United Kingdom, buoyed by strong political support and very high exploitable potential, has a significant lead with 9 MW of installed capacity. Many of its wave and current plants are at the European Marine Energy Centre (EMEC) in Scotland. Several major projects have been approved. The Scottish government issued a construction permit for the first 86-MW tranche of the forthcoming 398-MW Meygen tidal energy plant in the extreme north of Scotland. The project bearer, Australia's Atlantis Resources Corporation announced it had secured finance for the first 6 MW which should be completed in 2016. A permit has also been awarded to the 40-MW Aquamarine Power wave power farm, to be installed northwest of the Scottish coasts of Lewis. Lastly, in March 2014, the government gave the go-ahead for the world's first tidal lagoon project (240 MW) in Swansea Bay, South Wales. Construction could kick off in 2015 with connection to the grid by 2018.

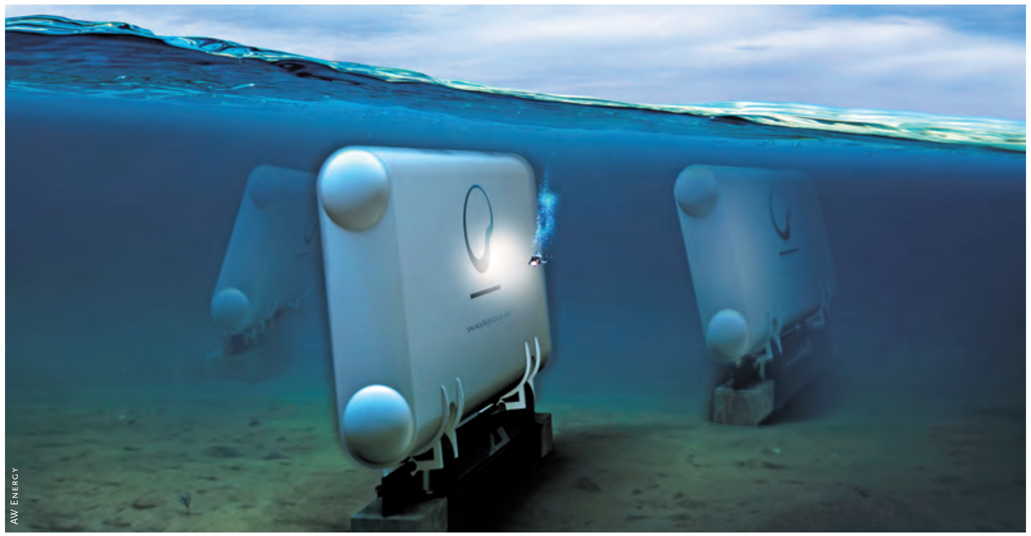
France also has great potential and harbours high ambitions. The call for EoI in "technology building blocks and demonstrators" shared by various marine energies that closed on 31 October 2013, enabled six projects to be selected for an investment total of 93.5 million euros. Ademe launched a call for EOI at the end of September 2013 for installing pilot underwater turbine farms at the Fromveur Passage and Raz Blanchard that closed on 16 May and it attracted huge interest enabling eight applications to be funded. The Nemo ocean thermal energy project (16-MW) which

should be installed in Martinique within the next four years was selected as part of the second NER 300 call for projects for a total of 72.1 million euros.
Portugal is one of the most promising countries for wave energy. However the Portuguese government abolished the FiT for new projects in 2013. Nonetheless the Swell wave energy farm (5.6 MW) was selected as part of the second NER 300 call for projects for a total of 9.1 million euros.
Ireland, which also has significant wave energy potential, has drawn up renewable energies development plan (OREDP), providing 26 million euros of funding between 2013 and 2016 to develop test sites, 19 million euros to boost R&D, and the creation of a Feed-in Tariff of 260 EUR/MWh to support the development of 30 MW. The WestWave experimental farm (5 MW in 2015) was awarded 23.3 million euros as part of the second NER 300 call for projects.
In Spain, Feed-in Tariffs for renewable energies ended in 2012. The two test sites, BIMEP (Biscay Marine Energy Platform) and PLOCAN (Oceanic Platform of the Canary Islands), are now up and running and contributing 20 MW and 15 MW respectively to the grid.

In the North of Europe, the University of Uppsala, Sweden, has constructed a tidal stream generator test site at Söderfors, Dalälven River, which is an addition to the wave energy converter site running since 2006. Denmark, which has two test sites – Nissum Bredning and DanWEC – is a major stakeholder in WEC technology. In Norway, the national utility Statkraft which had installed a small pilot plant to harness osmotic energy in 2009 at Tofte, south of Oslo, threw in the towel at the start of 2014 because of the scale of technical barriers it was facing.

100 GW IN 2050?

Although the harnessing of marine energy is small-scale, the sector attracts considerable commercial interest as borne out by the involvement of major manufacturing concerns (Alstom, DCNS, Voith Hydro and Andritz Hydro), innovating SMEs (Sabella) and electricity companies (EDF, GDF Suez, Vattenfall, Iberdrola, Fortum, etc.). Marine energy has the potential to create new high-quality jobs in project development, component manufacturing and operations management. Over the past seven years the private sector has poured more than 600 million euros into it.
A major contribution could be made towards Europe decarbonisation targets by intensifying the deployment of marine energy. By 2050, 100 GW could be installed. These technologies need to produce satisfactory cost-effectiveness. However, moving on from the demonstration phase of a prototype to commercialization is a difficult step for these emerging technologies, especially in the current economic climate. □


AW Energy

1

List of European Union plants harnessing ocean energy at the end of 2013 (MW)

United Kingdom			
Limpet	0.5 MW	2000	Connected
Open Center Turbine	0.25 MW	2006	Connected
SeaGen	1.2 MW	2008	Connected
Pulse Stream 100	0.1 MW	2009	Connected
Oyster 2	0.8 MW	2009	Connected
EON Pelamis P2	0.75 MW	2010	Being tested
Scottish Power Pelamis P2	0.75 MW	2011	Being tested
Atlantis Resources Corporation AR1000	1 MW	2010	Being tested
Andritz Hydro Hammerfest	1 MW	2011	Being tested
Scotrenewables Tidal Power	0.25 MW	2011	Being tested
Voith Hydro	1 MW	2012	Being installed
Wello	0.6 MW	2012	Being tested
Neptune	0.5 MW	2011	Connected
DeepGen Alstom	1 MW	2013	Connected
Seatricity Oceanus	n. a.	2012	Being tested
Fred Olsen Bolt "Lifesaver"	n. a.	2012	Being tested
Bluewater	n. a.	2012	Being installed
Portugal			
OWC Pico	0.4 MW	1998	Connected
Pelamis	2.25 MW	2008	On hold
Waveroller	0.3 MW	2012	Being tested
France			
Barrage de La Rance	240 MW	1966	Connected
Hydro Gen 2	0.01 MW	2010	Being tested
Open Hydro Arcouest	0.5 MW	2013	Being tested
Spain			
Mutriku OWC – Voith Wavegen	0.3 MW	2011	Connected
Innpacto Wave	n. a.	2012	Being tested
Denmark			
Poseidon Floating Power Plant	0.14 MW	2008	Connected
Wave Star	0.039 MW	2009	Connected
Ireland			
OE Buoy	0.015 MW	2006	Being tested
Sweden			
Seabased	1 MW	2015	Being installed

n. a.: not available. ***Source: EurObserv'ER 2014***

MUCH MORE RESTRICTED EXPANSION

Renewable energies once again scored points in the European Union in 2013, both for electricity production and energy consumption in general. Future gains in the electricity generating sector will certainly be harder to come by because the political goalposts on renewable electricity generating sector development have moved over the last two years, both at European institution level and under the impetus of many member states. Market logic has finally caught up on environmental logic that had previously held sway.

The new European Commission guidelines on promoting the renewable sectors is aimed at "designing more efficient public support measures that reflect market conditions, in a gradual and pragmatic way". In other words, they abandon the guaranteed Feed-in Tariffs system in favour of electricity sales market-based mechanisms. This new European policy has been justified on the grounds of needing to maintain a better grasp on the development of the renewable sectors, bring their energy bill costs under control and make their integration into the energy mix easier. This new policy is also justified by the fact that the production costs of some production sectors, such as onshore wind energy and PV solar power, are now considered sufficiently mature to take on the market. The stated aim is also to reduce competitive distortions between renewable and conventional electricity (coal, gas, oil, nuclear) in a globally crisis-ridden sector, where many energy operators have to contend with lower productivity from their production facilities.

It follows that the growth pace of the renewable electricity producing sectors should slow down in 2014, as a result of lower production infrastructure investments in 2012 and 2013, as presented in this publication.

ONE OUT OF EVERY 4 KWH OF ELECTRICITY CONSUMED IS RENEWABLY SOURCED

The year 2013 was a very good year for renewable electricity production. According to EurObserv'ER, gross renewable electricity production, not normalized for hydro and wind power, increased by 11.1%, i.e. 852.9 TWh, between 2012 and 2013. This increase, combined with a level of stability in the European Union's overall electricity consumption (3 314.6 TWh in 2012 as against 3 306 TWh in 2013), took the renewable share up to 25.8%, a 2.6 percent rise. Now more than a quarter of the European Union's total electricity consumption is renewably sourced. In 2004, the renewable share was only 14.3%, which means that over the decade the share has increased by 11.5 percentage points.

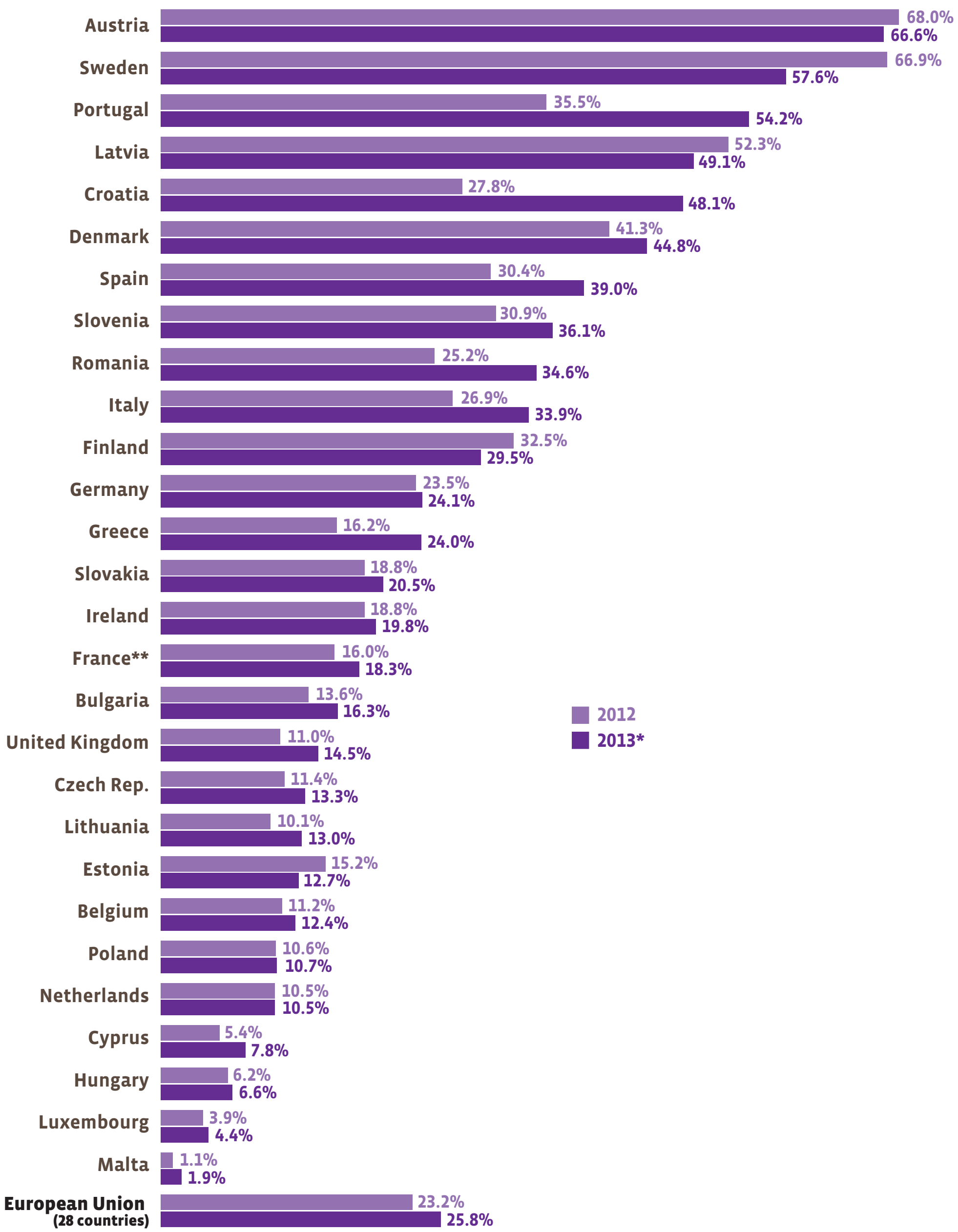
Between 2012 and 2013, most of the major production sectors posted two-digit growth rates. Wind energy posted 13.8% of growth, solar power (PV and CSP combined) with 19.7%, and biogas with 13.7%. A good year for hydropower (with a 10.3% increase) also contributed to the sharp growth in renewable electricity production. Incidentally it is hydropower that contributed the most to EU growth in renewable electricity production in 2013 by adding


Solar Euromed

an extra 34.4 TWh to its total estimated at 369.6 TWh (excluding pumped-storage installation production). Wind energy is not to be left out, as it increased by 28.4 TWh to reach 234.4 TWh. Solar power at 85.2 TWh, is the third-ranked contributor and increased production by 14.1 TWh of which 13.4 TWh was from PV alone. In 2013 the biomass sectors (solid biomass, biogas, renewable municipal waste and liquid biomass) were more subdued and only added 8.5 TWh to give a total of 157.3 TWh. Biogas was the main contributor of the four with an additional 6.3 TWh (for a total of 52.7 TWh). Solid biomass added a further 1.4 TWh for a total of 81.6 TWh. The other renewable electricity sectors' contributions were marginal (0.2 TWh more for geothermal power, for a total of 5.9 TWh) and even negative for marine energies (0.04 TWh less for a total of 0.4 TWh).

1

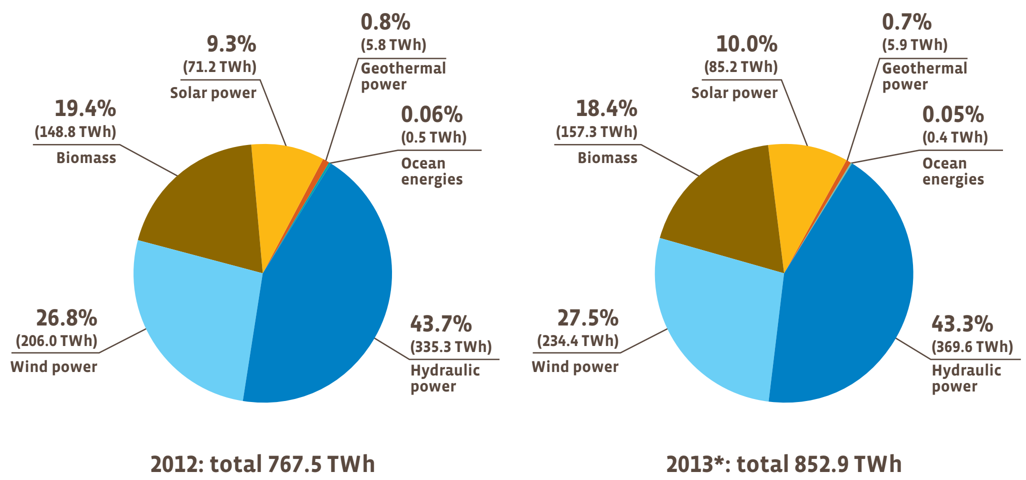
*Share of renewable energy in gross electricity consumption of EU countries in 2012 and 2013**



** Estimate. ** Overseas Departments not included for France.* ***Note:*** *Figures for actual hydraulic and wind generation (no normalisation).*
Source: EurObserv'ER 2014

2

Share of each energy source in renewable electricity generation in the EU 28 (%)



** Estimate.* ***Note:*** *Figures for actual hydraulic and wind generation (no normalisation).* ***Source: EurObserv'ER 2014***

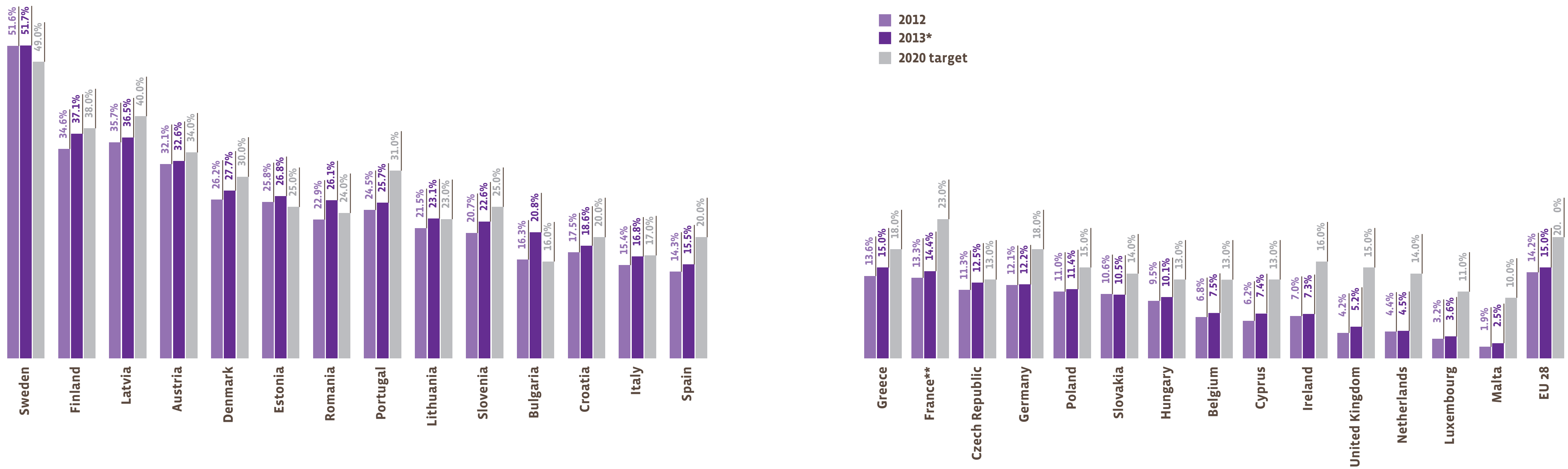
THE EUROPEAN TARGETS FOR 2020 – 5 POINTS TO BE GAINED IN SEVEN YEARS

The 2009/28 European directive provides that the Member States should reach a 20% renewable energy share in gross final energy consumption across Europe and has set binding individual country targets for 2020. EurObserv'ER is monitoring each Member State's trajectory towards achieving these targets.
Calculating the renewable energy share for each of the Member States is a tricky business and the EurObserv'ER findings are estimates based on the data collected by the project team over the past year. These initial estimates put the renewable energy share of the European Union's gross final energy consumption at 15.0% in 2013 compared to 14.2% in 2012... an increase of 0.8 of a percentage point.
Gross final renewable energy consumption increased by 8.4 Mtoe between 2012 and 2013 (from 163 to 171.4 Mtoe). Of the three main energy uses, heat, electricity and fuel production, renewable electricity production contributed the most to the 2013 increase. If we take into account the normalized hydropower and wind power production according to the rules laid down by the European Renewable Energy Directive, renewable electricity production in 2013 stood at 70.8 Mtoe, which is a 4.6 Mtoe gain over 2012. The additional contribution of renewable heat consumption was a little lower (an extra 4.1 Mtoe), but heat is the leading energy vector of final renewable energy consumption with a total of 89.2 Mtoe in 2013.
The consumption of energy in transport did not lead to an increase in the renewable energy share. Sustainably certified biofuel consumption (the only type that can contribute to the European Renewable Energy Directive targets) declined slightly between 2012 and 2013 (from 11.6 to 11.4 Mtoe). This drop is the upshot of the controversy over first generation biofuel sustainability and the lack of consensus across the European Union on the future of the biofuel sectors after the 2020 dateline, regardless of whether they are first or second generation.

The increase in final renewable energy consumption in 2013 can be put down to four key facts. Firstly, a sharp rise in the "normalized" wind power contribution of 2.3 Mtoe across the European Union. Biomass consumption for heat production purposes

3

Share of energy from renewable sources in gross final energy consumption in 2012 and 2013 and national overall targets in 2020*



***Note:** Calculations, defined by the Directive, use a normalized hydro and wind generation.*
** EurObserv'ER estimates, calculated on the basis of the project's data collection campaigns. ** Results for France calculated by EurObserv'ER don't include the overseas territories but for the purpose of Directive 2009/28/EC the accounting of energy from renewable sources for France has to include French overseas territories.* ***Source: EurObserv'ER 2014***

also increased (by 2.7 Mtoe), primarily through a surge in French consumption. The third factor is an increase of 1.2 Mtoe in PV power production between 2012 and 2013. Finally biogas also made a significant input through both the electricity recovery and heat recovery channels (adding 545 ktoe and 339 ktoe respectively).

Another factor boosted the renewable energy share of total gross final energy consumption. Our estimates indicate that total gross final energy consumption (renewable or otherwise) continued to fall in 2013. We can attribute this to the economic crisis and also to energy efficiency efforts. We calculate this fall at 5.8 Mtoe across the European Union (from 1 146.2 Mtoe in 2012 to 1 140.4 Mtoe in 2013).

Incidentally we should mention that the quality of the renewable energy statistics presented by the ministries and statistics offices is constantly improving as the result of the ambitious studies conducted to refine appraisal of actual renewable energy consumption. Their main focus is households, which are harder to estimate. These insights may lead to major statistical consolidations for specific sectors and lead to reassessments of the renewable share in some countries. This applies to Germany and Italy in 2013, following new surveys of household wood-energy consumption. A similar survey is in progress in France and should shortly publish its findings, which could also lead to some adjustments.

There could be a repeat of this phenomenon in 2014, relating to biofuel. In 2013, the biofuel sustainability certification system that endorses eligibility for admission into the national renewable energy target calculations, was still awaiting initiation in a few countries such as Spain, Portugal and Finland. Hence biofuel production in these countries has been excluded from the European Renewable Energy Directive target calculations, and affected their results.

Five EU countries have already achieved their 2020 targets, namely Bulgaria, Estonia, Lithuania, Romania and Sweden. Eight countries are almost on target with more than 90% achieved – Austria, Croatia, the Czech Republic, Denmark, Finland, Latvia, Slovenia and Italy. It should be borne in mind that the recent reassessment of final wood-energy consumption in Italian households undoubtedly contributed to this excellent result.

Of the big energy users, France and Germany have achieved 62.5 and 67.8% of their targets respectively, while the UK has achieved about 34.5%. These results appear to illustrate that the efforts set for the individual Member States to achieve their 2020 targets vary. Despite the heavy investments already made in these three countries, their 2020 goals are still far from being met. Most of the remaining effort will thus have to be made by the high energy-consuming countries. This could be repeated for the objectives of the next climate-energy package. In October 2014, the European Council presented its conclusions on the framework for action to be implemented on climate and energy by the 2030 timeline. A goal of at least 27% has been set for the renewable energy share of EU energy consumption by 2030. The target will only be binding across the European Union and will have to be negotiated between the Member States

4

Share of energy from renewable sources in gross final energy consumption in 2012 and 2013 and indicative trajectory*

Country	2012 (%)	2013* (%)	Indicative trajectory 2013-2014** (%)
Sweden	51.6	51.7	42.6
Finland	34.6	37.1	31.4
Latvia	35.7	36.5	34.8
Austria	32.1	32.6	26.5
Denmark	26.2	27.7	20.9
Estonia	25.8	26.8	20.1
Romania	22.9	26.1	19.7
Portugal	24.5	25.7	23.7
Lithuania	21.5	23.1	17.4
Slovenia	20.7	22.6	18.7
Bulgaria	16.3	20.8	11.4
Croatia	17.5	18.6	15.0
Italy	15.4	16.8	8.7
Spain	14.3	15.5	12.1
Greece	13.6	15.0	10.2
France***	13.3	14.4	14.1
Czech Republic	11.3	12.5	8.2
Germany	12.1	12.2	9.5
Poland	11.0	11.4	9.5
Slovakia	10.6	10.5	8.9
Hungary	9.5	10.1	6.9
Belgium	6.8	7.5	5.4
Cyprus	6.2	7.4	5.9
Ireland	7.0	7.3	7.0
United Kingdom	4.2	5.2	5.4
Netherlands	4.4	4.5	5.9
Luxembourg	3.2	3.6	3.9
Malta	1.9	2.5	3.0
EU 28	14.2	15.0	–

Note: *Calculations, defined by the Directive, use a normalized hydro and wind generation.*
** EurObserv'ER estimates, calculated on the basis of the project's data collection campaigns. ** All percentages originate from Annex I of Directive 2009/28/EC. The indicative trajectory has been calculated from Part B of the Annex. *** Results for France calculated by EurObserv'ER don't include the overseas territories but for the purpose of Directive 2009/28/EC the accounting of energy from renewable sources for France has to include French overseas territories.* ***Source: EurObserv'ER 2014***

SÜDTIROL MARKETING/MAX LAUTENSCHLÄGER

"guided by the need to deliver collectively the EU target". This compromise could lead to fears that most of the future growth of renewable energies in the European Union will only be carried by the countries where public opinion is ready to make efforts to combat global warming, thereby instituting a two-speed Europe. If this target, which observers describe as toothless, is approved by the European Parliament, a mean annual 0.7 point increase in the renewable energy share will be needed. □

SOCIO-ECONOMIC INDICATORS

The first chapter that presents the energy indicators is supplemented by one that sheds light on the socio-economic impact of the renewable sectors across Europe.

All 28 countries composing the European Union in 2013 are covered individually, detailing ten renewable sectors. The aggregates refer to the employment figures and sales turnover generated in 2012 and 2013.

Methodological note

This year again, EurObserv'ER has updated its database on the socio-economic impacts of renewable energy, primarily on jobs and sector turnover in all the European Union Member States. The socio-economic indicators published have been gathered from a wide variety of sources. All data and figures relate to the years 2012 and 2013. National statistical offices and national energy agencies provided the bulk of the energy data. Comprehensive national socio-economic statistics are provided and were used for France (Ademe), Germany (BMWi and AGEE-Stat), Austria (BMVIT/EEG), and the United Kingdom (REA) that conduct annual national surveys that result in the publication of employment and economic activity figures for all or some RES sectors.

*EurObserv'ER attempts to give a coherent estimate based on latest available energy market data to reflect the general market dynamics accurately in each sector. Certain underlying assumptions of our calculations and data have been partly revised retroactively. For various reasons the socio-economic indicators given below **cannot be directly compared to last year's figures** in the 2013 Overview Barometer edition:*

- *all the data in the socio-economic chapter now refers to the EU-28, so thus **including Croatia** as new EU member state, which is included for the first time and from this year onwards.*
- *Germany's working group on renewable energy statistics (AGEE-Stat) has also retroactively revised the **German renewable job statistics** for 2012. The overall employment figure for 2012 is now estimated at 399 800 jobs which 22 000 more than the 377 800 jobs previously reported. The 8 300 jobs in public administration and research are not covered by the EurObserv'ER methodology.*

- another break in data collection comes from the **United Kingdom** where new job and turnover figures were also found to be substantially higher than previously assumed. The Renewable Energy Agency (REA) and Price Waterhouse Cooper (PwC) have published significantly higher turnover and employment data for all sectors than the EurObserv'ER estimates. For the sake of consistency the newly-released figures have been adopted.
- a clear correction has been made for the **Danish** wind energy sector. The IEA – RETD report (2012) assumed a wind energy workforce of 40 000 that not even the Danish Wind Industry Association claimed. The latter quantified sector employment at around 28 500 for 2012, which is why we have retroactively adjusted this figure.
- the **wind energy sector** in the UK may have been underestimated in last year's edition. In the light of the REA/PWC report, the UK wind energy industry may already have employed 35 000 people in 2012.
- for the course of 2013 a further drop in module and overall system cost is assumed for the **photovoltaic (PV) sector.**

The methods used by individual countries, institutions and organizations for quantifying socio-economic impacts differ wildly and in many cases the indicators were estimated. These estimates were either based on energy data (installed capacities or energy output), or on regularly updated and improved employment and investment ratios, as identified in ongoing literature reviews. Major sources of investment and job coefficients are covered by meta studies such as the Institute for Sustainable Futures (ISF 2009 and 2012; EREC and Greenpeace (2010 and 2012), IRENA (2012, 2013), or are provided by European industry bodies such as EWEA (wind), EPIA (PV), ESTIF (solar thermal), ESHA (hydropower), ePURE and EBB (biofuels), EuBIA and AEBIOM (biomass), EHPA (heat pumps), or International industry bodies (IGA for geothermal energy, or WWEA and GWEC for wind energy). Furthermore, national associations were approached for suitable data. Other sources were European surveys (Stream Map/ESHA, EmployRES 2009), IEE project outputs (BiogasIn or GeoTrainNET, GEOELEC) or dedicated reports of international scope such as the REN21 Global status report 2011, the IEA Photovoltaic Power Systems (PVPS) national status reports or the IEA RETD 2012/2013 employment statistics and guidelines including employment data for Denmark, France, Ireland, Netherlands and the UK.

Wherever possible, EurObserv'ER has endeavoured to apply consistent definition and scope to the presentation of indicators. Important definitions affect the following issues:

- in order to represent the tentative nature of EurObserv'ER estimations, job figures are **rounded to the nearest 50 jobs** and turnover indicators **to the nearest €5 million.**
- employment data covers both direct and indirect jobs and relates to gross employment, i.e. not taking into account job losses in other industrial sectors or due to expenditure and investment in other sectors.
- direct jobs are those directly derived from RES manufacturing, equipment and component supply, or onsite installation and O&M.
- indirect jobs are those that result from activity in sectors that supply the materials or components used, but not exclusively so, by the renewables sectors (such as jobs in copper smelting plants part of whose production may be used for manufacturing solar thermal equipment, but may also be destined for appliances in totally unconnected fields).
- turnover figures, expressed in current million euros (M€), focus on the main **economic investment activity** of the supply chain (manufacturing, distribution and installation of equipment, plant operation and maintenance). Turnover arising from **electricity or heat sale, financial and training activities, or publicly funded research, etc. are excluded.**
- Socio-economic indicators for the **bioenergy sectors (biofuels, biomass and biogas)** include upstream activities, namely fuel supply in the **agricultural, farming and forestry sectors**. For solid biomass, the activity in terms of self-production/consumption of wood by individual households and the "informal" market is not included in our work.
- as in the previous edition, socio-economic indicators for the **geothermal sectors are split between near-surface applications (heat pumps**) and deep geothermal technologies.
- socio-economic indicators for **wind energy include small wind systems in the UK.**
- socio-economic indicators for **solar thermal include CSP**-related activities, mainly for installation and O&M in Spain and for technology supply in Germany.
- socio-economic indicators for **turnover from biofuel** were derived from averaged data from Italy, Germany and France as major producing countries. **Jobs and turnover in biofuels** also factor in the growing import shares that reduce the European part of value creation.

WIND POWER

Despite the various challenges confronting the European wind energy industry, the employment and economic activity forecasts for 2013 are quite good. Although the European Union internal market slowed down in 2013 -including Croatia- (down to 11 264 MW in 2013 from 12 700 in 2012), it managed to keep above the 11 GW threshold. The national segments of the EU market were much more volatile and more concentrated than in recent years, which points to a certain level of fragility. One reason for concern is that in 2013 the two main European markets, namely Germany and the UK, accounted for more than half of the installed capacity in the EU. The Scandinavian countries and some Eastern European countries such as Romania, Poland or new member state Croatia are making encouraging signals, whereas the former champions Spain, Italy or France are displaying dwindling enthusiasm. EurObserv'ER rates the sector at ***39.8 billion euro for 2013*** and approximately ***302 500 jobs***, which is fairly consistent with the European Wind Energy Association (EWEA) assumptions.

In terms of turnover ***Denmark*** is the class leader. The Danish wind industry association claims nearly stable sector turnover of 80.4 billion Kroner or ***10 780 M€*** and a slightly diminished workforce of around ***27 500 persons***. In its annual industry report the association explains that Danish wind sector companies actually outperformed several other competitors and put more emphasis on their domestic market. Exports saw a small decline of 1.6%. The economic volume is largely based on the world leader Vestas but the industry is well developed with numerous smaller SMEs, actively present in the global wind energy value chain.

Germany saw a new installation record with 3 466 MW installed in 2013. AGEE-Stat, the country's working group on renewable energy statistics, states an increase in wind energy-related turnover (***8 470 M€***, up from 5 180 M€ in 2012) and 20 000 new jobs, now apparently standing at ***137 800***, by far the largest share in total renewable energy related employment. The two main reasons for this are good performance in the labour-intensive offshore wind sector that took off in 2013 and a possible rather short-lived installation boom in the face of political uncertainty surrounding the revised renewable energy act (EEG – in effect from 1 August 2014) that aims to limit its annual installation rate to 2 500 MW.

The ***United Kingdom*** is the second largest onshore market in the EU and the unrivalled global offshore leader. In the offshore segment the UK Government has confirmed its ambition to reach 39 000 MW by 2030 which should further drive the socio-economic indicators that already stand at ***6 billion Euro*** and ***36 000 jobs*** according to a market review conducted by REA and PwC in 2013.

Spain (with ***20 000 jobs***) and mainly export-driven economic impacts of ***2 billion Euros*** on its economy according to the national industry body AEE) remains the top wind power producer in the EU-28. However the domestic market remained weak with only 175 MW installed over the last twelve months.

The ***French*** market in 2013 took place in a climate that was not too conducive to the development of the wind power industry. Newly-connected wind power capacity is down 23% from 2012 and 32% compared to 2011. The administrative red tape surrounding sector development in the wake of the Grenelle 2 law are partly to blame for the slowdown. The socio economic figures remained stable in terms of employment (***20 000 jobs***) while sales turnover swlod down slightly from 2.32 to ***2.23 billion euro***.

More encouraging news came from ***Austria*** (nearing ***900 million Euro and 4 500 employees*** in its wind sector) that presented an installation record. ***Poland*** maintained its high installation momentum (+893 MW) and even surpassed the 2012 mark with 884 MW. Correspondingly EurObserv'ER assumes ***2 billion euro*** as its sales turnover and ***3 000 jobs*** sustained by wind power in the country. With ambitious expansion plans (7 000 MW by 2020) Poland has met the expectations and there is still mileage to be made along the wind energy road.

Stiff international competition and less ambitious European climate goals jeopardized the wind energy sector slightly. It is unclear whether the NREAP targets for 2020 can be met and despite encouraging signals from individual countries, flat development in the socio-economic data might constitute a success for the current year. □

1

Employment

	2012		2013	
	Installed capacity to date (MW)	Employment (direct and indirect jobs)	Installed capacity to date (MW)	Employment (direct and indirect jobs)
Germany	31 304.0	121 800	34 660.0	137 800
United Kingdom	8 895.0	25 000	11 209.0	36 000
Italy	8 102.0	40 000	8 542.0	30 000
Denmark	4 162.8	28 500	4 810.0	27 500
France	7 622.0	20 000	8 202.0	20 000
Spain	22 795.0	30 000	22 964.0	20 000
Austria	1 377.0	3 900	1 684.0	4 500
Sweden	3 607.0	5 100	4 194.0	4 500
Netherlands	2 433.0	3 500	2 713.2	4 000
Belgium	1 365.0	3 000	1 653.0	3 500
Ireland	1 764.0	2 500	1 896.0	3 500
Poland	2 564.0	2 800	3 429.0	3 000
Romania	1 822.0	2 800	2 459.0	2 000
Finland	257.0	900	447.0	1 500
Portugal	4 531.0	1 500	4 731.0	1 500
Greece	1 753.0	1 500	1 809.0	1 400
Croatia	179.6	400	254.3	400
Lithuania	225.0	250	279.0	400
Bulgaria	669.6	500	676.7	250
Czech Republic	258.0	500	270.0	250
Estonia	266.0	400	248.0	100
Hungary	331.0	100	331.0	100
Cyprus	146.7	100	146.7	<50
Latvia	59.0	100	67.0	<50
Luxembourg	58.3	<50	60.6	<50
Slovakia	3.1	<50	3.1	<50
Slovenia	2.3	<50	2.3	<50
Malta	0.0	0	0.0	0
Total EU	106 552.4	295 300	117 741	302 450

Source: EurObserv'ER 2014

2

Turnover

	2012		2013	
	Annual installed capacity (MW)	Turnover (M€)	Annual installed capacity (MW)	Turnover (M€)
Denmark	220.6	11 000	656.6	10 780
Germany	2 439.5	5 180	3 466.0	8 470
United Kingdom	1 853.9	5 500	1 888.0	6 000
France	701.0	2 320	630.0	2 230
Poland	884.0	1 260	892.8	2 000
Spain	1 032.0	3 850	175.0	2 000
Netherlands	161.0	1 000	303.2	1 300
Italy	1 273.0	1 950	444.0	1 200
Sweden	846.3	1 500	725.4	1 200
Belgium	306.0	750	329.3	950
Romania	959.0	1 300	637.0	900
Austria	295.7	740	307.0	875
Ireland	80.0	250	131.7	400
Finland	89.7	150	162.3	350
Portugal	224.0	500	193.0	350
Croatia	50.0	80	119.2	200
Greece	117.0	200	115.2	175
Bulgaria	131.0	200	7.1	100
Estonia	89.0	150	10.5	100
Lithuania	46.0	60	54.0	75
Czech Republic	45.0	70	12.0	40
Latvia	20.0	25	2.0	15
Cyprus	13.0	15	0.0	10
Hungary	0.0	25	0.0	10
Luxembourg	11.0	10	2.3	10
Slovakia	0.0	5	0.0	5
Slovenia	2.3	5	0.0	5
Malta	0.0	0	0.0	0
Total EU	11 890.0	38 095	11 263.6	39 770

Source: EurObserv'ER 2014

PHOTOVOLTAIC

Q-Cells/André Forner

The global picture of photovoltaics (market shift to China, Japan, USA) saw the continuation of the worldwide consolidation and restructuring process. System prices fell a further 13% which is clearly lower than the 27% witnessed in 2012. In this context, the European market 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, and which has had dire consequences on a number of countries' electricity bills. At the same time the drop in photovoltaic installation investment costs has accelerated through economies of scale leading to lower margins and sector turnover correspondingly.

The downward trend in European PV-induced investments and employment continued and for 2013 EurObserv'ER assesses the market at around ***22 billion euro***, with a reduced work force of around ***159 000 persons*** in the European PV industry. Major job losses are reported from Germany (40 000), Italy (6 000), ***France (12 600)*** or Spain. The industry further distanced itself from its self-set target of 1 million jobs by 2020.

Following legislative changes and permanent discussions about the fundamental realignment of the Renewable Energy Sources Act (EEG) 2013, ***Germany*** saw a sharp drop in installations (57%) from 7.6 to 3.3 GW of newly- added capacity. Consequentially, turnover from investment, in installation and O&M fell 62% to ***5.570 M€*** and employment declined by 44% from 103 000 to ***56 000 persons*** in the German PV sector according to AGEE-Stat. This is well in line with estimates of the Solar Industry Association (BSW-Solar)[1] that claims around 60 000 jobs. The cause of this consolidation is keen international competition but also the steep and rapid PV feed-in tariff cuts in 2012 and 2013. System prices have declined by 25% since beginning of 2012 but at the same time support fell by 50% leading to collapse in further demand. The demise of the domestic market had disastrous effects on the German industry all along the value chain and this loss could not be made up by export activities. For 2014 the Industry body VDMA foresees a more positive investment climate and new orders. But this will certainly not turn the tide over the coming years.

As foreseen in last years edition, the Conto Energia 6.7 billion euro funding ran out, resulting in clear market contraction in 2013 in ***Italy***. The domestic market also shrank by more than half, thus the country lost some ground, despite remaining a PV hub in the EU. We estimate that the sector employs ***10 000 people*** and the economic value of PV for the country at ***2.8 billion euro***.

The third biggest European market in 2013, ***France*** is at a low point. Newly-connected capacity showed a 45% year-on-year slide. Matters are now critical for some of the developers with nationwide presence who are disappearing in fast succession. The sector's future has become even more uncertain as a result of the 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. However, there is light at the end of the tunnel for the sector. The connection level over the last quarter of 2013 (which will finally exceed 161 MWp) is much higher than the level recorded in Q4 of 2012 (95 MWp), suggesting a return to growth in 2014.

More positive market trends can be observed in ***Austria*** that has set a new installatuion record (nearly 5 000 jobs and over 500 million euro in business value). Also the ***Greek*** Solar sector displayed a more promising trend than the overall economic situation and ***Romania*** showed an extraordinary growth (nearly 973 MW installed, ***€1 billion in turnover and jobs for 2 500 people***).

On a global scale, PV analysts such as IHS project the 2014 market at around 40-46 GW and further growth for 2015 driven by China, the USA, Japan or Africa. As a general trend there is thus a growing need for companies to diversify and continue to exploit new markets to reduce their dependence on the EU markets. The picture is less gloomy if we consider that new market segments became relevant as we can already see in the growing O&M sector. In Europe, though investors will need to adapt lower feed-in tariffs and adjust to tenders instead of the more convenient feed-in tariffs. Another way out for the PV industry is to focus on new business models, products and services such as in the storageor self-consumption sectors. □

1. 2013 rd. 60.000 Arbeitsplätze in der Solarbranche in Deutschland, press release Bundesverband Solarwirtschaft e.V. (BSW-Solar) 28.1.2014.

1

Employment

	2012		2013	
	Installed capacity to date (MWp)	Employment (direct and indirect jobs)	Installed capacity to date (MWp)	Employment (direct and indirect jobs)
Germany	32 703.0	100 300	36 013.0	56 000
France*	3 953.0	39 000	4 625.0	26 400
United Kingdom	1 749.3	12 500	2 782.3	15 600
Greece	1 543.3	10 500	2 585.8	12 000
Belgium	2 581.1	20 500	2 912.1	10 000
Italy	16 420.0	16 000	18 420.0	10 000
Spain	4 645.7	12 000	4 766.0	7 500
Netherlands	365.0	5 800	665.0	6 500
Austria	421.7	4 850	690.4	4 850
Romania	49.3	500	1 022.0	2 500
Bulgaria	914.8	7 500	1 019.2	1 500
Czech Republic	2 022.4	1 500	2 132.8	1 500
Sweden	24.1	600	43.1	800
Portugal	245.3	750	302.8	750
Lithuania	6.2	100	68.1	700
Denmark	403.2	600	572.4	500
Slovenia	221.5	1 400	254.8	500
Luxembourg	76.7	400	100.0	300
Croatia	4.0	<50	19.0	200
Cyprus	17.2	100	34.8	200
Slovakia	543.1	700	537.1	200
Malta	18.7	150	24.7	100
Estonia	0.2	<50	0.2	<50
Finland	9.2	<50	10.2	<50
Hungary	12.3	100	15.4	<50
Ireland	0.9	<50	1.0	<50
Latvia	1.5	<50	1.5	<50
Poland	3.6	100	4.2	<50
Total EU	**68 956.2**	**236 200**	**79 622.8**	**158 900**

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

2

Turnover

	2012		2013	
	Annual installed capacity (MWp)	Turnover (M€)	Annual installed capacity (MWp)	Turnover (M€)
Germany	7 609.0	12 420	3 310.0	5 570
France*	1 150.0	4 490	672.0	3 780
Italy	3 648.0	4 600	2 000.0	2 800
United Kingdom	713.0	1 500	1 033.0	2 700
Netherlands	219.0	1 500	300.0	2 000
Greece	912.0	1 150	1 042.5	1 350
Romania	46.4	50	972.7	1 000
Denmark	385.0	1 300	169.2	605
Austria	234.5	390	268.7	510
Spain	270.4	800	120.3	400
Belgium	1 190.0	1 400	331.0	380
Czech Republic	109.0	300	110.4	300
Bulgaria	702.6	1 500	104.4	250
Lithuania	6.1	10	61.9	75
Portugal	68.1	75	57.5	70
Sweden	8.3	50	19.0	60
Slovenia	121.1	150	33.3	50
Luxembourg	35.7	40	23.3	30
Croatia	4.0	5	15.0	20
Cyprus	7.1	10	17.6	20
Slovakia	55.8	90	0.0	20
Malta	12.1	25	6.0	10
Estonia	0.0	<5	0.0	<5
Finland	1.0	<5	1.0	<5
Hungary	9.6	<5	3.1	<5
Ireland	0.2	<5	0.1	<5
Latvia	0.0	<5	0.0	<5
Poland	1.4	<5	0.6	<5
Total EU	**17 519.4**	**31 885**	**10 672.6**	**22 030**

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

SOLAR THERMAL

In 2013, the market slipped for the fifth time in a row, as just 3 027 532 m^2 of collector surface was installed (equating to 2 119.3 MWth of capacity), i.e. 13.2% less than in 2012. The slowdowns were particularly serious in the key European markets – France, Germany, Austria, Italy, Portugal and for the first time Greece, which is unprecedented. The results of all of that made a clear impact on our socio-economic figures. EurObserv'ER assumes a EU wide sector turnover of ***3.68 billion euro*** and a diminished workforce of ***41 650 jobs***.

The solar thermal sector witnessed a drop of 11% in 2013 in ***Germany***. In its annual market update AGEE-Stat[1] evaluates the industry at ***1 190 million euro*** (6% less) and ***12 500 people employed***. The losses in the domestic market could not entirely offset by export activities. The report also covers CSP-related economic activities (100 million euro and an additional 1 100 jobs). The emerging solar collector market trend might not be as alarming as it seems and the outlook is better as the new legislation on energy savings plans for the replacement of 30 year-old oil and gas heating systems, which will stimulate energetic modernization and hybrid systems including solar thermal applications. Also the numbers of new buildings fitted with ST systems is tending to rise so a reversal of the trend is likely in the coming years.

The ***UK*** entered the focus of our observations after the delayed RHI Renewable Heat Incentive programme came into effect, covering solar thermal along with heat pumps and biomass boilers and targeting domestic home owners. Socio-economic impacts cannot yet be seen and range at around ***40 million euro*** and ***800 jobs***, figures that will certainly be revised upwards over the coming years.

The situation in ***Italy*** so far is only potentially promising. The feed-in tariffs for heat production and the Conto Termico, or alternatively tax reductions have had only minor effects on actual installation rates. Thus is stagnating at ***4 000 jobs and a sector volume of 350 million euro***.

In ***France***, the market shrank in 2013 with socio-economic impacts. EurObserv'ER rates employment at around ***6 700 jobs and sector turnover of € 430 million***. To head off this situation, the solar thermal industry joined forces with their heat pump and biomass coun terparts last year and appealed to the authorities. They call themselves Alliance chaleur renouvelable "Renewable heat alliance" to give formal expression to the specific issues affecting renewable heat in the national debate on energy transition.

After two years of high growth in ***Poland*** in 2011 and 2012, the national market lost impetus in 2013. The rules for obtaining funding from the subsidy programme, the National Fund for Environmental Protection and Water Management (NFOSiGW), changed in 2013 and the financial resources allotted to the programme ran out. In this context many banks involved in its funding stopped approving subsidy demands once their budget targets were met. The result was a declining market. In 2013, 274 100 m^2 of collectors were installed compared to 302 074 m^2 in 2012. Despite that, the socio-economic indicators remained in line with 2012 around ***230 million euro*** and ***2 500 jobs***.

The solar thermal sector seems to be in the center of another crisis and it is clear that full-blown solar thermal market recovery will be contingent on an all-out renewable heat development policy that combines incentives to produce with promotional campaigning. Eleven European associations that represent renewable heat have joined forces in a Heat Coalition to urge the European institutions to apply remedial measures to send heat production back to the top of the agenda and revive the negotiation framework surrounding the adoption of the second climate and energy package. □

1. *BMWI / AGEE-STAT 2014: Bruttobeschäftigung durch erneuerbare Energien in Deutschland im Jahr 2013 -eine erste Abschätzung- Stand: Mai 2014*

1

Employment

	2012		2013	
	Annual installed capacity (MWth)	Employment (direct and indirect jobs)	Annual installed capacity (MWth)	Employment (direct and indirect jobs)
Germany*	819.0	12 700	728.0	12 500
France	197.7	7 200	159.9	6 700
Spain	160.5	4 500	162.8	4 500
Italy	231.0	4 350	207.9	4 000
Austria	146.2	3 400	126.4	2 900
Poland	211.5	2 550	191.9	2 500
Greece	170.1	3 000	147.7	2 100
Denmark	93.2	1 500	72.8	1 200
Czech Republic	70.0	1 000	55.7	800
United Kingdom	41.5	900	31.5	800
Portugal	63.6	1 100	40.1	600
Belgium	43.4	600	41.3	500
Slovakia	5.6	500	4.7	450
Cyprus	16.9	500	12.0	400
Netherlands	47.9	350	42.1	300
Ireland	19.0	200	19.4	250
Romania	14.0	200	16.8	250
Croatia	13.3	200	12.2	200
Hungary	36.2	200	12.6	150
Slovenia	9.4	150	6.3	100
Sweden	8.5	150	6.3	100
Bulgaria	5.6	100	3.9	<50
Estonia	1.3	<50	1.3	<50
Finland	2.8	<50	2.8	<50
Latvia	2.1	<50	1.9	<50
Lithuania	2.1	<50	1.3	<50
Luxembourg	4.8	<50	4.3	<50
Malta	4.2	<50	1.2	<50
Total EU	2 441.4	45 650	2 115.1	41 650

Source: EurObserv'ER 2014

2

Turnover

	2012		2013	
	Cumulated capacity to date (MWth)	Turnover (M€)	Cumulated capacity to date (MWth)	Turnover (M€)
Germany*	11 416.3	1 240	12 055.4	1 190
Spain	2 075.4	500	2 238.2	500
France	1 690.5	460	1 802.5	430
Italy	2 380.0	400	2 590.0	350
Austria	3 448.4	345	3 538.3	295
Poland	848.1	240	1 039.5	230
Greece	2 884.7	200	2 914.8	175
Denmark	499.0	110	550.2	90
Czech Republic	624.9	85	680.6	65
Belgium	334.0	50	374.2	50
Netherlands	605.2	60	615.6	50
Portugal	676.7	75	716.8	50
United Kingdom	455.3	50	475.2	40
Croatia	83.7	20	95.9	20
Hungary	125.3	35	137.3	20
Ireland	176.9	20	196.3	20
Romania	93.3	20	110.2	20
Cyprus	485.8	20	476.8	15
Bulgaria	58.1	<10	58.5	<10
Slovakia	108.0	<10	112.7	<10
Slovenia	141.8	<10	148.1	<10
Sweden	337.4	<10	341.6	<10
Estonia	4.3	<5	5.5	<5
Finland	29.9	<5	32.5	<5
Latvia	10.3	<5	12.1	<5
Lithuania	6.4	<5	7.7	<5
Luxembourg	23.1	<5	27.4	<5
Malta	33.8	<5	35.0	<5
Total EU	29 657	4 000	31 388.9	3 680

Source: EurObserv'ER 2014

SMALL HYDROPOWER

The hydropower sector and to be more exact, the small hydro sector with installed capacities of <10 MW is the most static of all renewable technologies. The reason for this is that most suitable sites are already utilized and new constructions are being hindered by numerous legislative or environmental obstacles and regulations.

According to EurObserv'ER data installed hydro capacity of<10 MW increased from 13 732 MW in 2012 to 14 052 MW in 2013 suggesting slow but continuous growth. Small hydro electricity generation in the EU-28 increased to 49.5 TWh, up from 43.6 TWh in 2012 but was still well below the 51.3 TWh monitored in 2010.

SÜDTIROL MARKETING/MAX LAUTENSCHLÄGER

Turnover is estimated at some ***€ 4.9 billion***. Job estimates are based on extrapolations of ESHA streammap data from 2012 whose industrial section unfortunately has not been updated. All in all around ***42 850 jobs*** are to be found in component manufacturing, plant installation, engineering activities and O&M across the European Union. With over 3 000 MW of small hydro capacity and annual output of 12 000 GWh, ***Italy*** is by far the largest market in the EU-28. Streammap estimated over 400 companies were active in the hydro industry in Italy in 2012. EurObserv'ER rates the sector at ***4 500 jobs*** including large hydro and sector turnover of ***€ 750 million***.

The hydro sector in ***France*** has been adjusted to ***3 850 jobs and sector income of € 450 million***. The country has a program to add 3 000 MW to the existing small hydraulic capacity. The progress of this program is slow because the sites for new facilities are scarce and subject to many constraints, especially relating to the law on rivers and water courses.
Figures released by the Energy Economics Group of the Technical University of Vienna indicate over ***6 000 jobs in Austria***. Hydropower is a significant and growing sector in the alpine country, which features very favourable conditions. Sector turnover is rated at ***€ 1 billion***, the largest of all observed EU Member States.

There are no indications of investment in the hydropower industry having increased between 2012 and 2013 in ***Germany***. The industry is, however, likely to have increased its turnover to ***€ 510 million*** (€ 250 million in investment in new installations and €260 million in O&M), following the results of a company survey regarding export expectations. Gross employment in the industry in 2013 totalled approx. ***13 100 jobs*** (up from 12 900 in 2012)[1]. These however include also large hydro sector jobs.

The growth prospects for small hydro power are rather limited as most viable sites have already been utilized. There will certainly be growing demand for the construction of pumped hydro storage, urgently needed for buffering excess (renewable) energy capacity. But once again the number of suitable sites is limited and often social acceptance and environmental integrity of these projects cannot be taken for granted. □

1. BMWI / AGEE-STAT 2014: Bruttobeschäftigung durch erneuerbare Energien in Deutschland im Jahr 2013 -eine erste Abschätzung- Stand: Mai 2014

1

Employment

	2012		2013	
	Installed net capacity to date (MW)	Employment (direct and indirect jobs)	Installed net capacity to date (MW)	Employment (direct and indirect jobs)
Germany *	1780.0	12 900	1774.0	13 100
Austria	1184.0	6 000	1233.0	6 150
United Kingdom	254.0	4 950	258	4 950
Italy	2904.0	4 000	3034.0	4 500
France	2025.0	3 850	2021.0	3 850
Portugal	380.0	1 750	373.0	1 700
Spain	1942.0	1 500	1948.0	1 500
Greece	218.0	1 250	220.0	1 250
Poland	273.0	950	277.0	1 000
Sweden	953.0	550	992.0	600
Romania	425.7	450	530.0	500
Hungary	14.1	400	16.8	450
Belgium	65.0	400	64.0	400
Bulgaria	285.0	400	285.0	400
Czech Republic	311.0	300	326.3	400
Finland	315.0	400	318.0	400
Slovenia	160.0	400	161.0	400
Latvia	26.0	350	30.0	350
Croatia	28.0	250	28.0	250
Slovakia	71.0	300	43.0	250
Lithuania	26.0	150	26.0	150
Ireland	41.0	100	41.0	100
Denmark	9.0	<50	9.0	<50
Estonia	8.0	<50	8.0	<50
Luxembourg	34.0	<50	34,0	<50
Netherlands	0.0	<50	0,0	<50
Cyprus	0.0	0	0,0	0
Malta	0.0	0	0,0	0
Total EU	13 732	41 800	14 050	42 850

** Figures for large and small hydro plants. **Source: EurObserv'ER 2014***

2

Turnover

	2012		2013	
	Small hydro gross electricity production (GWh)	Turnover (M€)	Small hydro gross electricity production (GWh)	Turnover (M€)
Austria	5 774	1 000	5 721	1 000
Italy	9 409	600	11 986	750
United Kingdom	868	725	802	720
Germany	7 206	450	7 819	510
France	5 756	400	7 196	450
Spain	2 934	200	5 241	400
Sweden	4 366	280	3 020	250
Portugal	627	95	1 195	150
Slovakia	109	140	115	150
Romania	540	95	603	110
Bulgaria	731	110	715	100
Czech Republic	917	70	1 094	100
Poland	938	80	994	100
Greece	669	55	772	75
Finland	1 733	45	1 077	40
Slovenia	297	15	363	25
Belgium	206	10	233	15
Croatia	77	<5	122	<5
Denmark	17	<5	13	<5
Estonia	42	<5	26	<5
Hungary	39	<5	62	<5
Ireland	108	<5	75	<5
Latvia	80	<5	60	<5
Lithuania	97	<5	92	<5
Luxembourg	99	<5	119	<5
Cyprus	0	0	0	0
Malta	0	0	0	0
Netherlands	0	0	0	0
Total EU	43 640.0	4 410	49 513.4	4 985

** Figures for large and small hydro plants. **Source: EurObserv'ER 2014***

GEOTHERMAL ENERGY

Geothermal energy can be recovered either as heat or electricity, with different technologies and for different applications for each type. Geothermal heat can supply district heating networks or alternatively be used to heat pools, greenhouses or aquafarms. Again this year EurObserv'ER has split up the socio-economic account of the European geothermal sector into heat pumps (primarily for domestic heating purposes - see separate section) and deep geothermal applications that generate heat and electricity in larger plants and installations. Whereas geothermal electric power plants are found in only a few countries, 19 out of the 28 European Union member states are now using geothermal heat. According to latest market trends and estimates based on the sparse solid job and turnover data available, EurObserv'ER rates the total 2013 sector volume at roughly ***€ 1.27 billion and a slightly increased labour force of 11 450 jobs***.

Italy is the unrivalled leader in deep geothermal energy use in the EU-28. With 729 MWe in capacity, its sector turnover remains at a level of around ***€ 600 million***, and ***5 500 jobs*** can be confidently assumed for the country. Another important geothermal hub in the EU is ***Hungary*** that could expand its geothermal heat generation to 784 MWth. ***More than 1 000 jobs*** and a ***turnover of € 75 million*** are the result of its continued geothermal efforts in 2013.

Most of ***France***'s high-temperature geothermal energy generation is in the overseas territories with two plants at Bouillante, Guadeloupe, with 16 MW of net capacity. The country aims to develop this sector with several experimental plants that will benefit from the results of Soultz-sous-Forêt... the first hot dry rock plants initiated in Europe in 1987. France has a good underground potential for heat generation, primarily in the Île-de-France region and in eastern France. For 2013 Ademe estimates the workforce at ***1 250 and an economic volume of € 80 million***.

In 2013, investment in geothermal energy and ambient heat in ***Germany*** increased by 4% over the previous year, totalling € 2 billion. Both deep geothermal energy and the heat pump industries contributed to this positive development. Some 90% of this can be attributed to the near surface (heat pump) section, which still ***leaves 1 500 jobs and € 200 million*** for the deep geothermal share according to AGEE-Stat.

Although geothermal energy is less dynamic than the heat pump segment due to the technological complexity of deep drilling, there are some ambitions for heat, and to a lesser extent for electricity operations by 2020, in the national action plans of the Member States. Many of the near and mid-term future perspectives of the sector will depend on the cost level of fossil fuels, which will affect investment decisions on renewable heat installations. □

1

Employment

	2012		2013	
	Cumulated capacity at the end of 2012	Employment (direct and indirect jobs in 2012)	Cumulated capacity at the end of 2013	Employment (direct and indirect jobs in 2013)
Italy	728.1 Mwe 778.7 MWth	5 500	729 Mwe 784.7 MWth	5 500
Germany	12 Mwe 170.3 MWth	1 400	24 Mwe 220.3 MWth	1 500
France	16.2 Mwe 287.4 MWth	1 200	16.2 Mwe 287.4 MWth	1 250
Hungary	714 MWth	850	774 MWth	1 000
Netherlands	51 MWth	400	51 MWth	400
Poland	115.4 MWth	200	119.2 MWth	200
Romania	176 MWth	200	176 MWth	200
United Kingdom	2.8 MWth	<50	2.8 MWth	200
Greece	104.9 MWth	150	101 MWth	150
Slovakia	14.2 MWth	170	14.2 MWth	150
Austria	0.7 Mwe 97 MWth	<50	0.7 Mwe 97 MWth	100
Croatia	45.3 MWth	<100	45.3 MWth	<100
Denmark	21 MWth	<100	33 MWth	<100
Lithuania	48 MWth	<100	48 MWth	<100
Portugal	25 Mwe 1.5 MWth	<100	25 Mwe 1.5 MWth	<100
Slovenia	66.8 MWth	<100	66.8 MWth	<100
Sweden	33 MWth	<100	33 MWth	<100
Belgium	6.1 MWth	<50	6.1 MWth	<50
Bulgaria	n.a.	<50	n.a.	<50
Czech Republic	4.5 MWth	<50	4.5 MWth	<50
Spain	n.a.	<50	n.a.	<50
Cyprus	0	0	0	0
Estonia	0	0	0	0
Finland	0	0	0	0
Ireland	0	0	0	0
Latvia	0	0	0	0
Luxembourg	0	0	0	0
Malta	0	0	0	0
Total EU	782 Mwe 2 737.9 MWth	10 970	794.9 Mwe 2 865.8 MWth	11 450

Source: EurObserv'ER 2014

2

Turnover

	2012		2013	
	Energy tapped (ktoe)	Turnover (M€)	Energy tapped (ktoe)	Turnover (M€)
Italy	614.6	600	621.3	600
Germany	68.3	160	79.9	200
Netherlands	11.8	80	23.7	90
France	117.3	60	137.2	80
Hungary	105.1	60	117.0	75
Belgium	1.5	40	1.7	40
Poland	15.8	30	18.6	30
Romania	21.6	25	21.6	25
Slovakia	3.6	25	3.8	25
Austria	27.7	15	28.4	15
Slovenia	34.6	10	38.4	15
Sweden	23.2	15	23.2	15
United Kingdom	0.8	<5	0.8	15
Croatia	7.0	<10	6.8	<10
Portugal	14.2	10	18.5	10
Bulgaria	33.4	<5	33.4	<5
Czech Republic	2.1	<5	2.1	<5
Denmark	6.9	<5	5.5	<5
Greece	13.1	<5	11.5	<5
Lithuania	3.8	<5	1.7	<5
Cyprus	0	0	0	0
Estonia	0	0	0	0
Finland	0	0	0	0
Ireland	0	0	0	0
Latvia	0	0	0	0
Luxembourg	0	0	0	0
Malta	0	0	0	0
Spain	0	0	0	0
Total EU	1 126.4	1 170.0	1 195.1	1 270.0

Source: EurObserv'ER 2014

HEAT PUMPS

The European market for heat pumps stalled once again in 2013. The socio-economic account of the European heat pump sector covers both air source and ground source heat applications and explicitly excludes the deep geothermal energy sector. For 2013 EurObserv'ER rates the heat pump sector in the EU-28 at ***96 200 jobs and turnover estimated at € 10.39 billion***. The major European markets are located in France, Italy, Germany, Sweden, Finland and Spain.

France is one of the top markets for ground source heat pump manufacturing and applications. With its domestic market nearly stable, its turnover should range at around ***€ 2.1 billion for 2013*** while the country has the largest GSHP workforce in the EU of ***32 000*** based on calculations by Ademe.

The Italian heat pump activity is hugely oriented towards air source technologies so the installation figures for ***Italy*** are somewhat misleading. As it is the prime market for air source heat pumps exceeding the million threshold, EurObserv'ER rates the sector at over ***€ 2.5 billion and 11 000 jobs*** although the ground source heat pump section is somewhat underdeveloped in Italy. In this table we have tried to express the jobs and turnover just related to reversible air-to-air heat pumps which represent around 12% of the total market.

Sweden is another big European player in the heat pump market. According to the industry association SVEP more than 96 000 heat pumps were sold, generating a slightly increased turnover of ***€ 620 million and 8 700 jobs. Finland***, another Scandinavian actor with an installed heat pump park of over 550 000 systems, is clearly visible on the map. EurObserv'ER estimates turnover at ***€ 400 million and 5 000 jobs***. A PwC report published in 2013 ranks the ***United Kingdom*** market at over ***7 000 jobs and over € 1.3 billion***.

Investment in geothermal energy and ambient heat increased in 2013 by 4% over the previous year in ***Germany***. Following the previous years' trend, air-to-water heat pump installations increased 2013, while growth in the number of new installations of brine-to-water and water-to-water heat pumps slowed down again. Installations of air-to-water heat pumps were up 13% year-on-year, increasing their market share to approx. two-thirds. AGEE-Stat puts the number of jobs provided in the near surface geothermal energy and ambient heat section at ***15 800*** and also claims sector turnover of around ***€ 1.7 billion***.

Despite the promising trend of growing installation figures in the EU-28, the sector is still not living up to its full potential and the expectations expressed by the European industry body EHPA (European Heat Pump Association), that foresaw more positive prospects for the coming years. The most recent slump in global oil prices – an important driver for house owners to invest in heat pumps – may negatively affect the sector in 2015. □

EUROBSERV'ER – THE STATE OF RENEWABLE ENERGIES IN EUROPE – 2014 EDITION

1

Employment

	2012		2013	
	Total heat pumps sales	Employment (direct and indirect jobs)	Total heat pumps sales	Employment (direct and indirect jobs)
France	137 017	32 000	138 072	32 000
Germany	60 733	12 500	61 140	15 800
Italy *	1 072 650	10 500	1 043 930	11 000
Sweden	95 107	8 500	96 550	8 700
United Kingdom	17 799	7 350	17 632	7 350
Finland	57 743	5 500	54 999	5 000
Spain	50 136	4 500	51 984	4 700
Netherlands	36 635	3 300	31 190	2 800
Denmark	27 936	2 700	27 370	2 500
Austria	14 646	1 200	14 572	1 300
Estonia	13 495	1 200	14 660	1 300
Portugal	8 047	700	9 221	850
Czech Republic	8 077	700	7 006	650
Poland	7 116	600	7 261	650
Slovenia	5 425	500	6 592	600
Belgium	6 553	600	5 503	500
Ireland	1 384	100	1 495	150
Hungary	676	<50	783	100
Lithuania	645	50	700	100
Slovakia	753	<50	960	100
Luxembourg	140	<50	n.a	<50
Bulgaria	0	0	0	0
Croatia	0	0	0	0
Cyprus	0	0	0	0
Greece	0	0	0	0
Latvia	0	0	0	0
Malta	0	0	0	0
Romania	0	0	0	0
Total EU	1 622 713	92 650	1 591 620	96 200

** The high figure of Italian Heat pumps market is not directly comparavle to the others because it includs systems only used for cooling. **Source: EurObserv'ER 2014***

2

Turnover

	2012		2013	
	Heat pump market evolution	Global Heat pumps market Turnover (M€)	Heat pump market evolution	Global Heat pumps market Turnover (M€)
Italy	-2%	1 825	-3%	2 500
France	-12%	2 060	1%	2 140
Germany	13%	1 530	1%	1 700
United Kingdom	-4%	1 325	-1%	1 325
Sweden	-11%	600	2%	620
Finland	-16%	400	-5%	400
Netherlands	-4%	500	-15%	400
Spain	-33%	300	4%	350
Austria	11%	210	-1%	250
Denmark	23%	220	-2%	210
Estonia	14%	95	9%	110
Poland	13%	65	2%	100
Czech Republic	10%	80	-13%	70
Portugal	-43%	50	15%	70
Belgium	10%	65	-16%	50
Slovenia	131%	45	22%	50
Ireland	13%	15	8%	15
Hungary	-18%	10	16%	10
Lithuania	8%	10	9%	10
Slovakia	41%	10	27%	10
Bulgaria	0%	0	0%	0
Greece	0%	0	0%	0
Latvia	0%	0	0%	0
Luxembourg	0%	0	0%	0
Malta	0%	0	0%	0
Romania	0%	0	0%	0
Croatia	0%	0	0%	0
Cyprus	0%	0	0%	0
European Union	-12%	9 415	-2%	10 390

Source: EurObserv'ER 2014

BIOGAS

Within Europe the expansion of biogas energy use has continued. Meanwhile more than 14 000 anaerobic digesters are in service in the EU-28, providing 13.5 Mtoe of energy. The number of methane injection plants has steadily risen to over 250 that are primarily based in Germany, Sweden, the Netherlands, Austria and Finland. The French and UK markets appear to have been developing particularly well, whereas the introduction of a new funding system in Italy led to a collapse in demand according to EBA and also the prime market in Germany has dwindled and following legislative changes in 2014 will be affected in years to come.

The literature on employment and economic value of biogas in the European Union is less comprehensive than on the other sectors. According to statistics from the European Biogas Association[1] there are 71 000 jobs in the biogas sector with the majority to be created and sustained in Germany. This is well in line with our observations as EurObserv'ER estimates a workforce of around ***65 400***. The biogas markets in the European Union are not as dynamic as other sectors and due to the dominating role of Germany, overall socio-economic figures are also largely influenced by developments there. Still EurObserv'ER estimates a slightly higher market value of ***over 5.8 billion euro*** for the European biogas industry.

According to BMWi data, investment in the ***German*** biogas sector was ***1.75 billion in 2013***. Companies were able to offset part of domestic decline in installations with their project development and sales activities outside Germany. AGEE-Stat counted 29 000 jobs in installation of biogas systems, and an additional 20 200 employees working in the provision of biomass, thus arriving at an employment level generated by the use of biogas plants of a total of approximately ***49 200***, including operation and maintenance, fuel supply and the operation of stationary liquid biomass installations[2].

The next bigger biogas markets in the EU-28 are located in ***France***, Italy and the UK. Specifically France is emerging as one of the most promising markets, following various legislative initiatives such as feed-in tariffs for biomethane injection and a heat fund. Ademe has published turnover figures of over ***410 million euro*** and job numbers approaching ***3 500***. If the projected 1 500 biogas plants planned to be built in France over the next 3 years materialize, the biogas landscape will change significantly.

A PriceWaterhouse Cooper (PWC) report jointly published with the British Renewable Energy Association (REA) quantified 141 companies active in the anaerobic digestion sector in the ***United Kingdom***. These created business worth ***450 million euro*** and employment for over ***2 800 people***.

1. EBA 2013: Biogas report 2013, December 2013.

2. BMWI / AGEE-STAT 2014: Bruttobeschäftigung durch erneuerbare Energien in Deutschland im Jahr 2013 -eine erste Abschätzung- Stand: Mai 2014

Italy is another major hub of biogas-related manufacturers, equipment providers and project developers. On the other hand a ministerial decree lowering the feed-in tariffs has changed the Italian biogas landscape – and not for the better. For 2013 however this has left no trace either in actual energy production from biogas (increasing to 1 815 ktoe), or in our socio-economic figures. The estimated industry volume stands at of ***2.5 billion euro*** and the biogas-related ***workforce at 4 200***. The European biogas sector is undergoing a substantial shift, away from energy crops towards by-products and organic wastes. This will not pass unnoticed. Annual installation caps in major markets will have impacts on installation rates in coming years and certainly also on employment and sales turnover. However, smaller and decentralized options together with the lift-off of biomethane injection projects might give biogas new positive impetus over the coming years. □

1

Employment

	2012		2013	
	Primary production of biogas (ktoe)	Employment (direct and indirect jobs)	Primary production of biogas (ktoe)	Employment (direct and indirect jobs)
Germany	6 421.4	51 000	6 867.9	49 200
Italy	1 178.8	2 600	1 815.4	4 200
France	394.4	3 500	436.7	3 500
United Kingdom	1 803.6	2 650	1 824.4	2 800
Czech Republic	374.9	850	571.1	1 300
Netherlands	297.5	700	302.8	700
Austria	206.4	550	196.8	500
Poland	168.0	350	181.4	500
Spain	290.9	600	285.5	500
Belgium	157.7	450	189.0	400
Sweden	126.7	250	145.0	300
Denmark	104.7	200	110.9	200
Hungary	79.8	150	82.2	150
Portugal	56.4	100	65.3	150
Finland	57.9	100	59.1	100
Greece	88.6	100	88.4	100
Ireland	55.9	100	48.2	100
Latvia	51.9	100	65.0	100
Slovakia	62.0	100	66.6	100
Slovenia	38.1	100	34.7	100
Bulgaria	0.1	<50	0.1	<50
Croatia	11.4	<50	16.6	<50
Cyprus	11.4	<50	12.0	<50
Estonia	2.9	<50	7.2	<50
Lithuania	11.6	<50	15.5	<50
Luxembourg	13.4	<50	12.8	<50
Malta	0.0	<50	0.0	<50
Romania	27.3	<50	30.0	<50
Total EU	12 093.6	64 950	13 530.7	65 400

Source: EurObserv'ER 2014

2

Turnover

	2012		2013	
	Primary energy production trend (%)	Turnover (M€)	Primary energy production trend (%)	Turnover (M€)
Italy	7%	1 900	54%	2 500
Germany	24%	2 075	7%	1 750
United Kingdom	1%	450	1%	450
France	12%	380	11%	410
Czech Republic	23%	100	52%	150
Netherlands	2%	75	2%	75
Poland	23%	50	8%	70
Austria	-9%	70	-5%	65
Spain	50%	75	-2%	65
Sweden	6%	50	14%	50
Belgium	23%	40	20%	35
Denmark	4%	25	6%	25
Greece	6%	25	0%	25
Hungary	31%	20	3%	20
Portugal	22%	15	16%	20
Slovakia	9%	15	8%	20
Finland	-3%	15	2%	15
Ireland	25%	15	-14%	15
Latvia	0%	15	25%	15
Romania	-11%	10	10%	10
Slovenia	-5%	10	-9%	10
Croatia	0%	<5	46%	<5
Cyprus	0%	<5	5%	<5
Estonia	5%	<5	148%	<5
Lithuania	2%	<5	34%	<5
Luxembourg	16%	<5	-4%	<5
Bulgaria	0%	0	0%	0
Malta	0%	0	0%	0
Total EU	16	5 455	12%	5 820

Source: EurObserv'ER 2014

BIOFUELS

In 2013, European biofuels consumption was marked by the first drop observed since the industrial expansion of the sector which started with the implementation of the biofuel directive on May 2003. Apart from the fact that some major countries have chosen to reduce their biofuels incorporation rates in their total fuel consumption, the uncertainty about the ILUC Directive increasingly disrupts the market and, in the absence of decisiveness and clear vision, the biofuel industry is also quite confused. Accordingly, EurObservER reported a 9.3% decline in EU biofuel consumption in its July 2014 Biofuel Barometer. The 2013 EU biofuel sector sales turnover was ***14.3 billion euro and work force of around 100 000 workers*** can be assumed as conservative estimate, taking into account the supply side activities of the agricultural sector.

TECHNOLOGYCENTER AINIA

Unlike the other sectors, biofuel consumption in ***France*** remained stable at 2.7 million toe in 2013 securing a leading position and also in socio-economic terms. The country is also EU's largest biodiesel consumer accounting for more than 20% in the EU. The resulting incorporation rate is around 6.5%. EurObserv'ER rates the industry at a stable ***3.2 billion euros*** and ***30 000 employees*** making it into one of the largest sector of all EU countries.

The downward employment trend in the German biofuel sector was reversed in 2013. Sales of biofuels in 2013 decreased in volume by 9% in ***Germany***. This affected both biodiesel and vegetable oil and ethanol. The production of biodiesel is assumed to have totalled approx. 3.2 million tonnes in 2013. Jobs in the production of biodiesel increased by 1% to 20 000. Bioethanol production is assumed to generate employment for another 5 600 persons according to AGEE-Stat, so the working group arrives at 25 600 jobs for 2013 (up from 22 700 in 2012)[1]. Sales turnover from the operation of biofuel facilities is estimated at 3.7 billion euro for Germany, which remains the largest EU market.

Spain - another former leading country - in turn witnessed halving of its biofuel consumption, following a decision to reduce the country's incorporation rate to 4.5% (down from 6.5%) with the intention of reducing fuel prices at petrol stations. EurObserv'ER assumes a sector turnover of nearly ***1 billion euro*** and workforce still around ***5 000 in fuel supply*** and 27 production sites in the country.

Poland (***7 500 jobs and 850 million euro*** of market volume) in turn could increase its biofuel consumption. ***Sweden*** maintained its top slot in the comparison of EU incorporation rates standing at 11% according to the Swedish Energy Agency. Furthermore, 99% of its biofuels consumption is claimed to be sustainably produced. ***750 million euro and 5 000 jobs*** are the outcome of this positive development for the Scandinavian country that aims to have one third of its cars running on biofuel by 2030 and is already today a leader of advanced biofuel production from farm waste and forest resources.

Imposed import duties on Argentinean and Indonesian biofuels imports have put away the hardest pressure on the European biofuel industry. However, not all producers have survived the legal uncertainty and the lowering of incorporation rates in some EU member states. The biofuel 2020 NREAP targets might be missed according to EurObserv'ER projections, however, geopolitical uncertainty and the strive to become less dependent on foreign resources might reverse the picture in coming years. The technological and investment trends favouring second generation or advanced biofuels using animal fats, straw or other agricultural wastes are possibly more important (and positive) for the European biofuel industry, which would also free the industry from the "fuel vs. food" debate and give the sector new impetus for years to come. □

1. BMWI / AGEE-STAT 2014: Bruttobeschäftigung durch erneuerbare Energien in Deutschland im Jahr 2013 -eine erste Abschätzung- Stand: Mai 2014, http://www.bmwi.de/BMWi/Redaktion/PDF/B/bericht-zur-bruttobeschaeftigung-durch-erneuerbare-energien-jahr-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

1

Employment

	2012		2013	
	Biofuel consumption for transport (toe)	Employment (direct and indirect jobs)	Biofuel consumption for transport (toe)	Employment (direct and indirect jobs)
France	2 685 992	30 000	2 686 865	30 000
Germany	3 048 587	22 700	2 768 334	25 600
Poland	784 874	5 500	729 498	7 500
Italy	1 342 568	5 250	1 234 009	5 000
Spain	2 100 739	9 450	899 327	5 000
Sweden	620 063	4 150	719 501	5 000
United Kingdom	885 570	3 000	1 014 546	3 500
Czech Republic	281 134	2 950	272 772	2 800
Belgium	329 879	2 000	330 849	2 000
Portugal	287 020	1 850	278 307	1 750
Denmark	223 818	800	223 616	1 500
Finland	206 696	1 500	231 325	1 000
Romania	202 544	950	206 356	1 000
Slovakia	101 042	700	135 442	1 000
Austria	457 844	1 000	480 372	900
Lithuania	60 517	850	58 675	800
Bulgaria	85 899	750	85 899	750
Greece	124 606	500	138 746	700
Hungary	122 671	800	106 705	600
Netherlands	334 790	700	319 528	600
Latvia	19 217	550	18 821	500
Ireland	60 174	300	72 443	400
Slovenia	51 627	200	56 942	350
Croatia	33 468	300	29 804	250
Luxembourg	47 031	200	53 504	250
Cyprus	16 136	<50	15 907	<50
Estonia	0	<50	0	<50
Malta	4 419	0	4 419	<50
Total EU	14 518 924	97 050	13 172 512	98 900

Source: EurObserv'ER 2014

2

Turnover

	2012		2013	
	Consumption trend (%)	Turnover (M€)	Consumption trend (%)	Turnover (M€)
Germany	2%	3 680	-9%	3 700
France	12%	3 180	0%	3 180
Italy	-3%	1 300	-8%	1 150
Spain	13%	1 830	-57%	950
Poland	-11%	580	-7%	850
Sweden	16%	560	16%	750
United Kingdom	-16%	550	15%	660
Netherlands	2%	660	-5%	600
Austria	6%	500	5%	345
Belgium	2%	310	0%	310
Denmark	73%	220	0%	280
Portugal	-9%	270	-3%	260
Czech Republic	-6%	270	-3%	250
Finland	2%	250	12%	200
Romania	0%	180	2%	190
Greece	21%	120	11%	130
Slovakia	-18%	100	34%	130
Ireland	-14%	80	20%	100
Hungary	-50%	75	-13%	70
Lithuania	35%	60	-3%	55
Slovenia	47%	50	10%	55
Luxembourg	3%	45	14%	50
Croatia	2%	30	-11%	25
Cyprus	1%	15	-1%	15
Latvia	-14%	20	-2%	15
Bulgaria	-42%	10	0%	<10
Estonia	0%	<5	0%	<5
Malta	0%	0	0%	<5
Total EU	0.8%	14 950	-9.3%	14 340

Source: EurObserv'ER 2014

RENEWABLE URBAN WASTE

By definition the incineration of waste (or the renewable biomass share contained in it) is considered by the Renewable Energy directive to contribute to the renewable energy statistics. Total primary energy production in the EU (electricity and heat from incineration plants) increased from 8 657.4 ktoe in 2012 to 8 965.8 ktoe in 2013, suggesting a minor upward trend. Most notably EurObserv'ER monitored an upward trend in heat generation. Heat sales to district heating networks grew in 2013, suggesting that the synergy between the incineration plants and the heating networks improved. Heat output increased 7.8% over 2012 to reach 2.4 Mtoe.

Of all the sectors, the socio-economic impacts of energy recovery from renewable municipal waste are the hardest to estimate. Unfortunately by the time this publication went to press, the Confederation of European Waste-to-Energy Plants (CEWEP) still had not released the bi-annual update on which EurObserv'ER bases its

AVR/van Gansewinkel Groep

Theo Moye

employment estimates. Overall EurObserv'ER estimates a more or less stable workforce ***totalling around 15 450 jobs***. Major countries with vast waste incineration capacities, the Netherlands and United Kingdom, are even importing waste for energy recovery, while France offers a substantial base of waste treatment plants and industrial players active throughout Europe.

The ***United Kingdom*** is assumed to have the largest renewable waste-related employment level. A joint report by Price Waterhouse Cooper and the Renewable Energy Association (REA) quantified the labour volume of waste-to-energy-related activities with over 6 500.

The ***Netherlands*** produces 51 toe of renewable energy per thousand inhabitants, making the country

one of the most active EU players pursuing energy recovery from household waste, and reached 855.3 ktoe in 2013. The country has some of the most modern incineration plants that were purpose-designed for energy recovery. EurObserv'ER estimates the jobs in the sector in the country at ***1 300***.

As indicated in the EurObserv'ER Renewable Municipal Waste Barometer (December 2014), Waste-to-energy recovery in the European Union is a patchwork panorama because of the political divergences on treatment methods and also delayed integration of the new Member States. Municipal waste dumping rates alternate between 1-3% in countries like Netherlands, Belgium, Sweden, Austria and Denmark and may be in excess of 90% in Eastern European member states: Romania, Bulgaria, Latvia and Lithuania, and also Malta.

Investments and new incineration capacities are in the pipeline most notably in the UK and Poland whereas Germany and the Netherlands are struggling with overcapacity issues. It will take some time before this unequal distribution is evened out. □

1

Employment

	2012		2013	
	Primary energy production from renewable municipal waste (ktoe)	Employment (direct jobs only)	Primary energy production from renewable municipal waste (ktoe)	Employment (direct jobs only)
United Kingdom	691.0	6 500	683.7	6 500
Sweden	769.5	2 900	820.2	2 900
Netherlands	849.7	1 300	855.3	1 300
Italy	806.8	900	827.6	1 000
Belgium	333.1	700	294.8	650
France	1 252.9	660	1 173.1	650
Denmark	490.1	700	494.0	600
Spain	175.7	750	157.2	500
Austria	143.7	500	129.9	450
Portugal	86.0	100	96.7	200
Czech Republic	83.7	100	82.9	100
Hungary	45.0	100	40.7	100
Ireland	44.4	100	48.7	100
Bulgaria	20.8	<50	21.0	<50
Finland	193.0	<50	222.0	<50
Luxembourg	17.1	<50	17.0	<50
Poland	32.5	<50	35.6	<50
Slovakia	18.6	<50	19.4	<50
Slovenia	7.5	<50	7.4	<50
Lithuania	0	<50	11.0	<50
Malta	0.7	<50	1.0	<50
Germany	2 595.6	n.a	2 926.6	n.a
Croatia	n.a.	n.a.	n.a.	n.a.
Cyprus	n.a.	n.a.	n.a.	n.a.
Estonia	n.a.	n.a.	n.a.	n.a.
Greece	n.a.	n.a.	n.a.	n.a.
Latvia	n.a.	n.a.	n.a.	n.a.
Romania	n.a.	n.a.	n.a.	n.a.
Total EU	**8 657.4**	**15 710**	**8 965.8**	**15 450**

n.a.: not available. ***Source: EurObserv'ER 2014***

SOLID BIOMASS

Consumption of solid biomass (including wood, wood waste, wood pellets, black liquor, bagasse, animal waste and other plant matter and residues) in the European Union increased again in 2013, by ***2.4 Mtoe year-on-year to 88.4 Mtoe***. Biomass has thus confirmed its major role for European power and heat supply. EurObserv'ER estimates that the economic value attributed to all energy-related activities in the EU including fuel supply amounts to roughly ***€ 36 billion for 2013*** (up from € 32 billion in 2012). Accordingly, employment rose to ***315 000 jobs***, impressively consolidating its role as major source of labour for all the RE sources, ahead of wind and far outpacing the photovoltaic sector.

With one of the biggest forest sectors in Europe, ***France*** is a powerful country in terms of solid biomass. Tenders made for biomass cogeneration sites associated with the "Heat Fund"programme have been heavily involved in the development of the sector in recent years. Ademe puts turnover at around the € 5 billion euro mark and employment at ***52 500***, which makes it the largest EU biomass labour market. The ***United Kingdom*** continues to promote biomass for energy use, primarily of wood fuel used for heating (5 000 wood-fired boilers installed) and even more through the conversion of coal-fired plants to biomass plants supplying ever larger amounts of electricity and heat. The reward is a ***21 000-strong biomass workforce*** and sector turnover that has reached nearly ***€ 3.5 billion***. The UK along with ***Italy*** spearheaded the European Union expansion in biomass electricity production in 2013, and made up for the drop in Swedish, Polish and Dutch output. Italy also features a buoyant pellet industry. In the absence of solid official data, EurObserv'ER assumes ***€ 2 billion and 20 000 jobs*** for this Mediterranean country, with both indicators clearly up on 2012.


AGCO/VALTRA

Sweden witnessed lower activity in its forestry industry and a decline in energy output. Still the Scandinavian country is in the top turnover ranks ***(€ 2 650 million)*** and biomass-related employment in the EU ***(27 500)***. ***Poland*** is still one of the top European Union biomass energy producers (6.8 Mtoe) with most of this output coming from coal/biomass co-firing plants. New renewable energy legislation will enable developers and owners of new renewable installations to auction their energy. This might further strengthen the Polish biomass industry, EurObserv'ER weighs it at ***€ 1.9 billion and 19 500 jobs*** in 2013. ***Austria*** is one of the few countries with detailed socio-economic data. The BMVIT ministry report counted 13 000 jobs and € 1.35 billion in biomass fuel supply, € 950 million and 4 500 jobs for biomass boiler manufacturing and trade and € 130 million and 500 jobs for pellet stove manufacturing to arrive at ***€ 2.430 million and over 18 000 jobs*** for the country.

Germany's solid biomass sector, like Austria's, remained stable. Primary energy output declined slightly to 10.9 Mtoe. Overall employment (***51 600 jobs*** including fuel supply) breaks down to 28 600 for the small-scale biomass systems and industry and 23 000 for the large biomass heating/power plants (systems construction, operation and maintenance) according to AGEE-Stat[1]. The entire sector turnover in biomass heat and electricity generation amounts to over ***€ 8.1 billion***. However, legislative changes to the EEG in August 2014 will have negative impacts for the years to come for the German biomass industry.

With European legislation in jeopardy and the industry and potential investors awaiting binding sustainability criteria –not expected until 2020 – the European biomass sector is at a standstill. However, the ability to provide uninterrupted energy supply and geopolitical considerations (gas import dependence and rising oil prices), makes biomass a sleeping giant that could wake up at any time with even more positive socio-economic impacts for the EU. □

1. BMWI / AGEE-STAT 2014: Bruttobeschäftigung durch erneuerbare Energien in Deutschland im Jahr 2013 -eine erste Abschätzung- Stand: Mai 2014 http://www.bmwi.de/BMWi/Redaktion/PDF/B/bericht-zur-bruttobeschaeftigung-durch-erneuerbare-energien-jahr-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

1

Employment

	2012		2013	
	Primary energy production (ktoe)	Employment (direct and indirect jobs)	Primary energy production (ktoe)	Employment (direct and indirect jobs)
France	9.779	52 250	10.842	52 500
Germany	10.931	51 700	10.902	51 600
Sweden	9.563	28 350	9.211	27 500
Finland	7.937	23 500	8.117	24 350
United Kingdom	1.849	19 000	2.153	21 000
Italy	7.249	12 200	7.448	20 000
Poland	6.988	20 500	6.834	19 500
Austria	4.806	18 600	4.749	18 100
Spain	4.964	14 500	5.443	16 000
Romania	3.795	10 400	4.233	12 500
Portugal	2.342	7 000	2.347	7 000
Czech Republic	2.153	6 450	2.293	6 900
Latvia	1.870	5 200	1.750	5 200
Hungary	1.385	4 300	1.454	4 400
Denmark	1.478	3 250	1.503	3 500
Belgium	1.413	3 300	1.408	3 300
Netherlands	1.112	3 300	1.118	3 300
Lithuania	0.992	3 000	1.041	3 100
Bulgaria	1.109	2 900	1.300	3 000
Estonia	1.012	3 000	1.067	3 000
Greece	1.000	3 000	0.847	2 700
Slovakia	0.801	2 150	0.818	2 200
Croatia	0.694	2 100	0.704	2 100
Slovenia	0.560	1 750	0.583	1 750
Luxembourg	0.047	150	0.055	150
Ireland	0.196	100	0.195	100
Cyprus	0.005	<50	0.005	<50
Malta	0.001	0	0.001	0
Total EU	86.032	302 000	88.422	314 800

Source: EurObserv'ER 2014

2

Turnover

	2012		2013	
	Primary energy production trend	Turnover (M€)	Primary energy production trend	Turnover (M€)
Germany	7%	7 525	11%	8 140
France	6%	4 430	0%	4 930
United Kingdom	4%	3 475	-4%	3 475
Sweden	15%	2 745	2%	2 650
Austria	6%	2 550	16%	2 430
Finland	3%	2 280	3%	2 350
Italy	4%	1 180	-2%	2 000
Poland	8%	1 990	-1%	1 900
Spain	0%	1 405	10%	1 600
Romania	0%	1 010	12%	1 225
Portugal	-11%	680	0%	680
Czech Republic	-11%	600	6%	670
Latvia	0%	505	-6%	510
Denmark	-1%	400	5%	450
Hungary	0%	415	2%	425
Bulgaria	17%	300	0%	350
Netherlands	-1%	320	1%	325
Estonia	8%	300	5%	310
Belgium	10%	300	17%	300
Lithuania	1%	290	5%	300
Greece	6%	290	-15%	250
Slovakia	-9%	210	2%	230
Croatia	1%	200	1%	200
Slovenia	-1%	160	4%	170
Ireland	3%	60	16%	60
Luxembourg	3%	15	-1%	15
Cyprus	0%	<5	-6%	<5
Malta	0%	0	-25%	0
Total EU	5%	33 640	3%	35 950

Source: EurObserv'ER 2014

After the golden period from 2005 to 2010 when renewable energies recorded strong energy production and economic growth, their development has slowed down during the recession. In 2013, the renewable sectors generally resisted well and maintained employment and economic activity levels comparable to 2012.

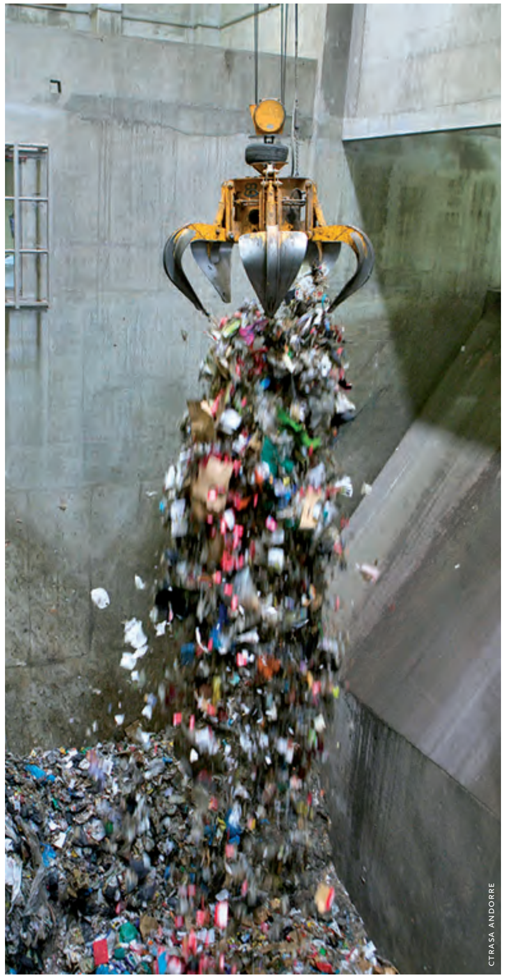
EMPLOYMENT

The downward trend in renewable related employment continued for the third year in a row. With around 1.148 million individuals directly or indirectly employed in EU's renewable energy sector, EurObserv'ER has recorded another decline of around 54 000 jobs between 2012 and 2013. The photovoltaic industry is the sector with the highest job losses (77 000 throughout Europe) and other technologies with weak growth (wind power: which added 7 000 jobs), (biomass: which added 14 000), and heat pumps (which added 4 000 job) were clearly unable to compensate for this further drop. The PV sector is now even more clearly distanced from the largest sectors, namely biomass (312 000) and wind energy (302 000). It is worth noting that biomass took the top position in our account of socio-economic impacts for the first time. Looking at the country distribution, despite heading the table, Germany (363 000 jobs), has also suffered most from the demise of its PV-related workforce (with 40 000 job losses). France is the second largest RES employer (177 000 jobs with 15% of EU total) followed by the UK (99 000) which has moved up a rank, and Italy with 95 000 jobs.

The growth of renewable energy related employment in the EU-28 continues to take a breather, while it is still a significant economic player. The rapid growth rates observed in the first decade of the century currently seem out of reach. New momentum for job creation and growing turnover might emerge from a clearer orientation towards the rapidly expanding international markets of Asia, South America and more recently Africa that are starting to appear on the global renewable energy map. It remains to be seen how far the EU 2030 targets will stimulate the revitalization of renewables. There is no doubt that the revision of the European Emission Trading System (ETS) is quintessential for further market growth ◻

RWE/ANDREAS TEICHMANN

TURNOVER



CTRASA ANDORRE

Total European turnover of all 9 observed RES technologies in the 28 EU member states is estimated to have reached around € 138 billion mark in 2013 which is thus some € 4.8 billion less than in 2012. This reflects the general picture of stagnation in overall investment and installation activities in various sectors as observed in previous years. It is also a market response to budget cuts and revisions of renewable energy support systems. Last but not least, lower turnovers mirror some slight advances in the productivity of RE equipment production and lower average installation prices, as is the case in solar photovoltaics. Turning to the countries, Germany (over € 31 billion) still holds the lion's share of 25% of overall RES-related turnover in the EU but has lost significant parts. France, meanwhile ranks second (€ 17.6 billion and 12%), followed by UK (with € 15.4 billion or 11%), Italy (€ 13.9 billion), and Denmark (€ 12.5 billion).
Whereas the overall momentum of ever-growing markets has come to a halt, the European renewable energy sector still represents a major field of investment. With new 2030 targets and the forthcoming revision of the European Emission Trading System, the picture is not too bleak for the next few years. However the industries have been forced to adapt to new market conditions in the international arena as well as new policy frameworks. ◻

EMPLOYMENT

2013 distribution of employment by sector

	Country total	Solid Biomass	Wind power	Photovoltaic	Biofuels	Heat pumps	Biogas	Small hydro power	Solar thermal	Waste **	Geothermal energy
Germany	363 100	51 600	137 800	56 000	25 600	15 800	49 200	13 100*	12 500	n.a.	1 500
France	176 850	52 500	20 000	26 400	30 000	32 000	3 500	3 850	6 700	650	1 250
United Kingdom	98 700	21 000	36 000	15 600	3 500	7 350	2 800	4 950	800	6 500	200
Italy	95 200	20 000	30 000	10 000	5 000	11 000	4 200	4 500	4 000	1 000	5 500
Spain	60 200	16 000	20 000	7 500	5 000	4 700	500	1 500	4 500	500	<50
Sweden	50 400	27 500	4 500	800	5 000	8 700	300	600	100	2 900	<100
Austria	39 750	18 100	4 500	4 850	900	1 300	500	6 150	2 900	450	100
Denmark	37 500	3 500	27 500	500	1 500	2 500	200	<50	1 200	600	<100
Poland	34 850	19 500	3 000	<50	7 500	650	500	1 000	2 500	<50	200
Finland	32 350	24 350	1 500	<50	1 000	5 000	100	400	<50	<50	0
Belgium	21 250	3 300	3 500	10 000	2 000	500	400	400	500	650	<50
Greece	20 400	2 700	1 400	12 000	700	0	100	1 250	2 100	n.a.	150
Netherlands	19 900	3 300	4 000	6 500	600	2 800	700	<50	300	1 300	400
Romania	18 950	12 500	2 000	2 500	1 000	0	<50	500	250	n.a.	200
Czech Republic	14 700	6 900	250	1 500	2 800	650	1 300	400	800	100	<50
Portugal	14 500	7 000	1 500	750	1 750	850	150	1 700	600	200	<100
Hungary	7 050	4 400	100	<50	600	100	150	450	150	100	1 000
Latvia	6 150	5 200	<50	<50	500	0	100	350	<50	n.a.	0
Bulgaria	5 900	3 000	250	1 500	750	0	<50	400	<50	<50	<50
Lithuania	5 250	3 100	400	700	800	100	<50	150	<50	<50	<100
Ireland	4 700	100	3 500	<50	400	150	100	100	250	100	0
Estonia	4 400	3 000	100	<50	<50	1 300	<50	<50	<50	n.a.	0
Slovakia	4 450	2 200	<50	200	1 000	100	100	250	450	<50	150
Slovenia	3 800	1 750	<50	500	350	600	100	400	100	<50	<100
Croatia	3 400	2 100	400	200	250	0	<50	250	200	n.a.	<100
Luxembourg	700	150	<50	300	250	<50	<50	<50	<50	<50	0
Cyprus	600	<50	<50	200	<50	0	<50	0	400	n.a.	0
Malta	100	0	0	100	<50	0	<50	0	<50	<50	0
Total EU	1 148 050	314 800	302 450	158 900	98 900	96 200	65 400	42 850	41 650	15 450	11 450

** Small and large hydro. ** Direct jobs only. n.a.: non available.* ***Source: EurObserv'ER 2014***

TURNOVER

2013 turnover by sector in millions of euros (€M)

	Country total	Wind	Solid Biomass	Photovoltaic	Biofuels	Heat pumps	Biogas	Small hydro	Solar thermal	Geothermal energy
Germany	31 230	8 470	8 140	5 570	3 700	1 700	1 750	510	1 190	200
France	17 630	2 230	4 930	3 780	3 180	2 140	410	450	430	80
United Kingdom	15 385	6 000	3 475	2 700	660	1 325	450	720	40	15
Italy	13 850	1 200	2 000	2 800	1 150	2 500	2 500	750	350	600
Denmark	12 450	10 780	450	605	280	210	25	<5	90	<5
Spain	6 265	2 000	1 600	400	950	350	65	400	500	0
Austria	5 785	875	2 430	510	345	250	65	1 000	295	15
Sweden	5 605	1 200	2 650	60	750	620	50	250	<10	15
Poland	5 285	2 000	1 900	<5	850	100	70	100	230	30
Netherlands	4 840	1 300	325	2 000	600	400	75	0	50	90
Romania	3 480	900	1 225	1 000	190	0	10	110	20	25
Finland	3 365	350	2 350	<5	200	400	15	40	<5	0
Greece	2 185	175	250	1 350	130	0	25	75	175	<5
Belgium	2 130	950	300	380	310	50	35	15	50	40
Portugal	1 660	350	680	70	260	70	20	150	50	10
Czech Republic	1 650	40	670	300	250	70	150	100	65	<5
Bulgaria	825	100	350	250	<10	0	0	100	<10	<5
Hungary	640	10	425	<5	70	10	20	<5	20	75
Ireland	620	400	60	<5	100	15	15	<5	20	0
Slovakia	600	5	230	20	130	10	20	150	<10	25
Latvia	570	15	510	<5	15	0	15	<5	<5	0
Estonia	545	100	310	<5	<5	110	<5	<5	<5	0
Lithuania	535	75	300	75	55	10	<5	<5	<5	<5
Croatia	485	200	200	20	25	0	<5	<5	20	<10
Slovenia	390	5	170	50	55	50	10	25	10	15
Luxembourg	120	10	15	30	50	0	<5	<5	<5	0
Cyprus	70	10	5	20	15	0	<5	0	15	0
Malta	20	0	0	10	<5	0	0	0	<5	0
Total EU	138 215	39 750	35 950	22 030	14 340	10 390	5 820	4 985	3 680	1 270

Source: EurObserv'ER 2014

INVESTMENT INDICATORS

For the second time, EurObserv'ER presents indicators that shed light on the financing side of RES. In order to show a comprehensive picture, the investment indicators cover two broader aspects:

- the first group of indicators relates to investment in the application of RE technologies (e.g. building power plants) ;
- the second group of indicators shifts the focus towards the development and the production of the technologies themselves (e.g. producing solar modules).

First of all, investments in new built capacity for all RES sectors in all EU member states are covered under asset finance. Asset finance data based on the Bloomberg New Energy Finance (BNEF) data base and covers utility-scale investments in renewable energy, basically investment in power plants.

The second part starts to analyse investment in RE technology by providing venture capital and private equity (VC/PE) investment data as derived from BNEF for all RES for the EU as a whole in order to capture the dynamics of the EU market for new technology and project developing companies.

Then, RES stock indices are presented, that have been constructed by the EurObserv'ER team, which cover the largest European firms for the major RES. This illustrates the situation of publicly traded equity in RE technology producing firms. The data used for the construction of the indices is collected from the respective national stock exchanges as well as public databases (e.g. Yahoo Finance). It should be mentioned that the data on asset finance and VC/PE investment presented in this edition cannot be compared to the data in the previous edition of the State of Renewable Energies in Europe. The reason is that the database evolves continuously. This means that, whenever information on investment deals in previous years is found, it is added to the database to make it as comprehensive as possible. Hence, the investment figures for 2013 presented in last year's edition and this edition naturally differ.

Investment in Renewable Energy Projects

Asset finance covers all investment into renewable energy generation projects at utility scale. It covers the RES-sectors: wind, solar PV, CSP, solid biomass, biogas, and waste-to-energy projects with a capacity of more than 1 MW and investments in biofuels with a capacity of more the one million litres per year. Furthermore, the underlying data is deal-based and, for the investment indicators presented here, all completed deals in 2012 and 2013 were covered. This means that for all included projects the financial deal was agreed upon and finalised, so the financing is secured. Note that this does not give an indication when the capacity will be added. In some cases the construction starts immediately, while in several cases a financial deal is signed for a project, where construction starts several months (or sometimes years) later. Hence, the data of the associated capacity added shows the estimated capacity added by the asset finance deals closed in the respective year. This capacity might be added either already in the respective year or in the following years. Furthermore, a certain amount of the individual deal values are not disclosed. In these cases, estimations (by BNEF) are assigned to the respective projects.

Methodological note

Asset finance is differentiated by three types: *balance-sheet finance, non-recourse project finance, and bonds and other approaches. In the first case, the respective power plant is financed from the balance-sheet of typically a large energy company or a utility. In this case the utility might borrow money from a bank and is – as company – responsible to pay back the loan. Non-recourse project finance implies that someone provides equity to a single purpose company (a dedicated project company) and this project company asks for additional bank loans. Here, only the project company is responsible to pay back the loan and the project is largely separated from the balance sheet of the equity provider (sponsor). Finally, the third type of asset finance, new / alternative financing mechanisms are captured as bonds (that are issued to finance a project), guarantees, leasing, etc. These instruments play so far a very minor role in the EU, particularly in comparison to the US, where the market for bond finance for RES projects is further developed. Nevertheless, these instruments are captured to monitor their role in the EU.*

WIND POWER

Asset finance in utility-scale wind capacity stayed almost constant between 2012 and 2013. Total investments in wind power plants amounted to € 13.6 billion in 2013 compared to € 14.2 billion in 2012, meaning a reduction of 4.5%. The picture changes, however, when looking at the number of projects that decreased by roughly 20% from 354 projects in 2012 to 282 projects in 2013. A direct consequence of this observation is, of course, that the average investment size increased between the years. The average investment in a wind power plant in 2013 was € 48.2 million compared to € 42.2 million in the previous year. A similar trend to the change in the number of projects can be observed for the capacity added. The asset finance deals closed in 2013 translate into an estimated capacity added of 7.09 GW compared to a capacity added of 8.84 GW associated with asset finance in 2012. Relating this notable decrease in capacity added of almost 20% to the almost constant total investments in both years indicates an increase in investment cost per MW capacity. Average investment expenditures per MW were € 1.92 million in 2013 compared to € 1.61 million in 2012.

Comparing the types of asset finance for wind in the EU in 2012 and 2013, the situation stays almost the same across both years. Around two thirds of all investments are financed from balance sheets (68% in 2012 and 65% in 2013) whereas project finance accounts for approximately one third of all investments (32% in 2012 and 35% in 2013). Looking at the number of projects reveals that project finance is generally used for larger projects. In both years, project finance covers only a minor share of all the projects (12% in 2012 and 15% in 2013) and hence these projects are on average larger that the balanced sheet financed wind power plants. Finally, the very minor role of bonds and other asset finance types is very obvious in the wind sector, although a small positive trend can be observed. In 2013, this type of financing accounted for 0.7% of overall asset finance compared to 0.2% in the previous year.

OFFSHORE CAPACITY THREE TIMES MORE EXPENSIVE THAN ONSHORE

Differentiating between offshore and onshore investments allows further insights. In both years, overall investments in onshore wind were larger than in offshore. But in contrast to onshore, there is increasing trend in investments in offshore wind farms. Offshore investments increased by almost 20% from € 3.77 billion in 2012 to € 4.52 billion in 2013. Hence, also the share of offshore in total wind investments went up significantly. While in 2012 the share of offshore investments was 26%, more than 33% of all 2013 wind investments went into offshore wind farms. The associated capacity added rose to a less extent by only 3.5% from 962 MW in 2012 to 996 MW for all asset finance deals closed in 2013.

Taking a closer look at offshore investments reveals significant differences compared to onshore. The most striking difference is the project size. While an average investment in an onshore wind plant was € 33 million (€ 30 million) in 2013 (2012), asset finance deals in offshore amounted to, on average, € 471 million per plant in 2012 and even increased to € 502 million in 2013. Furthermore, offshore capacity is around three times as expensive as onshore capacity. The average expenditure for 1 MW onshore wind capacity was € 1.49 million (€ 1.33 million) in 2013 (2012) compared to € 4.54 million (€ 3.92 million) in 2013 (2012).

Looking at the type of financing for offshore reveals the relatively higher importance of project financing compared to onshore wind projects. Project financing accounted for 58% (54%) of all investments in 2013 (2012). This is not surprising since project financing tends to be applied for large projects. As shown above, offshore power plants require on average significantly higher investments that onshore plants.

1

Overview of asset finance in the wind power sector (onshore + offshore) in the EU member states in 2012 and 2013

	2012			2013		
	Asset Finance - New Built (mln. €)	Number of Projects	Capacity (MW)	Asset Finance - New Built (mln. €)	Number of Projects	Capacity (MW)
Germany	2 555.85	68	1 256.5	4 367.74	70	1 764.0
United Kingdom	3 396.18	83	1 718.9	3 397.37	65	1 566.3
Sweden	1 140.33	22	784.9	1 171.67	19	734.2
France	648.23	33	576.7	1 065.88	39	629.4
Romania	907.66	10	643.6	625.04	7	552.3
Ireland	461.13	13	381.0	515.07	9	380.2
Netherlands	132.61	5	121.7	480.80	1	129.0
Finland	273.11	7	143.4	425.71	12	310.3
Greece	0.00	0	0	382.77	3	37.9
Poland	1 064.44	28	818.9	379.43	9	294.0
Denmark	417.49	23	274.1	338.80	23	321.4
Italy	777.22	24	655.8	232.27	8	199.7
Portugal	579.09	3	362.1	124.34	12	118.0
Austria	314.54	7	280.5	43.57	2	27.0
Spain	479.72	13	373.4	18.64	1	5.0
Czech Republic	19.18	4	17.6	14.55	1	13.8
Belgium	907.75	7	288.8	7.44	1	6.2
Bulgaria	144.38	2	132.5	0.00	0	0
Luxembourg	15.04	2	13.8	0.00	0	0
Total EU	14 233.94	354	8 844.0	13 591.08	282	7 088.4

Source: EurObserv'ER 2014

GERMANY RETAKES THE POLE POSITION FROM THE UK

Looking at the breakdown by major countries, Germany has retaken its pole position in asset financing into wind energy from the United Kingdom. This is mainly due to the significant increase in closed asset finance deals in Germany that almost doubled from € 2.56 billion

GDF SUEZ

in 2012 to € 4.37 billion in 2013. Half of this increase in Germany can be attributed to 2 very large offshore wind farm deals in 2013 amounting to € 2.63 billion which is around € 1.1 billion more investments in offshore than in 2012. In the United Kingdom, where the highest EU-wide wind investments were recorded in 2012, wind investments stayed almost constant at € 3.4 billion. The same trend can be observed in the UK offshore sector, where asset financing amounted to € 1.35 billion in 2012 and € 1.39 billion in 2013. With these high investments, Germany and the UK dominated wind investments in the EU. Both countries together accounted for 42% of all investments in 2012 and even 57% in 2013. The situation is even more pronounced in the offshore sector where 75% of all closed asset finance deals were recorded in the UK and Germany in 2012. In 2013 this share even went up to 89%.

INCREASE OF INVESTMENT IN FRANCE, SWEDEN KEEPS HIGH LEVEL

In Sweden, asset finance stayed on a constantly high level. Total investments in new wind capacity of € 1.14 billion in 2012 and € 1.17 billion in 2013 mean the third highest new investments in wind in the EU in both years. Investments in wind capacity in France totalled € 648 million in 2012, but experienced a major increase to € 1.06 billion in 2013. This means that France ranked fourth with respect to asset finance for wind in 2013.

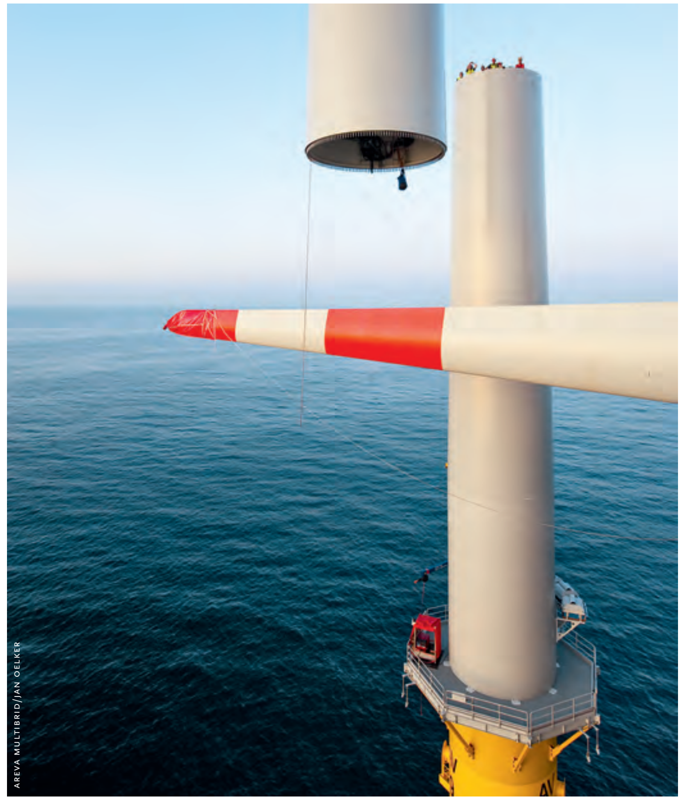
Other success stories of 2013 are Ireland, the Netherlands, Finland, and Greece that all saw increases in asset financing. Particularly noteworthy are the Greek investments of € 383 million in 2013, the 9th highest in the EU, since there were no closed asset finance deals for wind recorded in the previous year. Wind investments also significantly increased in Finland from € 273 million in 2012 to € 426 million in 2013. One striking aspect of Finnish investments is that, while investment increased by around 56%, the associated capacity added more than doubled. In Ireland asset finance increase more modestly by almost 12% to € 515 million in 2013. Since the number of projects decreased from 13 in 2012 to 9 in 2013, this increase was mainly driven by a considerable increase in the average project size. Finally, the asset finance sums in the Netherlands of € 133 million in 2012 and € 481 million in 2013 are difficult to compare. In 2012, total investments are comprised of 5 onshore wind farms whereas in 2013 only one closed asset finance deal for an offshore wind farm was observed.

2

Share of different types of asset finance in the wind power sector (onshore + offshore) in the EU in 2012 and 2013

	2012		2013	
	Asset Finance - New Built (%)	Number of Projects	Asset Finance - New Built (%)	Number of Projects
Balance Sheet	67.93%	88.14%	64.60%	82.62%
Project Finance	31.90%	11.58%	34.67%	15.96%
Bond/Other	0.17%	0.28%	0.73%	1.42%
Total UE	100.00%	100.00%	100.00%	100.00%

Source: EurObserv'ER 2014



AREVA MULTIBRID/JAN OELKER

3

Overview of asset finance in the wind power sector (offshore) in the EU member states in 2012 and 2013

	2012			2013		
	Asset Finance - New Built (mln. €)	Number of Projects	Capacity (MW)	Asset Finance - New Built (mln. €)	Number of Projects	Capacity (MW)
Germany	1 496.10	3	412.0	2 634.36	2	576.0
United Kingdom	1 347.94	3	306.8	1 387.16	5	285.5
Netherlands	0.00	0	0	480.80	1	129.0
Spain	0.00	0	0	18.64	1	5.0
Belgium	823.27	1	216.0	0	0	0
Portugal	104.02	1	27.0	0	0	0
Total EU	3 771.33	8	961.8	4 520.96	9	995.5

Source: EurObserv'ER 2014

REDUCTIONS IN INVESTMENTS IN SEVERAL COUNTRIES

Six European countries with solid asset finance amounts in 2012 faced drastic decreases in asset finance in 2013. This trend is certainly most noteworthy for Italy and Poland, since both countries had very high investments in 2012: € 1.06 billion in Poland and € 777 million in Italy. In both countries, asset finance in wind capacity fell to roughly one third of the previous year's values, namely € 379 million in Poland and € 232 million in Italy. The number of projects fell with the same magnitude in both countries. Other countries facing immense reductions in investments are Spain and Austria, where, in the former, asset finance fell from € 480 million in 2012 to only € 19 million in 2013 and, in the latter, investments decreased from € 314 million (2012) to € 44 million. The situation is similar for Portugal, where investments fell from € 579 million in 2012 to € 124 million in 2013. In Denmark, wind investment decreased in a more moderate magnitude to € 339 million in 2013. In the previous year, investments were € 418 million. Relating Danish investments to the whole EU, however, show that this decrease is still less dramatic compared to other countries. While Denmark had the 10th highest investments in 2013, it was only ranked 12th in the previous year.

The investment sums in 2012 and 2013 are more difficult to compare in the case of Belgium. Belgium certainly saw significant reductions in asset finance. Investment sank to only € 7 million in 2013 (compared to € 908 million in 2012). This drastic difference in investments, however, is due to the fact that there has been a very large offshore investment in 2012, amounting to € 823 million, which is the main driver of the high total investment in 2012. Looking only at onshore investments, that were € 85 million in 2012, the drop in investments is still significant, but less dramatic.

Investments stayed relatively constant at a low level in the Czech Republic: € 19 million in 2012 and almost € 15 million in 2013. Finally, in Luxembourg and Bulgaria, where € 15 million and € 144 million of investments in wind were observed in 2012, no finance deals for wind capacity were closed in 2013. □

4

Share of different types of asset finance in the wind power sector (offshore) in the EU in 2012 and 2013

	2012		2013	
	Asset Finance - New Built (%)	Number of Projects	Asset Finance - New Built (%)	Number of Projects
Balance Sheet	46.19%	75.00%	41.73%	77.78%
Project Finance	53.81%	25.00%	58.27%	22.22%
Bond/Other	0.00%	0.00%	0.00%	0.00%
Total UE	100.00%	100.00%	100.00%	100.00%

Source: EurObserv'ER 2014

PHOTOVOLTAIC

When analysing asset financing of solar PV, two points are particularly important to be kept in mind. First of all, asset financing only contains utility-scale investments. Hence, all small-scale investments as rooftop installations that make up the largest share in PV installations in most of the EU countries are not included in the asset finance data. Hence, for the first time, EurObserv'ER reports EU wide investments in commercial and residential PV installations. This data provides estimates on financing for small-scale PV installations with capacities below 1 MW. Thus, it is complementary to the asset finance data that captures all PV power plants with capacities above 1 MW.

PV INVESTMENTS DROP DRASTICALLY

Asset financing for utility-scale photovoltaic capacity significantly decreased from 2012 to 2013. EU-wide investment in new utility-scale PV capacity totalled almost € 7.6 billion in 2012; the investments in 2013 only amounted to € 3.1 billion. This corresponds to a decrease of 60%. The amount of projects also decreased by 34.08% from 355 projects in 2012 to 234 projects in 2013. The average investment into solar PV power plants dropped notably from € 21 million per project in 2012 to an average investment sum of € 13 million in 2013. Furthermore, the sharp decrease in prices for PV from 2012 to 2013 can be seen clearly in the data. Although asset financing for PV plants dropped by 60%, the associated capacity added fell with a substantially smaller magnitude. The associated capacity added of 2012 asset financing was 3.13 GW compared to 2.23 GW for 2013, which corresponds to a decline by 29%. Relating investments to capacity, the fall in PV prices because particularly obvious. While the average investment per one MW was € 2.42 million in 2012, the 2013 average investment for one MW was only € 1.37 million. This corresponds to a drop of around 43% within only one year.

Looking at the type of asset finance shows that balance sheet financing was the pre-dominant way of financing PV power plants in both years, although its share

1

Overview of asset finance in the photovoltaic sector in the EU member states in 2012 and 2013 (PV plants)

	2012			2013		
	Asset Finance - New Built (mln. €)	Number of Projects	Capacity (MWp)	Asset Finance - New Built (mln. €)	Number of Projects	Capacity (MWp)
United Kingdom	1 139.78	87	485.0	1 732.02	119	1 320.5
Romania	276.67	21	120.0	447.62	34	325.3
France	1 389.88	30	537.7	385.90	27	251.4
Italy	512.69	40	209.1	262.34	16	172.0
Germany	2 962.35	85	1 252.0	163.14	19	112.9
Spain	92.15	10	33.6	38.55	9	32.0
Greece	219.21	22	93.9	15.53	5	11.45
Poland	0.00	0	0	6.65	1	4.0
Czech Republic	5.30	1	2.3	3.98	3	3.3
Austria	0.00	0	0	3.92	1	1.0
Belgium	10.86	2	4.7	0	0	0
Bulgaria	904.82	53	366.9	0	0	0
Denmark	2.57	1	1.1	0	0	0
Netherlands	3.50	1	1.5	0	0	0
Portugal	41.10	1	17.6	0	0	0
Slovakia	2.33	1	1	0	0	0
Total EU	7 563.20	355	3 126.3	3 059.65	234	2 233.8

Source: EurObserv'ER 2014

slightly declined from 75% in 2012 to 68% in 2013. Consequently, project financing gained importance. Its share increased from 24% in 2012 to 32% in 2013. Since project financing only captures 20% (15%) of all projects in 2013 (2012), project financed PV investments are on average larger than those financed from balance sheets. This is not surprising since project financing tends to be applied for large projects. Whereas at least a very minor share of PV investments in 2012 was financed through bonds (0.7%), no projects in 2013 used this type of financing.

The data on small-scale PV investments shows that these installations play a by far more important role in the PV sector. Financing for small-scale PV installations is more than four times higher than asset finance for PV power plants

2

Overview of asset finance in the photovoltaic sector in the EU member states in 2012 and 2013 (commercial and residential PV)

	2012		2013	
	Investment (mln. €)	Capacity (MW)	Investment (mln. €)	Capacity (MW)
Total EU	33 484.48	11 563.55	13 024.35	7 014.52

Source: EurObserv'ER 2014

with capacities more than 1MW. However, also these investments have dropped significantly from € 33.5 billion in 2012 to € 13 billion in 2013. Similar to PV plants, a significant drop in PV costs for small-scale installations can be observed. Although financing declined by 61% between 2012 and 2013, the decrease in capacity added only fell by 40%. Hence, the average installation costs fell notably. On average, € 2.9 million were spent in the EU for 1 MW of small-scale PV in 2012 compared to only € 1.9 million in 2013.

THE UK TAKES THE POLE POSITION

With respect to asset financing for utility-scale investment, the EU shows a rather pessimistic picture. Only in two countries investments in PV power plants increased between 2012 and 2013. The top 2 countries with respect to asset finance for PV are the United Kingdom and Romania. Both countries are as well the two only success stories of 2013 with positive investments trends. In the UK, utility-scale PV investments grew from very high € 1.14 billion in 2012 to the outstanding amount of € 1.73 billion in 2013. These high investments mean that more than 56% of all EU asset financing deals for PV plants can be attributed to the UK. The share is similar for the number of projects as well as the capacity added. This increase in investments catapults the UK from its 4th rank in 2012, to the first ranked and dominant country with respect to asset finance for PV. The total UK asset finance associated with an added capacity of 1.32 GW.

With investments almost doubling from € 277 million in 2012 to € 448 million in 2013, Romania saw the second highest investments in utility-scale PV in the EU in 2013. In that year, asset finance deals for 34 projects were closed in Romania translating into a capacity added of 325 MW. Comparing the added capacities associated with the respective investments in 2012 and 2013 in these top 2 countries reveals how significantly the average investment costs declined in both countries. Both in the UK and in Romania the associated capacity added almost tripled. In comparison, asset financing less than doubled in Romania only grew by around 50% in the UK.

INVESTMENTS FALL IN MOST EU COUNTRIES

Next to other countries that experienced declines in new investments, by far the most striking country is Germany. In 2012 almost 40% of all EU asset financing for PV power plants happened in Germany. Hence, Germany was well ahead of other EU countries with respect to utility-scale PV investments. From 2012 to 2013, asset finance for PV broke down by more than 94% from € 2.96 billion to only € 163 million. This decrease is driven by two effects. The number of projects decreased from 85 projects in 2012 to 19 in 2013. Furthermore, the average project size declined drastically. In 2012, the average project size in Germany was € 35 million compared to only € 9 million in 2013.

The drop in investments is similarly dramatic in France and Bulgaria. In Bulgaria, where € 905 million were invested in PV plants in 2012, no asset finance at all was observed in 2013. In France, PV investments also declined significantly, but less dramatically than in Germany. While asset finance amounted to € 1.4 billion in 2012, only € 386 million were invested in utility-scale PV in 2013. But due to the overall decrease in the EU, France remains the third ranked country with respect to PV investments, which illustrates the overall trend in the EU between both years. Looking more closely at the data for France shows, that this decline was mainly driven by a massive decline in the size of PV plants, since the number of projects stayed almost constant across both years (30 in 2012 and 27 in 2013). Furthermore, the associated capacity added only fell by 53% whereas the total investment fell by 72%.

Major decreases in new investment in solar PV plants could be observed in Italy, Spain, and Greece. In Italy investments fell from € 513 million in 2012 to € 262 million in 2013. In contrast, the associated capacity added in Italy only marginally declined from 209 MW in 2012 to 172 MW in 2013. Even more dramatic are the drops in investments in the other two countries, in particular in Greece, where asset financing slumped from € 219 million in 2012 to only € 16 million in 2013. Although investments also fell significantly in Spain, the situation has actually not changed much when looking closer to the data. Both the number of projects and particularly the associated capacity added barely changed (33.6 MW in 2012 and 32 MW in 2013).

In Poland, the Czech Republic, and Austria small investments in utility-scale PV, ranging from € 3.9 million to € 6.7 million, could be observed in 2013. In two of these, Poland and Austria, no investments were recorded for 2012. In the Czech Republic, however, the 2012 investments in 2012 were higher with € 5.3 million compared to € 4 million in 2013. Finally, there are five further countries (Belgium, Denmark, the Netherlands, Portugal, and Slovakia), where relatively small investments between € 2 million and € 41 million could be observed in 2012, whereas no activity with respect to asset finance was recorded for 2013. □

3

Share of different types of asset finance in photovoltaic sector in the EU member states in 2012 and 2013

	2012		2013	
	Asset Finance - New Built (%)	Number of Projects	Asset Finance - New Built (%)	Number of Projects
Balance Sheet	75.13%	84.23%	68.31%	80.34%
Project Finance	24.13%	14.65%	31.69%	19.66%
Bond/Other	0.74%	1.13%	0.00%	0.00%
Total UE	100.00%	100.00%	100.00%	100.00%

Source: EurObserv'ER 2014

Q CELLS ANDRE FORNER

GEOTHERMAL ENERGY

This technology uses geothermal energy for heating and or electricity generation. Before discussing the asset financing for geothermal plants in the EU, the types of investments included in the underlying data have to be differentiated. The data includes four types of geothermal investments, namely: (I) electricity generation from geothermal energy, (II) district heating, (III) combined heat and power (CHP), and (IV) enhanced geothermal systems (EGS)[1].

Geothermal energy has a strong regional focus in the EU. By far the largest user of geothermal energy is Italy, although other EU countries also use this energy source to a certain extent. In 2013 no investment deals were reported and in 2012 only in three countries – Hungary, Italy, and Germany – asset financing for geothermal power plants has been observed. But this is to a certain extent in line with the potentials for geothermal energy, which are relatively high in those three countries.

The total new investments in 2012 are estimated to lead to an added capacity of 36 MW. The cost per MW is higher € 3.4 million.

Taking a closer look at the types of asset financing, it is striking that all money for geothermal investments in 2012 came from balance sheet finance.

In 2012, the highest new investment in geothermal energy was recorded in Hungary. This investment of almost € 81 million is particularly large when compared to other projects. Further investments in that year were observed in Italy and Germany. In the former, asset financing amounted to € 35 million while the project in Germany was particularly small with less than € 8 million of total investment.

Compared to other technologies, asset financing for geothermal energy is rather low. The fact that there is only potential in certain regions and the rather low incentives for this technology could mean that the investments in the upcoming years might stay low. □

1. EGS technologies exploit geothermal resources in hot dry rocks (HDR) through 'hydraulic stimulation'

1

Overview of asset finance in the geothermal sector in the EU member states in 2012 and 2013

	2012			2013		
	Asset Finance - New Built (mln. €)	Number of Projects	Capacity (MW)	Asset Finance - New Built (mln. €)	Number of Projects	Capacity (MW)
Hungary	80.68	1	11.8	0	0	0
Italy	35.02	1	20	0	0	0
Germany	7.88	1	4.5	0	0	0
Total	123.58	3	36,3	0	0	0

Source: EurObserv'ER 2014

2

Share of different types of asset finance in the geothermal sector in the EU in 2012 and 2013

	2012		2013	
	Asset Finance - New Built (%)	Number of Projects	Asset Finance - New Built (%)	Number of Projects
Balance Sheet	100.00%	100.00%	0%	0%
Project Finance	0.00%	0.00%	0%	0%
Bond/Other	0.00%	0.00%	0%	0%
Total UE	100.00%	100.00%	0%	0%

Source: EurObserv'ER 2014

BIOGAS

When analysing asset financing of biogas, it is essential to characterise the projects that are covered by the data. According to the data base, the following four types of biogas utility-scale investments are tracked: (I) electricity generation (new) – new built biogas plants with 1MWe or more that generate electricity, (II) electricity generation (retrofit) – converted power plants such that they can (at least partly) use biogas (also includes refurbished biogas plants), (III) heat – biogas power plants with a capacity of 30MWth or more generating heat, and (IV) combined heat & power (CHP) – biogas power plants with a capacity of 1MWe or more the generate electricity and heat. In addition to power plants for heating and / or electricity that use biogas, there are also plants that do not produce electricity, but rather produce biogas (bio methane plants) and export it into the natural gas grid. However, the latter are by far the minority in the data. For the 2013 and 2013 data, e.g., there is only one project of that kind was recorded in the whole EU. However, to allow for distinguishing between these two types of biogas investments, two tables are presented, one with asset finance for biogas power plants and one for facilities producing biogas.

BIOGAS INVESTMENTS ALMOST HALVED

Asset financing for utility-scale biogas capacity decreased from 2012 to 2013. EU-wide investment in biogas, aggregating biogas power plants and plants producing and exporting gas into the natural gas grid, totalled € 100 million in 2012, whereas investments in 2013 amounted to € 53 billion. This corresponds to a decrease in new investments of almost 50%. The number of projects, however, stayed constant at 7 projects in both 2012 and 2013. Hence, the average project size of biogas investments declined. While an average investment in a biogas utility was almost € 15 million in 2012, the average project size in 2013 was only marginally more than € 6 million.

Both biogas producing plants were financed from balance sheets. With respect to biogas power plants, project financing is the main type of financing in both years. In 2012, 68% if total asset finance was project financed, whereas the remaining 32% were financed from balance sheets. In 2013, the share of project finance in total investments decreases, but still remains the main type of finance with more than 56%. Balance sheet financing is used for the remaining 44%. In both years, the total investment sum covered by project financing exceeds the respective number of projects. Hence, project financing is used for the, on average, larger projects.

The capacity added associated to the investments in biogas power plants also decreased drastically. While 2012 asset finance is estimated to translate into 155MW, the 2013 investments are supposed to generate new capacity of only 13MW. It is, however, difficult to compare the capacities. The reason is that the Finnish investment in 2012 is an exception, since it is a 140-MW biomass-gasification facility that is connected to an existing coal power plant, where the biogas will be combusted along with coal. Omitting this special facility, investments in biogas plants only decreased slightly from € 48 million in 2012 to € 38 million 2013. The associated capacity added, however, stays almost constant at 15MW in 2012 and 14MW in 2013.

1

Overview of asset finance in the biogas sector in the EU member states in 2012 and 2013 (biogas plants)

	2012			2013		
	Asset Finance - New Built (mln. €)	Number of Projects	Capacity (MW)	Asset Finance - New Built (mln. €)	Number of Projects	Capacity (MW)
United Kingdom	26.74	2	7.5	22.87	4	9.2
Italy	0.00	0	0	9.04	1	3.3
Romania	6.32	1	3.0	6.14	1	1.5
Finland	40.92	1	140.0	0	0	0
France	6.10	1	2.0	0	0	0
Poland	9.34	1	2.4	0	0	0
Total EU	89.42	6	154.9	38.05	6	14.00

Source: EurObserv'ER 2014

2

Overview of asset finance in the biogas sector in the EU member states in 2012 and 2013 (biomethane)

	2012			2013		
	Asset Finance - New Built (mln. €)	Number of Projects	Capacity (m³/hr)	Asset Finance - New Built (mln. €)	Number of Projects	Capacity (m³/hr)
United Kingdom	10.02	1	12 000	14.88	1	n.a.
Total EU	10.02	1	12 000	14.88	1	0

n.a.: not available. Source: EurObserv'ER 2014

SPORADIC INVESTMENTS ACROSS THE EU

A more detailed look at the data reveals two striking points concerning the situation of new investments in biogas plants. New investments are highly irregular across the EU – there are almost no countries with investments in biogas in both years. One exception is the UK that plays an important role in biogas investments in both years. The UK is only country where asset finance deals for bio methane plants that export it into the natural gas grid were observed in 2012 and 2013. Investments amount to € 10 million in 2012 and € 15 million in 2013, respectively.

With respect to biogas power plants, the UK is as well an important player in both years. With asset financing of € 23 million for four power plants in 2013, the UK is responsible for around two thirds of total biogas plant investments in that year. The UK's 2013 investments are estimated to translate into a capacity added of 9.2MW. In 2012, the UK ranked second with investments totalling € 27 million. However, as discussed above, the highest investment in 2012 in Finland is a very special facility that is difficult to compare to the other investments. Total asset financing in the UK translates into a capacity added of 7.5MW.

The country with the second largest investment in 2012 was Italy where asset financing of € 9 million was recorded for one new biogas plant. The final country with an investment of € 6.1 million is Romania. Asset finance in Italy and Romania is expected to translate into capacity of 3.3MW and 1.5MW, respectively.

3

Share of different types of asset finance in biogas sector in the EU in 2012 and 2013 (biogas plants)

	2012		2013	
	Asset Finance - New Built (%)	Number of Projects	Asset Finance - New Built (%)	Number of Projects
Balance Sheet	31.94%	50.00%	43.54%	50.00%
Project Finance	68.06%	33.33%	56.46%	50.00%
Bond/Other	0.00%	0.00%	0.00%	0.00%
Total UE	100.00%	100.00%	100.00%	100.00%

Source: EurObserv'ER 2014

VALTRA/LAURI JOKELA

EWE

In 2012, three other EU members, in addition to the UK and Finland, experienced investments in biogas power plants, namely Romania, France, and Poland. In all of them, asset financing was secured for one project, respectively. Investments were € 9.34 million in Poland, € 6.32 million in Romania, and € 6.1 million in France. The investments in all three countries add up to a capacity added of 7.4MW. Next to the UK, Romania is the only EU country with investments in 2012 and 2013. □

4

Share of different types of asset finance in the biogas sector in the EU in 2012 and 2013 (biomethane)

	2012		2013	
	Asset Finance - New Built (%)	Number of Projects	Asset Finance - New Built (%)	Number of Projects
Balance Sheet	100.00%	100.00%	100.00%	100.00%
Project Finance	0.00%	0.00%	0.00%	0.00%
Bond/Other	0.00%	0.00%	0.00%	0.00%
Total UE	100.00%	100.00%	100.00%	100.00%

Source: EurObserv'ER 2014

BIOFUELS

Biofuels are liquid transportation fuels that include biodiesel and bioethanol. Biofuels differ largely from the other renewable energy technologies, where asset financing is almost entirely defined as investment in power plants that produce electricity (or in a few cases also heat).
For biofuels, the asset financing is investments in plants that produce biofuels. Hence, it excludes producers of biomass that is used as an input for biofuels. According to the data base, the following two types of biofuel utility-scale investments are tracked: (I) Diesel substitutes and (II) gasoline/petrol substitutes. For the first time in this edition, these two types of biofuels are reported separately in two tables.

NOT A GOOD YEAR FOR BIOFUELS

Looking at biofuels a as a whole, aggregating investments in biodiesel and bioethanol plants, a significant drop in asset finance can be observed. While in total € 934 million were invested in 2012, asset financing fell drastically to only € 117 million in 2013. This corresponds to a decrease by almost 88%. In contrast to total asset finance, the number of projects only halved to 4 projects in 2013 and hence the average investment size fell from € 117 million per project in 2012 to only € 29 million per investment. The associated capacity fell by almost two thirds from 1,206 mLpa in 2012 to 441 mLpa in 2013.

The types of financing used for investments in biodiesel and bioethanol in 2012 significantly differ, whereas both biofuels show the same picture for 2013. In 2013, all investments in both biodiesel and bioethanol plants were financed entirely from balance sheets. In 2012, however, both balance sheet finance and project finance are used, but in a reversed magnitude. Investments in biodiesel plants where mainly financed from balance sheets (58% of all investments). The remaining 42% were project financed. As opposed to this, 65% of all bioethanol investments were project financed compared to 35% balance sheet financed investments.

OPPOSING TRENDS FOR BIODIESEL AND BIOETHANOL

Distinguishing between the type of biofuel – biodiesel and bioethanol/-methanol – a significant difference in the investment trends between 2012 and 2013 becomes obvious. In 2012, asset finance for bioethanol production

1

Overview of asset finance in the biodiesel sector in the EU member states in 2012 and 2013

	2012			2013		
	Asset Finance - New Built (mln. €)	Number of Projects	Capacity (mLpa)	Asset Finance - New Built (mln. €)	Number of Projects	Capacity (mLpa)
Italy	0.00	0	0	99.75	1	378.5
Greece	0.00	0	0	10.36	1	39.3
Netherlands	0.00	0	0	4.69	1	17.8
Finland	214.39	2	170.0	0	0	0
France	191.54	2	213.2	0	0	0
Germany	16.21	1	59.5	0	0	0
Total EU	422.14	5	442.7	114.80	3	435.60

Source: EurObserv'ER 2014

2

Share of different types of asset finance in the biodiesel sector in the EU in 2012 and 2013

	2012		2013	
	Asset Finance - New Built (%)	Number of Projects	Asset Finance - New Built (%)	Number of Projects
Balance Sheet	58.33%	80.00%	43.54%	50.00%
Project Finance	41.67%	20.00%	56.46%	50.00%
Bond/Other	0.00%	0.00%	0.00%	0.00%
Total UE	100.00%	100.00%	100.00%	100.00%

Source: EurObserv'ER 2014

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3

Overview of asset finance in the bioethanol sector in the EU member states in 2012 and 2013

	2012			2013		
	Asset Finance - New Built (mln. €)	Number of Projects	Capacity (mLpa)	Asset Finance - New Built (mln. €)	Number of Projects	Capacity (mLpa)
Sweden	0.00	0	0	1.77	1	5
Netherlands	182.91	1	500	0	0	0
Poland	74.03	1	63	0	0	0
United Kingdom	258.83	1	200	0	0	0
Total EU	515.77	3	763	1.77	1	5

Source: EurObserv'ER 2014

NOVOZYMES/ANDREA CAVALLI

plants played the more important role in overall biofuels investments. Of the overall € 937 million, € 422 million were invested in biodiesel plants whereas € 516 million were invested in bioethanol plants. In 2013, biodiesel makes up for almost the whole of asset finance for biofuels with € 115 million, compared to only one small asset finance deal of less than € 2 million for bioethanol. Hence the dramatic fall of biofuel investments between 2012 and 2013 is mainly driven by bioethanol.

In case of both technologies, investment expenditures per mLpa decreased within both years. Bioethanol investment costs decreased from € 0.68 million per mLpa in 2012 to € 0.35 million in 2013. Investment expenditures for biodiesel plants decreased even more from € 0.95 million per mLpa in 2012 to only € 0.26 million per mLpa in 2013. These changes in investment per mLap, however, should be interpreted with caution. The reason is that the data also includes retrofit refineries, e.g., refineries that used to produce petroleum based diesel, but were converted for biodiesel production. For these projects, investments per mLpa are typically significantly lower.

VERY HETEROGENEOUS SITUATION ACROSS THE EU

With respect to the location of asset finance for biofuels, it is striking that for both biodiesel and bioethanol, there is not a single EU country were asset finance deals were closed in both years. The highest biodiesel investments in 2012 could be observed in Finland with two projects of € 214 million in total. In France, investments were at almost the same level. Asset finance deals for two biodiesel plants were closed amounting to € 192 million. Finally, investments of € 16 million could be observed in Germany. In 2013, the overall significantly smaller investments in biodiesel plants happened in Italy, Greece, and the Netherlands. In Italy, the by far largest sum of € 100 million was invested. Asset finance deals in Greece and the Netherlands were significantly smaller amounting to € 10.4 million and € 4.7 million, respectively.

The only asset finance deal for a small bioethanol production plant in 2013 was observed in Sweden, amounting to € 1.8 million. In 2012, the substantially higher investments in bioethanol happened in

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the United Kingdom, the Netherlands, and Poland. Although in each of these countries only one asset finance deal could be observed, the respective investment size is relatively large. The largest investment of € 259 million happened in the UK followed by a € 183 million investment in the Netherlands. The asset finance deal in Poland amounted to € 74 million. □

4

Share of different types of asset finance in the bioethanol sector in the EU in 2012 and 2013

	2012		2013	
	Asset Finance - New Built (%)	Number of Projects	Asset Finance - New Built (%)	Number of Projects
Balance Sheet	35.46%	33.33%	100.00%	100.00%
Project Finance	64.54%	66.67%	0.00%	0.00%
Bond/Other	0.00%	0.00%	0.00%	0.00%
Total UE	100.00%	100.00%	100.00%	100.00%

Source: EurObserv'ER 2014

RENEWABLE URBAN WASTE

Similar to the solid biomass data, the asset financing data on waste-to-energy data includes four types of utility-scale investments: (I) electricity generation (new) – new built plants with 1MWe or more that generate electricity, (II) heat – thermal plants with a capacity of 30MWth or more generating heat, and (III) combined heat & power (CHP) –power plants with a capacity of 1MWe or more to generate electricity and heat. In practice, all the recorded investments in waste-to-energy plants in 2011 and 2012 belong to the categories (I) electricity generation (new) and (III) CHP. The reason for this similarity in the categories among solid biomass, waste-to-energy, and biogas is due to the fact that the underlying data source does not distinguish between the three industries. This disaggregation was done on a project basis. Another element to note is that waste to energy plants burn municipal waste which is conventionally deemed to include a 50% share of waste from renewable origin. This part presents investments related to plants, not to the production of renewable waste they burn.

INVESTMENTS MORE THAN DOUBLE

In contrast to all other renewable energy sectors, asset financing for utility-scale waste-to-energy capacity significantly increased from 2012 to 2013. EU-wide investment in new waste-to-energy capacity totalled € 705 million in 2012 compared to total new investments of € 1.62 billion in 2013. Unlike this significant increase in total investments, the number of projects rose more moderately from 6 projects in 2012 to 8 projects in 2013. Since the number of projects increased less than total asset finance, the average investment into waste-to-energy power plants increased notably. An average investment amounted to more than € 117 million in 2012 and almost doubled to € 202 million in 2013. In line with these changes in asset financing, the associated capacity added rose as well. 2012 investments are associated with an estimated capacity added of 133 MW compared to more than 245 MW in 2013. Relating the capacity added and asset finance for these projects, a marginal decrease of investment costs per MW installed becomes apparent. Investments per MW were € 5.28 million in 2012 compared to € 6.6 million in 2013.

Looking at the type of financing used for investments in waste-to-energy plants, a sharp increase in the importance of project finance becomes obvious. Already in 2012, project finance was used for the majority of investments: 72% of investments were project financed compared to 28% financed from balance sheets. In 2013, the use of project finance even gains importance. 97% of all investments in waste-to-energy plants are using project finance structures. Only 3% are balance-sheet financed. As in the other sectors, the larger investments were financed through project finance, whereas smaller investments were balance sheet financed. Neither investments in 2012 nor in 2013 used bonds or other types of asset finance.

THE UK REMAINS THE DOMINANT PLAYER

The most striking observation concerning asset finance for waste-to-energy is that, while there are three countries with investments in 2013, the UK is the only EU-country where waste-to-energy asset financing was recorded in 2012. But when taking a closer look at 2013, the significance of the UK in investment in waste-to-energy plants in both years becomes obvious. In the UK, € 1.36 billion were invested in six waste-to-energy plants. Hence, the UK almost doubled the investments of 2012. Since the number of projects is the same in both years, the increase in investments is mainly due to an almost doubled project size of € 226 million per plant in 2013. Relating UK investments to the total EU investments shows the dominance of the UK in asset finance in this sector: 84% of all EU wide investments for waste-to-energy plants were observed in the UK.

The other two countries with asset finance for waste-to-energy in 2013 are Finland and France, where investments totalled € 214 million and € 47 million, respectively. In both countries one project was recorded. Compared to the average project size in the UK, € 226 million, and the investment in Finland, the French plant is relatively small. The associated capacities of Finnish and French investments are 78 MW and 17 MW, respectively. □

1

Overview of asset finance in the waste sector in the EU member states in 2012 and 2013

	2012			2013		
	Asset Finance - New Built (mln. €)	Number of Projects	Capacity (MW)	Asset Finance - New Built (mln. €)	Number of Projects	Capacity (MW)
United Kingdom	704.90	6	133.4	1357.29	6	150.0
Finland	0.00	0	0	213.78	1	78.0
France	0.00	0	0	47.41	1	17.3
Total EU	704.90	6	133.4	1 618.48	8	245.3

Source: EurObserv'ER 2014

2

Share of different types of asset finance in the waste sector in the EU in 2012 and 2013

	2012		2013	
	Asset Finance - New Built (%)	Number of Projects	Asset Finance - New Built (%)	Number of Projects
Balance Sheet	27.82%	66.67%	2.93%	12.50%
Project Finance	72.18%	33.33%	97.07%	87.50%
Bond/Other	0.00%	0.00%	0.00%	0.00%
Total UE	100.00%	100.00%	100.00%	100.00%

Source: EurObserv'ER 2014

SOLID BIOMASS

When analysing asset financing of solid biomass, it is essential to characterise the underlying data before discussing the changes in investments in details. First of all, the asset financing for biomass discussed here solely includes investment into solid biomass power plants. Hence, there are no investments in biomass production capacity in the data. The data contains four types of biomass utility-scale investments: (I) electricity generation (new) – new built biomass plants with 1MWe or more that generate electricity, (II) electricity generation (retrofit) – converted power plants such that they can (at least partly) use biomass (also includes refurbished biomass plants), (III) heat – biomass power plants with a capacity of 30MWth or more generating heat, and (IV) combined heat & power (CHP) – biomass power plants with a capacity of 1MWe or more that generate electricity and heat.

FALL OF INVESTMENTS IN BIOMASS

Asset financing for utility-scale biomass capacity decreased from 2012 to 2013. EU-wide investment in new solid biomass capacity totalled € 1.73 billion in 2012, whereas investments in 2013 amounted to € 1.35 billion. This corresponds to a decrease in investments of more than 21%. The number of projects also almost halved from 22 projects in 2012 to 12 projects in 2013. The comparison of associated capacity added in 2012 and 2013 is rather difficult. On the first sight, the difference between 1.47 GW in 2012 and only 282 MW in 2013 seems to be by far too large bearing in mind the investments in both years. The reason for this difference is that, as mentioned above, the data also contains investments into converting existing power plants (e.g. coal) to use biomass. This is the case for two projects in 2012, one in Denmark and one in the UK, that add up to 930 MW. In these cases, the investment expenditure per MW is significantly lower than for new build biomass power plants. But since these also add to the biomass capacity, they are also included in the tables. In the analysis below, however, they will be excluded at certain points whenever it advisable.

1

Overview of asset finance in the solid biomass sector in the EU member states in 2012 and 2013

	2012			2013		
	Asset Finance - New Built (mln. €)	Number of Projects	Capacity (MW)	Asset Finance - New Built (mln. €)	Number of Projects	Capacity (MW)
United Kingdom	626.53	10	702.7	872.48	6	173.3
France	0.00	0	0	461.36	4	99.9
Sweden	627.80	2	282.0	19.19	1	7.0
Belgium	0.00	0	0	1.65	1	2.0
Denmark	74.50	1	300.0	0	0	0
Germany	82.04	3	19.9	0	0	0
Hungary	99.16	1	35.0	0	0	0
Poland	21.25	1	7.5	0	0	0
Romania	48.18	2	89.1	0	0	0
Spain	145.69	2	35.0	0	0	0
Total EU	1 725.15	22	1 471.2	1 354.67	12	282.2

Source: EurObserv'ER 2014

The average investment into a biomass power plant increased from € 78 million per project in 2012 to an average investment sum of € 113 million in 2013. The difference between both years is even larger, if the two converted power plants are excluded, which results in an average investment of almost € 61 million in 2012. Total associated capacity added of new built biomass plants (excluding converted plants), almost halved from 541 MW for asset financing in 2012 to only 282 MW in 2013. On average, the investment for one MW of only new built biomass was € 2.24 million in 2012 and € 4.8 million in 2013.

When it comes to the type of financing of solid biomass investments, a major difference between 2012 and 2013 is obvious. In 2012, the majority of investments, namely 73%, but a significantly smaller share of projects, 36%, were project financed. In the case of balance sheet financing, the situation is, of course, reversed. Only 27% of all investments in 2012 were financed from balance sheets, but almost 64% of all projects. Hence, the size of project financed investments was on average significantly larger than those financed from balance sheet. In 2012, no biomass investments were financed through bonds. In 2013 the share of project financed and balance sheet financed investments is almost identical. Since project finance captures 58% of all projects compared to only 36% for balance sheet financing, the average project size is smaller for project finance deals, which is rather untypical. Finally, almost 7% if all asset finance deals were financed through emitting bonds.

THE UK AND FRANCE DOMINATE INVESTMENTS IN 2013

A more detailed look at the data reveals two striking points concerning the situation of new investments in solid biomass plants. New investments are not only heterogeneous across the EU – there are both countries with partly high increases and decreases in investments – but also within countries – there is only one country with similar investment amounts in 2012 and 2013. Furthermore, in most of the countries, where new investments in solid biomass were recorded, there were one to four projects only. The only exceptions is the UK, where significantly more closed asset finance deals for biomass plants could be observed

Hence, not surprisingly, the highest investments in 2013 happened in the UK, amounting to € 872 million. This is a notable increase compared to the investments of € 627 million in 2012. Leaving out the converted British plant in 2012, however, results in investments of only € 187 million in that year. Hence, when considering only new built plants, asset finance in the UK in 2013 is almost five times higher than in the previous year. Furthermore, also the average investment per new build biomass plant in the UK increased significantly. The average project size (without the retrofit plant) in 2012 was only € 21 million compared to € 145 million per project in 2013. The second highest investments in biomass in 2013 were observed in France, where in total € 461 million were invested. In 2012, however, no asset finance deals were closed. The 2013 investments are associated with a capacity added of 100 MW resulting in an average project size of € 115 million. Finally, a very small investment of € 1.7 million could be observed in Belgium in 2013.

SIGNIFICANT INVESTMENT REDUCTION IN SWEDEN

In contrast to France and the UK, many countries, where finance deals for biomass plants were closed in 2012, saw no investments in 2013. The highest drop in investments could be observed in Sweden. With € 628 million investments, Sweden was leading the board in asset finance for biomass in 2012. Swedish investments fell drastically to € 19 million in 2013. A reason might be that the two plants for which asset finance was secured in 2012 were particularly large amounting to 282 MW of capacity added. But being a biomass country, it is not unrealistic that Swedish investments go up again in 2014.

Further countries with investments in 2012, but no closed asset finance deals in 2013, are Denmark, Germany, Hungary, Poland, Romania, and Spain. In all these countries investments in one to three biomass plants, respectively, could be observed in 2012. The highest investments were conducted in Spain, amounting to € 146 million. Investments in the remaining countries ranged from € 21 million in Poland to € 99 million in Hungary. □

2

Share of different types of asset finance in the solid biomass sector in the EU member states in 2012 and 2013

	2012		2013	
	Asset Finance - New Built (mln. €)	Number of Projects	Asset Finance - New Built (mln. €)	Number of Projects
Balance Sheet	27.14%	63.64%	46.74%	33.33%
Project Finance	72.85%	36.36%	46.36%	58.33%
Bond/Other	0.00%	0.00%	6.91%	8.33%
Total UE	100.00%	100.00%	100.00%	100.00%

Source: EurObserv'ER 2014

CONCENTRATED SOLAR POWER PLANTS

Concentrated solar power (CSP) plants use concentrated sun light to heat a transfer fluid in order to drive power generation equipment. CSP can be differentiated in four different technologies. The most typical technology is parabolic trough. This technology uses parabolic trough mirrors that concentrate the solar heat onto receiver pipes that contain a circulating (heat transfer) fluid. An alternative is the parabolic dish technology, where parabolic dish mirrors concentrate solar heat towards a single point receiver. The third technology is called Fresnel. This technology concentrates light with long, flat mirrors on a linear absorber tube. Finally, the tower and heliostat technology uses a field of sun tracking mirrors (heliostats) that concentrate the heat on a central receiver set on a tower. Due to their specific attributes, CSP power plants are only profitable in very sunny regions. Hence, Spain is so far the only EU-country, where – with few exceptions (mainly prototypes) – CSP power plants are being operated. Given the complete lack of investments in 2013 in this sector in Europe, this situation is likely to last.

In 2012, asset financing for CSP power plants was only recorded in Spain. In 2013, no country reports any deal. In Spain this severe drop is directly attributable to the moratory which cut off all financial aid for Spain's renewably-sourced power plants since 29 January 2012. The 2012 investments will translate into 174 MW of capacity.

As far as types of asset finance for CSP are concerned, in 2012, 82% of total asset finance came from balance sheet finance. Bonds and other types of finance did not play any role in the CSP sector.

The average project size in CSP is striking and supersedes the typical projects in all other renewable energy technologies. This observation shows that CSP power plants need a certain size such that they can be operated in an economically efficient way. Furthermore, the parabolic trough technology is the by far most dominant technology used, which comes as no surprise since it was already the case for the already existing plants. In 2012, in all new investments parabolic troughs were used. The costs per MW amounted to € 5.3 million in 2012. □

1

Overview of asset finance in the CSP sector in the EU in 2012 and 2013

	2012			2013		
	Asset Finance - New Built (mln. €)	Number of Projects	Capacity (MW)	Asset Finance - New Built (mln. €)	Number of Projects	Capacity (MW)
Spain	915.78	4	173.5	0.00	0	0
Total	915.78	4	173.5	0.00	0	0

Source: EurObserv'ER 2014

2

Share of different types of asset finance in the CSP sector in the EU in 2012 and 2013

	2012		2013	
	Asset Finance - New Built (%)	Number of Projects	Asset Finance - New Built (%)	Number of Projects
Balance Sheet	81.59%	75.00%	0.00%	0.00%
Project Finance	18.41%	25.00%	0.00%	0.00%
Bond/Other	0.00%	0.00%	0.00%	0.00%
Total UE	100.00%	100.00%	0%	0%

Source: EurObserv'ER 2014

ONE WORD ON PUBLIC FINANCING

In general, it can be said that public finance institutions play an important role in catalysing and mobilising investment in renewable energy. There are numerous instruments which are used by these institutions which are typically either state-owned or mandated by their national government. The instruments range from providing subsidies/grants, equity to classic concessional lending (loans with favourable conditions) or guarantees. The dominant instrument in terms of financial volume is concessional lending. The loans provided by public finance institutions are typically aimed at projects that have commercial prospects, but would not have happened without the public bank's intervention.

There are a number of public finance institutions providing RES investment support in the EU. These include, but are not limited to, the two European public banks – the European Investment Bank (EIB) and the European Bank of Reconstruction and Development (EBRD) – as well as numerous regional and national public banks such as the Nordic Investment Bank, KfW, Caisse des Dépôts, Cassa Depositi e Prestiti, Instituto de Crédito Oficial.

Investment by public finance institutions for renewable energy projects is generally included in the asset finance data. Although it is more complex to determine details on individual transactions, the lending activities of these banks can shed some light on public finance for renewable energy projects. When looking at the lending of public banks for RES projects, it should be kept in mind that the banks mainly co-finance projects. That means that the projects also receive financing from other sources, e.g. private banks.

As an EU institution the EIB has signed loans for RES projects amounting to € 3.7 billion in 2011[1] and over € 2 billion in 2012[2]. In 2013, EIB increased the funding dedicated to renewable energy to € 6.4 billion[3]. In the case of the EBRD, a multilateral bank focussing on Eastern Europe, the investment volume was about € 0.8 billion[4] and € 0.3 billion[5] in 2011 and 2012 respectively. In 2013, the investment in renewables and renewable-related activities for EBRD rebounded to € 0.79 billion[6].

In the case of the Nordic Investment Bank, lending within its global (not restricted to the EU) "Climate Change, Energy Efficiency and Renewable Energy" (CLEERE) lending facility is reported to amount to about € 1.3 billion and € 1.1 billion in 2011 and 2012, expanding the total loans under the facility to € 4 billion; by the end of 2012 the facility was fully allocated with no additional loans added in 2013 or 2014[7]. KfW's lending for RES projects within its national renewable energy promotional activities add up to total loan commitments for renewable energy projects in Germany of € 7 billion in 2011 and € 7.9 billion in 2012; this figure dropped to € 4.7 billion in 2013[8].

As a general trend the activities by public finance institutions are stable as a whole; as observed from the above, while the investment in renewables decreased for the regional and national public banks, the two European public banks increased/resumed their share in renewable energy investment Meanwhile, public finance institutions are moving towards a stronger focus on using the scarce public funds in order to maximize private investment mobilized; an example is GEEREF, which is initiated by the European Commission in 2006 and advised by EIB that uses seed contributions from the public sector to leverage private capital in RES/EE investment. □

Between 2012 and 2013, EU wide investments in utility-size renewable energy projects have decreased by almost 22%. While in 2012 new investments totalled € 25.3 billion, asset financing was € 19.8 billion in 2013. This decline, however, is significantly smaller compared to the drop in investments between 2011 and 2012. The associated capacity added declined even more by 28% from 13.7 GW in 2012 to 9.9 GW in 2013. This is due to increased investment costs per MW in certain sectors, particularly in the wind sector. In 2013, a significantly higher share of wind investments went into offshore, which has significantly higher investment costs per MW. In spite of this average increase in costs per MW over all RES, there are also sectors with decreasing investment costs. In the PV sector, investment costs per MW decreased by 43%. But due to the magnitude of wind investments (around two thirds of all investments in 2013), the investment cost increase in the wind sector dominates other sectors with decreasing investment costs, as the PV sector.

For CSP and geothermal no asset financing was recorded in 2013. The analysis showed that the majority of renewable energy generation projects are financed from balance-sheets, typically by large utilities. Exceptions are biomass and waste where project financing dominates. In general, project finance is used for a smaller number of projects, these projects, however, tend to be larger. It is unclear, whether new finance instruments, e.g. project bonds, will have a more important role in renewable energy financing in the EU. Up to 2013 bonds play a very minor role in asset finance for RES. □

1. EIB (2011), EIB Activity Report 2011, pp. 21, European Investment Bank; the figure "€ 3.7 billion" is estimated from "Lending for power generation in the EU reached EUR 4.6bn in 2011, with 80% supporting renewable energies" on page 21 of the annual report.

2. EIB (2012), EIB Activity Report 2012, pp. 13, European Investment Bank

3. EIB (2013), EIB Activity Report 2013, pp. 27, European Investment Bank

4. EBRD (2011), EBRD Annual Report 2011, pp. 16, EBRD; the figure "€ 0.8 billion" is estimated from "The bank provided support to the power sector for a total of € 1.2 billion… the support for renewable energy accounted for nearly 70 percent of the Bank's power transactions" on page 16 of the annual report.

5. EBRD (2012), EBRD Annual Report 2012, pp. 30, EBRD

6. EBRD (2013), EBRD Annual Report 2013, pp. 28, EBRD

7. NIB (2012), Nordic Investment Bank Annual Report 2012, pp. 13, Nordic Investment Bank; NIB (2014), Environmental Lending BASE & CLEERE, Nordic Investment Bank, http://www.nib.int/loans/environmental_lending_base_cleere

8. KfW (2011), KfW Annual Report 2011, pp. 43, KfW Group; KfW (2012), KfW Annual Report 2012, pp. 34, KfW Group; KfW (2013), KfW Annual Report 2013. pp.59, KfW Group; the figures indicate the volume of loans within KfW's Renewable Energies Programme.

Investment in Renewable Energy Technology

The EurObserv'ER investment indicators also focus on describing the financing of the developpment and the production of the RES technologies themselves. To this end, they provide an overview of the investments in venture capital and private equity on the one hand, and on the evolution of RES firms listed on stock markets on the other hand.

Methodological note

VENTURE CAPITAL & PRIVATE EQUITY

EurObserv'ER collects data investments of venture capital and private equity funds into renewable energy technology developing firms. Venture capital (VC) focuses on very young start-up companies typically with high risks and high potential returns. Venture capital can be provided to back an idea of an entrepreneur before the business has started. It may be used to finalize technology development or to develop initial business concepts before the start-up phase. Venture capital can be also used in the subsequent start-up phase to finance e.g. product development and initial marketing or the expansion of a business. Basically, venture capital funds finance risky start-ups with the aim to sell the shares with a profit. Private equity (PE) is a type of equity that is not traded on stock markets. Generally, PE aims at more mature companies than VC and can divided into two types. PE expansion capital is financing companies that plan to expand or restructure their operations or enter new markets. While expansion capital is usually a minority investment, PE buy-outs are investments to buy a company. These investments are often accompanied by large amount of borrowed money due to the usually high acquisition costs.
Summing up, venture capital investments target renewable energy technology firms at the start-up phase, while private equity aims at relatively mature companies. While VC investments are typically small, private equity deals are usually larger that VC deals. PE-buyouts are in general the by far largest deals since in such a deal a mature company is acquired. All these investments together shed a light on the activity of start-up und young renewable energy technology firms, while it is essential to distinguish between the typically large PE buy-outs and the other investments when analysing the VC/PE investments in the RES sectors.

RES INDICES

The sectoral indices are intended to capture the situation and dynamics on the EU market for equipment manufacturers and project developers. The methodological approach is to include RES firms that are listed on stock markets and where at least 90% of the firms' revenues were generated by RES operations. Hence, there might be important large firms that are not included in the indices. The reason is that there are numerous (partly very large) companies that produce renewable energy technologies but are also active in other sectors (e.g. manufacturers producing wind turbines, but as well turbines for conventional power plants). These are not included since their stock prices might be largely influenced by their operations in other areas than RES. Furthermore, there is also a large group of small firms that are not listed on stock markets which hence are also not included here. For the sectoral indices, RES firms are allocated if they are only (or mainly) active in the respective sector. The final choice among the firms in each sector is done by the firm size measured in revenues. Hence, the indices contain the ten largest RES-only firms in the EU in the respective sector.

The indices are constructed as Laspeyres-Indices. The aim of a Laspeyres-Index is to show the aggregated price changes, since the weighting is used based on the base values. Hence, firms are weighted by their revenues in the respective previous period. In 2012, the firms are weighted by their 2011 revenues whereas in 2013, the 2012 revenues are applied. So the weighting is adjusted every year in order to keep the structure appropriate. The reason for this approach – in contrast to weighting the firms according to their market capitalisation – is that this approach reflects less the short term stock market fluctuations but rather focuses on long-term developments as it is in this analysis that concentrates on the development of two years.

VENTURE CAPITAL – PRIVATE EQUITY

Venture capital (VC) and private equity (PE) investment in renewable energy fell dramatically by 83% in the EU between 2012 and 2013. Despite this dramatic drop in the total investment sum, the drop in the number of VC/PE deals was less severe by 30%. This indicates that the investments have been on average smaller in 2013: while in 2012 a VC/PE investment was on average € 37 million, it was only € 9 million in 2013. The data of the European Private Equity and Venture Capital Association (EVCA) shows, however, that overall VC/PE investment in the EU (including all sectors) stayed almost constant between 2012 and 2013. Hence, the renewable energy sector seems to be in a more difficult situation at that time compared to all other sectors.

STAGES IN VC/PE INVESTMENT

In order to get a more comprehensive picture on the development of renewable energy technologies, a closer and more disaggregated look at the VC/PE data is necessary. In 2012, the by far largest sums of VC/PE investment could be observed in the wind and in the biomass and waste sector. These high investments, however, are mainly driven by private equity buy-outs, that are investments to buy (a majority of) a RES company and usually imply high investments compared to the other VC/PE deals. In the wind sector, e.g., there are six major PE buy-outs in 2012 amounting to € 843 million. Similarly, also in the Biomass & Waste sectors there are four PE buy-outs of € 809 million in total. Hence, omitting these deals for the time being, the 2012 VC/PE investments in the wind sector are € 136 million and € 24 million for biomass and waste. Hence, it is essential to also compare investments in both years without major PE buy-outs. Since PE buy-outs are purchases of companies or a controlling interest of a company's shares and happen later in the life-cycle of a firm, the remaining VC/PE investments are a better proxy for the innovation activity in the renewable energy sectors.

DR

When the respective RES sectors are analysed below, it is always explicitly differentiated between all VC/PE investments and VC/PE investments without PE buy-outs. Looking at EU wide VC/PE investments without PE buy-outs, that are venture capital and PE expansion capital, investments in 2012 are € 490 million compared to € 300 million in 2013. Hence, the majority of the difference in overall investments between € 2.25 billion in 2012 and € 378 million in 2012 is due to larger PE buy-outs in 2012. But even after omitting PE buy-outs, the data shows a decrease in investments by only 39% between 2012 and 2013.

TECHNOLOGY TRENDS

When taking a more detailed look at the respective renewable energy technologies, the above discussed types of VC/PE investment are important to be kept in mind. Hence, if total VC/PE data is dominated by specific large PE buy-out deals, this will be addressed in the analysis of the respective sectors. Furthermore, it should be pointed out that biomass and waste-to-energy are not disaggregated. The main reason is that there are several companies that received VC/PE funds that are biomass and waste project developers or equipment developers that provide technologies for both biomass and waste-to-energy.

The renewable energy technology with the highest VC/PE investments 2012, wind, has experienced a decisive drop in investments from 2012 to 2013 by € 750 million. But despite this decline, wind kept its VC/PE investment pole position in 2013. As outlined above, the very large investments in wind in 2012 compared to 2013 – as well as most other RES sectors in 2012 – are due to the fact that the sector experienced some large PE buy-outs that amount to € 842 million in 2012. Hence, the decrease in total VC/PE investments can be almost

EUROBSERV'ER – THE STATE OF RENEWABLE ENERGIES IN EUROPE – 2014 EDITION

1

Venture capital and private equity investments in renewable energy per technology in the EU in 2012 and 2013

	2012		2013	
	Venture Capital / Private Equity (mln. €)	Number of Projects	Venture Capital / Private Equity (mln. €)	Number of Projects
Wind	978.65	15	222.27	10
Biomass & Waste	833.60	11	15.81	8
Biogas	186.11	9	14.85	4
Solar PV	96.01	16	74.98	16
Small Hydro	25.84	3	0.00	0
CSP	4.41	1	0.00	0
Geothermal	0.00	0	0.00	0
Biofuels	124.38	6	50.82	5
Total EU	2 249.00	61	378.73	43

Source: EurObserv'ER 2014

solely explained by a reduction of large PE buy-outs. In 2013, one of the ten deals is a PE buy-out amounting to almost € 78 million. Comparing the amounts of venture capital and private equity expansion capital, that is VC/PE investment without PE buy-outs, shows even an increase in investments from € 136 million in 2012 to € 144 million in 2013. Hence, earlier stage investments in renewable energy technology firms kept their magnitude, although all-over VC/PE investments showed a major decline.

Solar PV has experienced the second highest VC/PE investments in 2013. The investment amounts in both years already indicate that there haven't been any major PE buy-outs in both years in the magnitude of what happened in the wind and biomass sectors in 2012. VC/PE investments in PV technology firms and project developers decreased from € 96 million in 2012 to € 75 million in 2013. The number of deals, however, remained constant at 16. Although the deal size declined between the years, solar technology development almost kept its level between both years.

The sector with the third largest VC/PE investments in 2013 is biofuels. While there is a significant drop in total VC/PE investments from € 124 million in 2012 to € 51 million in 2013, the number of deals stayed almost constant. The high investment in 2012 is driven by one large PE buy-out deal amounting to € 107 million. Hence, comparing the remaining VC/PE investments shows an increase of investments from € 17 million in 2012 to € 51 million in 2013.

Overall VC/PE investments in biomass & waste in 2012, amounting to € 834 million, by far supersede 2013 investments of only € 16 million. Similar to the wind and the PV sector, however, the large number for 2012 is mainly driven by large PE buy-out deals. Omitting these four PE buy-out deals of € 809 million in 2012, the remaining 2012 investments, add up to only € 24 million. Although the magnitude is less severe, there is still a decline in VC and PE expansion capital investments in the biomass & waste sector: investments drop by around one third.

The fourth sector with VC/PE investments in 2013 is biogas. Compared to the other sectors discussed above, the case of biogas is easier since in both years no PE buy-outs were observed. VC/PE investments dropped significantly from € 186 million in 2012 to € 15 million. Since the number of deals did not decrease as much, the average VC/PE investment in the biogas sector shrank notable. In 2012, an average investment was almost € 21 million, compared to € 4 million in 2013.

Finally, in two sectors VC/PE investments could only be observed in 2012. These investments were, however, relatively small compared to the other sectors. In the small hydro sector, VC/PE investments of € 26 million were observed compared to only € 4.4 million in the CSP sector.

GERMANY, ITALY, AND THE UK DOMINATE THE MARKET

The top four countries with respect to VC/PE investments amounts and number of deals in 2012 are Germany, the United Kingdom, and France. While Germany experienced the largest overall investments in 2012, the highest amount of deals were observed in the United Kingdom switched their positions. Almost 88% of all VC/PE investments in 2012 happened in these four economies.
The situation substantially changes in 2013. Germany, where the by far highest amount of investments was recorded in 2012, almost did not play a role in 2013 with around 3% of all investments. In contrast, Italy, the UK, and France remain in the top four countries in 2013. The highest VC/PE investments were observed in Italy, namely 30% of all 2013 investments. The second highest VC/PE financing in 2013 happened in Ireland that joins the top four economies in 2013. Finally, it is striking that a significant amount of VC/PE deals were observed in France and the UK, together accounting for around 60% of all VC/PE deals in the EU. The share of VC/PE investments in the top four countries in 2013 is almost 86%. □

RES INDICES

In order to shed some light on the situation of RES technology firms, EurObserv'ER constructed several RES indices. All these indices are normalized to 100 at the base date, on the 1st January 2011, which explains that they start at a different level on the 1st January 2012. The indices presented here are a wind, a solar PV, and a composite bio-technology index. The latter is composed of biofuel, biogas, and biomass sub-indices. The wind and solar PV indices contain the respective ten largest firms that operate solely/mainly in the wind / solar PV sector in the EU. The bio-technology index consists of 15 companies out of which four are biogas companies next to five biofuels and six biomass companies. Since there are only few companies on the stock market per bio-technology sector, a composite bio-index was constructed.

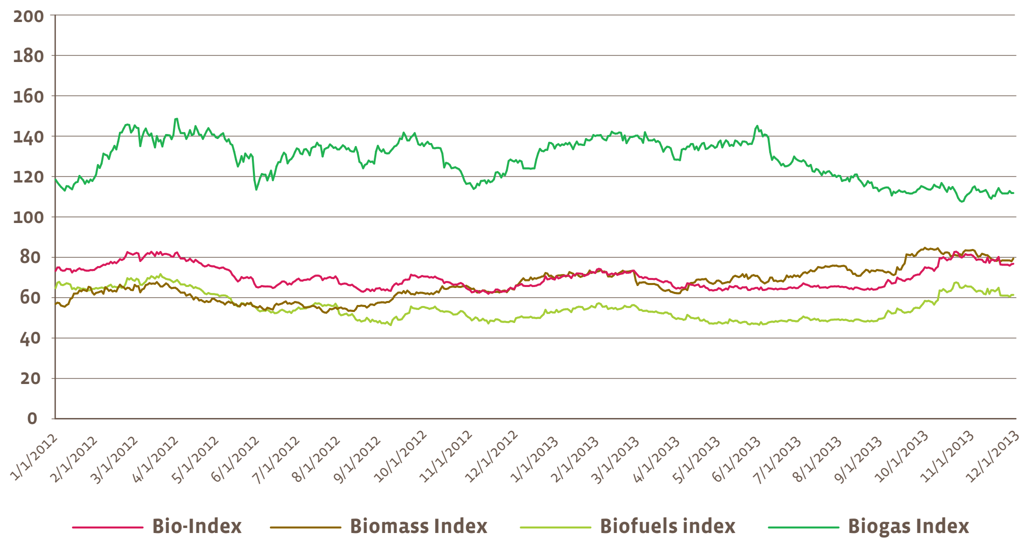
As stock market indices, they are focusing on companies that are listed on stock exchanges. Therefore, entities that are owned by parent companies (e.g. Siemens Wind Power owned by Siemens AG) or limited liability companies (e.g. Enercon) are not reflected. Furthermore, there are numerous companies that are not only active in a RES sector. Examples are Abengoa, a Spanish company that is active in CSP and biofuels, but also in other fields as water treatment and conventional generation and hence does not satisfy the criteria of the RES indices as their revenues are not mainly driven by their activities in the area of renewables.

Compared to last year's edition, some firms in the indices were replaced. One reason for removal was that companies are not listed anymore since they were either bought by other firms or had to file for insolvency. Furthermore, some firms were replaced by others in the indices based on revenues, since the indices contain the respective largest firms based on revenues. An overview of all included companies can be found in the note p. 185. With respect to the regional distribution of biofuels and biogas firms, German companies are dominating. In all three bio indices, French companies are included. In the biomass index, however, half of the firms are French whereas the other half is British firms. The PV index consists of six German firms and one from Spain, Italy, the UK, and Sweden, respectively. The largest company is SMA Solar Technology AG. Finally, the wind index is significantly more heterogeneous with respect to the regional distribution of the companies with the Danish turbine manufacturer Vestas being by far the largest company in the index.

In order to analyse the development of the bio, solar PV, and wind indices, also the STOXX Europe 50 index is captured. The reason for this comparison is to assess how RES companies perform in relation to the whole market. The STOXX Europe 50 is an index that contains the 50 largest companies in Europe. Like the RES indices the STOXX Europe 50 is normalized to 100 at the base date to allow for a better comparability with the RES indices. Since the STOXX is using market capitalization weights, it cannot in every detail be compared to the RES indices. Compared to the total EU market, approximated by the STOXX Europe 50, the bio-index and the PV index have underperformed against the whole market. While the STOXX's close value at the end of 2013 was higher than at the base date – all the bio- and the PV index ended at almost the same value as in the beginning of 2012. The wind index, however, performed significantly better than the STOXX Europe 50 index, particularly in 2013.

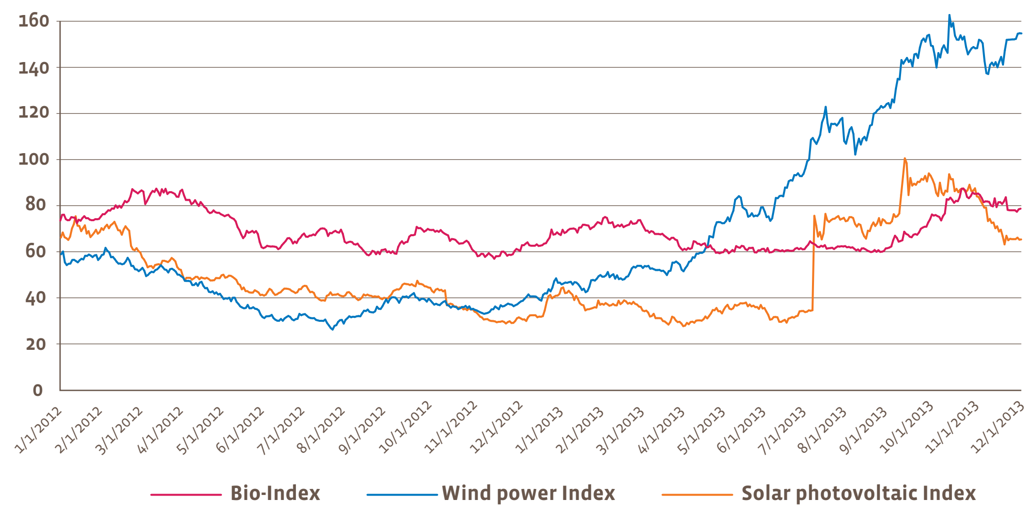
1

Evolution of the biotechnologies indices during 2012 and 2013



2

Evolution of the RES indices during 2012 and 2013

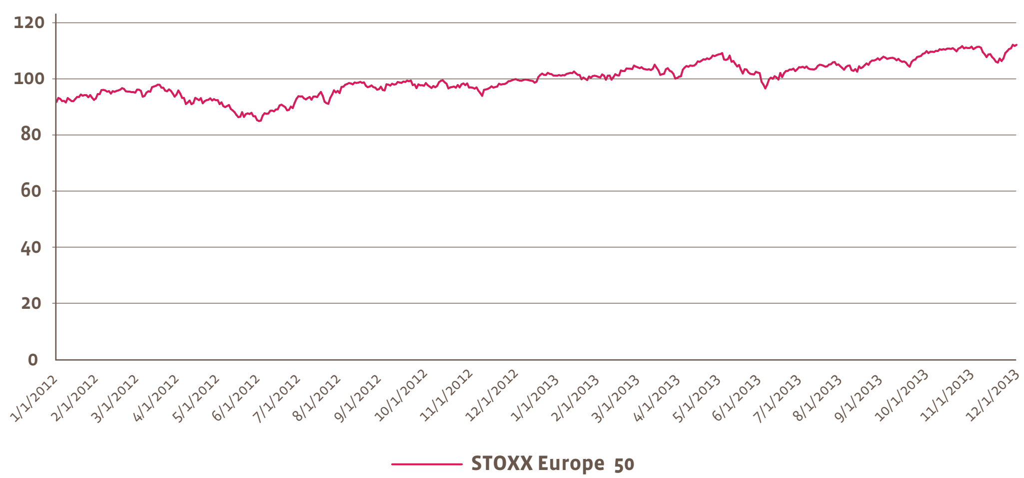


Comparing the three RES indices with each other also reveals interesting differences. The composite bio-technology index does not show any significant positive or negative trend in over 2012 and 2013. In spite of some fluctuations of the two years, the index closes at 78.7 points in the end of 2013 compared to the initial value of 74.2 points in the beginning of 2012. The PV index shows a slightly negative trend until the end of 2012. Afterwards it stays relatively constant around 40 points until the second half of 2013. The leap of the PV index end of July 2013 is driven by one of the largest companies in the index. After the termination of the insolvency proceedings of the company Centrotherm Photovoltaics a conversion of its shares in the ratio of 1: 5 was conducted resulting in a sharp increase of the share price. After a rather volatile period in the last five months of 2013 the index closes at the end of 2013 at almost the same value as it started in the beginning of 2012. In contrast to the other indices, the wind index shows a significant positive trend. Starting in the end of 2012, the wind index constantly increases. At the end of 2013, the index closes at 142.3 which is almost double of the initial value in the beginning of 2012 (74.2 points) and 42.3 points above the value at the base date.

In order to analyse the composition of the bio-technology index, figure 1 displays the bio-technology index and the respective sub-indices. As the wind and the solar PV indices, the biofuels, –gas, and –mass indices were weighted by revenues. The most remarkable point is the heterogeneous characteristics of the sub-indices. The biogas index is the only one that starts and closes above the base value in the observation period. The index dropped by only 7% between the beginning of 2012 and the end of 2013. It is striking, however, that the biogas index seems to be more volatile than the other biotechnology indices. The biofuels index does not show a clear positive or negative trend. Its closing value in the end of 2013, however, is 6% below the initial value in the beginning of 2012. The biomass index fluctuates around its starting value until the end of 2012 when a slight positive trend can be observed that lasts until the end of 2013, when the biomass index closes at 85.9 points. This corresponds to an increase by 50% over 2012 and 2013. It is further

3

Evolution of the STOXX Europe 50 reference indice during 2012 and 2013



noticeable that the composite bio index has a weak positive trend. Furthermore, it behaves similar to the biofuels index. This is due to the large weight of the biofuels index in the overall index. Around two thirds of the revues on the bio-technology sectors are generated by the included biofuels companies. Hence, the bio index is mainly driven by the biofuels sector.

Overall, the RES indices show that the years 2012 and 2013 were not really prosperous for the large listed RES-only companies in the EU. Most indices did not change significantly between the beginning of 2012 and the end of 2013, some experienced small declines while others grew by a small amount. Hence, most RES sectors performed worse than the whole European market, approximated by the STOXX Europe 50 index, which grew by 20% in the observation period. With 112 points at the end of 2013, it closes over the value at the base date, which can be only observed for two RES indices (biogas and wind). The wind sector is a major exception. The wind index increases notably, mainly in 2013, and performs significantly better than all other RES sectors and the benchmark index. A potential reason for the overall difficult business environment for the RES firms might stem from the increasing competition from other providers of the respective renewable energy technology providers outside Europe, notably in Asia. While for well-established technologies the global competition is considerable, Europe might still provide a good environment to develop advanced high-tech-solutions. However, these are frequently not driven by companies listed on stock exchanges. □

1. ***Wind Index:*** *Vestas (DK), Enel Green Power (IT), Suzlon (UK), Gamesa (ESP), Nordex (GER), EDP Renovaveis (POR), Falck Renewables (IT), PNE Wind AG (DE), Energiekontor AG (DE), Théolia (FR)*
Photovoltaic Index: *SMA Solar Technology AG (DE), Solarworld AG (DE), Centrotherm Photovoltaics AG (DE), Roth & Rau AG (DE), Capital Stage AG (DE), Solar-Fabrik AG (DE), Solaria Energia (ESP), PV Crystalox Solar PLC (UK), Ternienergia (IT), Etrion (SWE)*
Biomass Index: *Albioma (FR), Cogra (FR), Active Energy (UK), Weya (FR), React Energy PLC (UK), Helius Energy (UK)*
Biofuels Index: *Cropenergies AG (DE), Verbio Bioenergie (DE), Petrotec AG (DE), Global Bioenergies (FR), Nandan Cleantec (UK)*
Biogas Index: *Envitec Biogas (DE), 2G Energy AG (DE), DTB-Deutsche Biogas AG (DE), Méthanor (FR)*

ON THE WHOLE

Between 2012 and 2013, investments in renewable energy generation projects have dropped. In some RES sectors, however, investments remained relatively stable or even increased. Financing for commercial and residential PV also decreased significantly, although the drop in associated capacity added is far less severe. This shows the cost reductions in the PV sector. In contrast to overall VC/PE investments in Europe, that stayed relatively stable between 2012 and 2013, VC/PE investments in renewable energy technology have declined between these years. The RES indices indicate that the situation of listed RES only companies stabilised in 2012 and 2013.

INVESTMENT IN RENEWABLE ENERGY PROJECTS FALLS

The indicators on investment in renewable energy projects capture asset finance for utility-scale renewable energy generation projects. Combining all RES sectors analysed above, the total investment in renewable energy projects in the EU was € 25.3 billion in 2012 compared to total investments of € 19.8 billion in 2013. However, the situation is quite heterogeneous between the RES sectors. In 2013, there were no asset finance deals in the CSP and geothermal sectors. The highest drop in investments could be observed in the solar PV sector, where investments in utility-scale PV dropped by € 4.5 billion to only € 3 billion in 2013. Another sector that experienced significant drops in investments is the biofuels sector, where asset financing dropped by more than 70%. In the biomass sector, the decline in investments is more moderate. Investments in biomass slipped by 21% to € 1.35 billion in 2013.

HETEROGENEOUS SITUATIONS IN RES SECTORS

In contrast, wind investments stayed relatively stable. In 2013, asset finance for wind power totalled € 13.6 billion which corresponds to a minor decline by 4.5% compared to the 2012 investments. The waste to energy sector is the only sector that has seen a significant increase in investments. Asset finance for waste totalled € 1.6 billion in 2013, which is more than double of the investments in 2012. The renewable energy megawatts installed due to these investments declined by 28% between 2012 and 2013 compared to asset finance that dropped by 22% in this period. This indicates that overall the investment costs per MW increased marginally. This potentially unexpected result is driven by certain sectors, as e.g. the wind sector. Although wind investments slightly declined, the amount invested in offshore increased which drives up the average investments per MW. Particularly in the solar PV sector, significant drops of costs could be observed. In the case of PV power plants, investment costs per MW decreased by 43% between 2012 and 2013. For small distributed PV capacity, costs dropped by 36%.

SIGNIFICANT DROP IN VENTURE CAPITAL & PRIVATE EQUITY INVESTMENTS

VC/PE investment in renewable energy fell dramatically by 83% in the EU between 2012 and 2013. In 2012, the by far largest sums of VC/PE investment could be observed in the wind and in the biomass and waste sector. These high investments, however, were mainly driven by private equity buy-outs, that are investments to buy (a majority of) a RES company and usually imply high investments compared to the other VC/PE deals. Hence, it is essential to also compare investments in both years without major PE buy-outs. Since PE buy-outs are purchases of companies or a controlling interest of a company's shares and happen later in the life-cycle of a firm, the remaining VC/PE investments are a better proxy for the innovation activity in the renewable energy sectors. Looking at EU wide VC/PE investments without PE buy-outs, that are venture capital and PE expansion capital, investments in 2012 are € 490 million compared to € 300 million in 2013. But even after omitting PE buy-outs, the data shows a decrease in investments by almost 39% between 2012 and 2013.

With respect to the regional distribution of VC/PE investments, the situation differs between 2012 and 2013. In 2012, Germany, the UK, and France dominated the VC/PE market. The situation substantially changes in 2013. Germany, where the by far highest amount of investments was recorded in 2012, almost did not play a role in 2013 with around 3% of all investments. In contrast, Italy, the UK, and France remain in the top four countries in 2013.

This decline in VC/PE investments seems to be renewable energy specific. The data of the European Private Equity and Venture Capital Association (EVCA) shows that overall VC/PE investment in the EU (including all sectors) stayed almost constant between 2012 and 2013. Hence, the renewable energy sector seems to be in a more difficult situation at that time compared to all other sectors.

RES INDICES

In order to shed some light on the situation of RES technology firms, EurObserv'ER constructed several RES indices. These sectorial indices are intended to capture the situation and dynamics on the EU market for RES equipment manufacturers and project developers.

Relative to the total EU stock market, approximated by the STOXX Europe 50, all included RES indices showed a marginally lower performance. Most indices did not change significantly between the beginning of 2012 and the end of 2013, some experienced small declines while others grew by a small amount. Compared to the significant drops of all indices in 2011, the situation of listed RES firms seems to have at least stabilised in 2012 and particularly 2013. In contrast, the STOXX Europe 50 index grew by 20% in the observation period.

Comparing the RES indices reveals interesting differences. The composite bio-technology index does not show any significant positive or negative trend in over 2012 and 2013. The PV index shows a similar overall trend. The wind sector is a major exception. It increases notably, mainly in 2013, and performs significantly better than all other RES sectors and the benchmark index.

A potential reason for the overall difficult business environment for the RES firms might stem from the increasing competition from other providers of the respective renewable energy technology providers outside Europe, notably in Asia. While for well-established technologies the global competition is considerable, Europe might still provide a good environment to develop advanced high-tech-solutions. However, these are frequently not driven by companies listed on stock exchanges. □

EXAMPLES OF INNOVATIVE FINANCING SCHEMES

Under the current macro-economic trends in the EU it is difficult for public budgets to secure funds for the further support of renewables. Thus, the so far abundant support system for renewables (mainly in the form of feed-in-tariffs and quota systems) has been drastically downturned. In many EU countries, companies are trying to find alternative ways to secure financing for their renewable energy projects. However, it has to be noted that the withdrawal of public support did not cancel the EU's green ambitions, therefore, new ways of attracting private capital for the realisation of green energy goals have to replace the old schemes. The finance and investment gap needs to be filled by the private sector, by new business and financing models.

It takes effort to convince the market actors to mobilize their accumulated financial resources for the development of renewables. Perception of risk is the most important factor impeding such investments, however, good news is that there is already a significant number of good practice examples, in this chapter we describe some of them. The private capital was mobilised by pensions funds (Pension Fund Denmark), local citizens (energy cooperatives and Solar25 local buyers of green electricity in Germany), by public and semi-public companies (a joint venture between a region and energy utility in France and the public real estate company in Austria). Innovative financing mechanisms are likely to play an increasingly important role in the allocation of risk among different investor classes and help mobilize investments for new green energy projects in the future.

ENERGY COOPERATIVES

CITIZEN INVOLVEMENT IN RENEWABLE ENERGY FINANCE

In Germany, an increasing involvement of citizens in renewable energy investments can be observed. In 2012, almost 50% of the existing renewable energy capacity was owned by citizens, e.g. private persons, farmers, or energy cooperatives. Hence, the renewable energy market substantially differs from conventional energy generation that is dominated by energy utilities.

There are different concepts of citizen contribution to renewable energy. Citizens can act as investors. Numerous regional banks offer green savings certificates. All the funds generated through these certificates are invested in regional renewable energy projects. A more direct option for citizen involvement are energy cooperatives. Generally, a cooperative is an association of natural or legal persons whose goal is the economic or social advancement of its members through a joint business operation. Activities of energy cooperatives often involve the establishment and operation of renewable energy production facilities or the participation in such systems. Citizens can become members of an energy cooperative by acquiring a share and receive dividend payments. The number of registered energy cooperatives in Germany grew from 136 in 2008 to 888 in 2013.

INNOVATIVE FINANCING MECHANISM – ENERGIEGENOSSENSCHAFT ODENWALD

One of the major challenges for the large-scale deployment of renewable energies is the substantial amount of required investments. Furthermore, renewables to some extent lack public acceptance which increases the risk of public opposition at the planning and permitting stages of renewable energy plants or the required transmission lines. A potential solution to these two challenges is citizen participation through energy cooperatives.

A primary example is the Energiegenossenschaft (energy cooperative) Odenwald (EGO) founded in 2009. Starting with 205 members and a balance sheet total of € 1.5 million at the end of 2009, the EGO had, at the end of 2013, 2515 members and a balance sheet total of € 37.6 million. With the capital of participating citizens, the EGO has installed more than 30 MW of capacity in the region. In addition to its engagement in renewable energy generation, the EGO developed the so called "Haus der Energie" (house of energy). It serves as a business park with office spaces for local companies and as a competence centre for renewable energy and energy efficiency in building. For its engagement for renewable energy, the EGO was awarded the German Solar Prize in 2013.

REPLICABILITY POTENTIAL

The general concept of citizen involvement in renewable energy financing has a high replicability potential, since it can be organized in quite a flexible manner. Next to cooperatives, there are other models of citizen participation frequently used in Germany, as GmbH & Co KG (hybrid of limited private partnership and limited liability company), that is often used for citizen wind parks in Germany. In other EU countries, as the UK or Denmark, energy cooperatives play an increasingly important role. One main advantage of citizen contribution in renewable energy deployment is the increased acceptance and hence a lower risk of resistance against renewable energy projects. A potential challenge for energy cooperatives is the planned replacement of the feed-in tariff by competitive procurement and bidding. This might negatively affect the success of citizen participation models that, among other things, profited from the high degree of investor protection offered by the feed-in tariff system. □

SOURCES:
- *www.trendresearch.de*
- *www.unendlich-viel-energie.de*
- *www.energiegenossenschaft-odenwald.de*
- *www.eurosolar.de*

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PENSIONDANMARK

NATURE OF THE FINANCING MECHANISM

Pension funds have large amounts of funds at their disposal. At the same time, the funds have to guarantee a certain return to their investors, which rely on the secure management of their invested money. As the committed funds are to be invested long-term, renewable energy projects with lifetimes of up to 30 years or more match the fund's investment horizon fairly well. Once the projects are set-up and running the reliable generation of stable cash flows moreover appears attractive to the investment model of pension funds. As renewable energy markets in most countries are marked by a high degree of government regulation, pension funds feel comfortable with this sort of projects. The involvement of these investors in renewables hence seems to be a reasonable step. However, comparatively high perceived risks in the initial stages of the technologies led to hesitation by the funds. With the development of a more comprehensive track record for technologies, such as on- and offshore wind and photovoltaics, the former skepticism appears to fade. In this process successful examples from one of the first-moving countries in renewable energy development contributes to more appreciation of suchlike projects as investment targets for pension funds.

INNOVATIVE FINANCING MECHANISM - PENSIONDANMARK AS FRONTRUNNER IN SUSTAINABLE ENERGY FINANCING

Denmark can justifiably be declared the birth place of wind energy application for electricity generation purposes. Whereas other countries started wind energy development in the late 90's or the beginning of the new millennium, the technology has for a long time been developed and applied in the Scandinavian country. As a consequence, there are a number of companies with special expertise in the sector. Most popular examples certainly include the major wind turbine manufacturer Vestas Wind Energy Systems or the utility DONG Energy, which is world-leading in offshore wind development.

It is therefore no surprise that Danish pension funds are amidst the first-movers in renewable energy financing. One of the primary examples is the pension fund PensionDanmark, which started its involvement in renewable energies in 2010. The fund was established as industry-wide pension fund in the early 1990's and has more than 640,000 members as of today. Total assets amount to approximately € 20bn with fast projected growth rates. To date, PensionDanmark has invested approximately $ 2.4bn in infrastructure project, of which the majority are renewable energy projects. The below tables provides an overview of the investments undertaken until today.

1

Renewable energy investment by PensionDanmark

Year	Project name	Description	Investment amount
2014	DolWin 3	Offshore wind grid connection in Germany	€ 384m
2013	UK Wind Farms	Six wind farms in Wales and Scotland	$ 240m
2013	Biomass	JV with Burmeister & Wain, which will build biomass power plants internationally	£ 120m
2013	Cape Wind	Offshore wind farm in the USA	$ 200m
2012	US Wind Farms	Three onshore wind farms in the USA	n/a
2011	Anholt	Offshore wind farm in Denmark	$ 680m
2010	Nysted	Offshore wind farm in Denmark	$ 130m

In addition to the presented investments, PensionDanmark committed DKK 200m (approx. € 27m) in the Danish Climate Investment Fund, which invests in renewable energy and climate change mitigation projects in developing countries.

The pension fund aims to increase investments in infrastructure to 10 per cent of total assets. Due to that ambition PensionDanmark plans to invest a further 1.5 billion $ in infrastructure over the next four years. Most of these investments will be in energy-related infrastructure. Therefore, PensionDanmark committed € 970m to a fund managed by the newly established investment management company Copenhagen Infrastructure Partners in 2012. Moreover, € 382m were committed to a fund solely investing in the offshore wind grid connection DolWin3.

The fund's CEO Torben Möger Pedersen highlighted the attractiveness of renewable energy investments to the company in connection with the investment in six wind farms in the United Kingdom: "Our investments in different types of infrastructure ensure our members an attractive and inflation linked return for many years. The investment in the six UK wind farms is an important element in this strategy with Falck Renewables as a very strong partner in European wind."

Besides PensionDanmark, other Danish pension funds are also active in renewable energy projects to a varying degree. The funds include: ATP, PKA, PBU, Sampension. Moreover, the Danish export credit agency EKF has a significant commitment level in Danish exports related to renewable energy projects and provides funding for certain types of projects (e.g. offshore wind farms). On 2 October 2014, Copenhagen Infrastructure Partners announced the launch of a new fund, Copenhagen Infrastructure II K/S, where PensionDanmark is also one of eight Danish institutional investors that have in total committed DKK 8 bn € 1.05 bn. This fund will be active in Northern and Western Europe as well as North America and focus on investments as, among others, wind and biomass power as well as investments in the electricity grid.

REPLICABILITY POTENTIAL

In the current low-yield environment, pension funds all over the globe are looking for attractive investment opportunities. More and more of them identify renewable energy projects as potentially profitable investments. The example of PensionDanmark is thus being replicated in some cases with e.g. pension funds in Canada or Germany venturing first renewable energy investments. However, pension funds and other institutional investors, such as insurance companies, still bear a considerable potential for the provision of supplementary funds for projects. □

SOURCES:

- *www.ifu.dk/en/services/the-danish-climate-investment-fund*
- *www.pension.dk/en/english/Investments/Investments-in/Infrastructure*
- *www.renewableenergyworld.com/rea/news/article/2014/04/pension-funds-hold-a-key-to-renewable-energy-finance*
- *www.cipartners.dk*
- *www.ccap.org/assets/PensionDanmark.MogerPedersen.Roleof-PensionFundInREInvestments.pdf*

INTEGRATED ENERGY CONTRACTING (IEC) IN STYRIA, AUSTRIA

NATURE OF THE INNOVATIVE FINANCING MECHANISM

The underlying principle of the Integrated Energy Contracting (IEC) is the integration of both energy efficiency measures and renewables to achieve the climate protection goals: any (renewable) supply should first of all focus on energy efficiency by evaluating all possible demand-reduction opportunities. The remaining energy demand is supplied as efficiently as possible from renewables.

« We believe that there is great need for action in terms of energy efficiency. The potential [in energy savings] must be used much more than before. The remaining should be covered by renewable sources. » States Bernd Stampfl, Sales Energy Efficiency, Building Technologies, Siemens AG Austria.

The IEC combines two already well established ESCO financing mechanisms. i.e.: Energy Supply Contracting (expressed in MWh of energy supplied i.a. by heating and cooling from renewables) and Energy Performance Contracting (expressed as NWh saved i.a. by energy management, new HVAC[1], lighting, insulation and induction of behavioral changes) in one investment.

CASE STUDY APPLICATION

The IEC model was developed by Graz Energy Agency (consultant) and the real estate company of the region Styria: Landesimmobiliengesellschaft Steiermark (LIG Styria, an investor). LIG, the investor was founded in 2001. LIG is a state-owned real-estate holding and management agency of the regional government of Styria (100% owned), Austria. LIG is managing some 420 buildings in Styria; about 200 of these, (> 600,000 m²) are owned by LIG. The original motivation of LIG was to substitute renewable energy sources for heating oil wherever possible.

LIG Styria has performed a number of IEC-projects in the years 2007-2012. The Graz Energy Agency supported the investor, by organizing 3 pools for tenders. The IEC model has been implemented in 10 buildings with different size and usage (conference hotel, schools, home for the elderly, office buildings). The outsourced heat supplies have been switched from fossil to renewable fuels and various energy efficiency measures have been established (controls for lights, solar thermal collectors, optimization of heat distribution, etc.). In total 790 thousand € were spent with 17-31% heat savings, 5-12% electricity savings and 90% of CO_2 reduction levels due to replacement of fossil fuels with renewables, prevailingly biomass boilers and solar thermal collectors.

Closure of a contract for IEC is proceeded by a tendering procedure, which is negotiated as defined in public procurement law, with the following criteria for the project-cycle: 1. The lowest cost for energy supply 2. The lowest CO_2 emissions 3. The highest energy cost savings through demand-side saving measures proposed by the ESCO. The IEC contract is awarded for 15 years. An integral part of the IEC contract is the quality assurance plan (additional requirements of the contract, i.e. detailed procedures at the stages of planning, commissioning, auditing, proof of function, performance measurement, handover). The national subsidies (30%) by the Kommunalkredit Public Consulting (KPC) were made available for public customers, if energy efficiency measures were implemented through contracting concepts.

One of the investment realized under the IEC, with LIG Styria as an investor scheme was a regional care center for eldery people in Bad Radkersburg, located at the feet of the southern side of Weineberge mountain.

« Styria has set a goal to reduce greenhouse gases in 2008 through the replacement of heating oil to renewable heat in the nursing home for elderly persons in Bad Radkersburg and in parallel to introduce energy efficiency measures in the areas of heating, water and electricity. » states Alfred Scharl, Head house engineering at the LIG

The dwellers are 28 elderly persons and 100 caretakers. The building was constructed in 1964, and refurbished under the IEC contract in 2010. The investment costs amounted to 340.000 €, expected profit after 15 years contract has been estimated at 260.000 €. At the supply side (MWh) 8 MW biomass district heating network supplies this site with space heat, of which 500 kW (in the future reduced to 320 kW) is dedicated only for this site. At the same time 143 m² of solar collectors and 3,000 liters storage covers the demand for hot water. Heat demand was reduced by 35% (364 MWh/a) and electricity demand by 12% (51 MWh/a), which is to be proven by a dedicated auditing procedure.

« The contract period is 15 years. This is sufficient to guarantee the project's profitability. » States Bernd Stampfl, Sales Energy Efficiency, Building Technologies, Siemens AG Austria.

REPLICABILITY

The implementation of the future EPC supposes that subsidies are obtained to lessen the high initial investment costs □

SOURCES:

- www.eesi2020.eu
- www.nachhaltigwirtschaften.at
- www.iea-retd.org
- www.grazer-ea.at
- www.intendesign.com
- www.energie-bau.at
- www.technik.steiermark.at
- www.soziales.steiermark.at
- www.cee.siemens.com
- www.stadtbadradkersburg.at

1. Heating, ventilation and air-conditioning.


ENERGIEGENOSSENSCHAFT RITTERSDORF EG

SOLAR25 REGIONAL TARIFF

CASE STUDY APPLICATION
Solar25 regional tariff is a product offered by the company Grünstromwerk in two German regions: Mittelthüringen and New Nordoberpfalz, the next one is expected in Hesse. Green electricity is sold both to private and commercial customers as a product of Grünstromwerk with an outstanding feature – local product. Solar energy without governmental support is purchased directly from the producer, sold to customers in its vicinity. The exceptional feature of the product is the guarantee of the local production: at least 25% of green electricity is produced locally. It gives new customers a feeling of not only doing something for the environment in the global sense but also of becoming supporters of regional economic development. New PV projects are developed where there are enough customers- at least 1000 for a new PV plant (local expansion guarantee).

The product guarantees that at every moment, the custumers' consumption is covered by an equal injection of Norwegian hydroelectricity or local German photovoltaic electricitiy into the grid. The electricity is bought by Grünstromwerk directly from the PV producers without intermediaries. One of the green energy producers participating in the scheme is the Energy Cooperative Rittersdorf, founded at the beginning of 2013. The PV farm is located on a former landfill site, has the capacity of 1.5 MW with 17 000 modules, and producing 1,5 GWh per annum. The investment costs were € 1.7 million. The contract details between Grünstromwerk and energy producer remain secret.

NATURE OF THE INNOVATIVE FINANCING MECHANISM
Solar25 regional tariff allows to realize new renewable energy investments regardless of the political climate, electricity is supported by means of a special tariff without any support from the national feed-in tariff (FIT) scheme, guaranteed under the German Renewable Energy law (EEG). PV power plants producers do not get the EEG feed-in tariffs. Energy cooperatives receive no FIT and thus have to be compensated for the risk they take. The reimbursement height is negotiated. However, PV power has become an attractive commodity: generation costs have fallen from 56,7 c€ kWh in 2003 to 14,9 in 2013.
« PV plants are often criticized for their expansion geared by maximization of feed-in tariffs. Decoupling of the electricity market from the demand for power is indicated as a consequence (...). With Solar25 we want to make PV independent of the EEG remuneration and integrate them in the market. In order to convince the producer we have to offer a more attractive price than the EEG, it makes the whole thing expensive. We manage to offer attractive prices to customers by providing 25% of regional PV power and the rest from hydropower. » States Tim Meyer, Grünstromwerk CEO. Cited in PV-magazine.de.

The new elements of the innovative scheme, which are planned for the future are i.a. inclusion of wind parks in the scheme as well as power purchase agreements for renewables located in the vicinity of big customers.

REPLICABILITY
The idea is perceived as innovative in Germany and it was apprised by the PV Magazine as the "Top Business Model" award winner (2014) for the most innovative PV business models in Germany.
It has to be noted that its existence is conditioned to the availability of a cheap hydroelectricity which allows to cover the remaining 75% of consumption. □

SOURCES:
- *www.pv-magazine.de*
- *www.gruenstromwerk.de*
- *www.faz.net*

ESTER, THE SEMI-PUBLIC COMPANY

A JOINT VENTURE BETWEEN A FRENCH REGION, A LOCAL UTILITY AND A MANUFACTURER

ESTER that stands for Electricité Solaire des Territoires (Solar Electricity for local Territories), benefits from a solar energy development support mechanism. It was founded on the basis of a partnership between Solairedirect, a manufacturer and operator of photovoltaic installations, the Poitou-Charentes region and Sorégies and Séolis, two local utilities (for the departments of Vienne and Deux-Sèvres). The concept was the brainchild of Solairedirect in 2011 in reaction to the December 2010 moratorium on photovoltaic Feed-in Tariffs and took form during the course of the year as the semi-public company ESTER was set up. The first PV solar plant to emerge from this initiative, TIPER 3, with 8.7 MWp of capacity was commissioned early in December 2014. Construction of another facility, TIPER 1, with 10.8 W of capacity is underway on an adjoining plot. Incidentally the TIPER solar plants are located on disused military land and are at the heart of an ecosite project with educational bent. Séolis has entered into a contract with Solairedirect to purchase the electricity produced by TIPER 3 for 30 years.

AN INNOVATIVE BUSINESS MODEL

ESTER is a semi-public company owned 65% by the Poitou-Charentes region and 35% by Solairedirect. The region had many good reasons to take up this stake – to develop its local photovoltaic production capacities, gain from the resulting positive socio-economic impacts, build on its assets and make a return on investment. The local utility, for its part, wanted to secure its electricity supplies at below the wholesale market price for 10 to 15 years. The following principle applies: ESTER takes shares in a project company that includes the power plant operator and possibly other shareholders. The project company sells electricity to the local utility, Séolis in TIPER 3's case, according to the terms of the framework contract signed with Solairedirect. The solar power purchase agreement (SPPA) stipulates that the sale is made in two phases – firstly via a Feed-in Tariff contract (local utilities are entitled to enter Feed-in Tariff contracts) then as soon as the wholesale price exceeds the Feed-in Tariff, the electricity is sold at market price. In the second phase, the sale price to the local utility confined by floor and ceiling prices will be indexed to the wholesale market price minus an undisclosed discount. This arrangement enables the project company to set its banks' minds at rest about the potential risk and the local utility to restrain the impact of market price fluctuations. The Phase I maximum term is for 20 years, which equates to the Feed-in Tariff term (c.f. graph no. 1). However the Feed-in Tariff curve may intersect the wholesale market price before the 1st phase term expires, which Solairedirect assumes will happen.

A REPRODUCIBLE SETUP

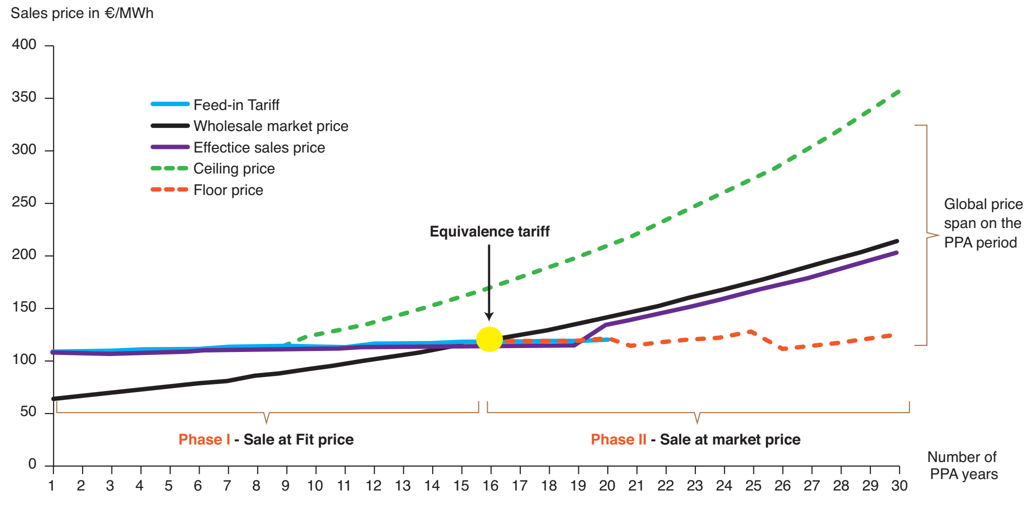
In this model, entering a 30-year term contract, securing low-cost finance and the efforts made by Solairedirect all along the value chain to reduce the investment costs mean that it can operate at the currently very low Feed-in Tariff rate applicable to PV solar plants. Recent successful tender bids in France for new plants specify a much higher purchase price. This particular application was also helped by the region's fund set up in 2011 to support PV development projects, which contributed 9% towards the TIPER 3 plant (intervention is capped at 10%). The advance from the region becomes repayable once the banks have been paid off, which smoothes out the debt without depressing shareholders' revenues during the first years. But as a regional official reminds us, "The absolute prerequisite, is to find a purchaser ready to buy electricity for 30 years. In TIPER 3's case it is Séolis." □

SOURCES:

- www.poitou-charentes.fr/ester
- www.solairedirect.com
- www.territoires-energie-positive.fr
- www.tiper.fr

1

Evolution of the sales price of the photovoltaic electricity



Source: Solairedirect

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CONCLUSION

The five analysed case studies show a broad spectrum of new approaches to innovative financing schemes in the renewable energy sector, however, they could be found only in mature RES markets, in the western part of the EU. Most of the described innovative financing mechanisms targeted the green electricity market, with one example of application of the new business model to the heating sector (Integrated Energy Contracting in Styria, Austria).

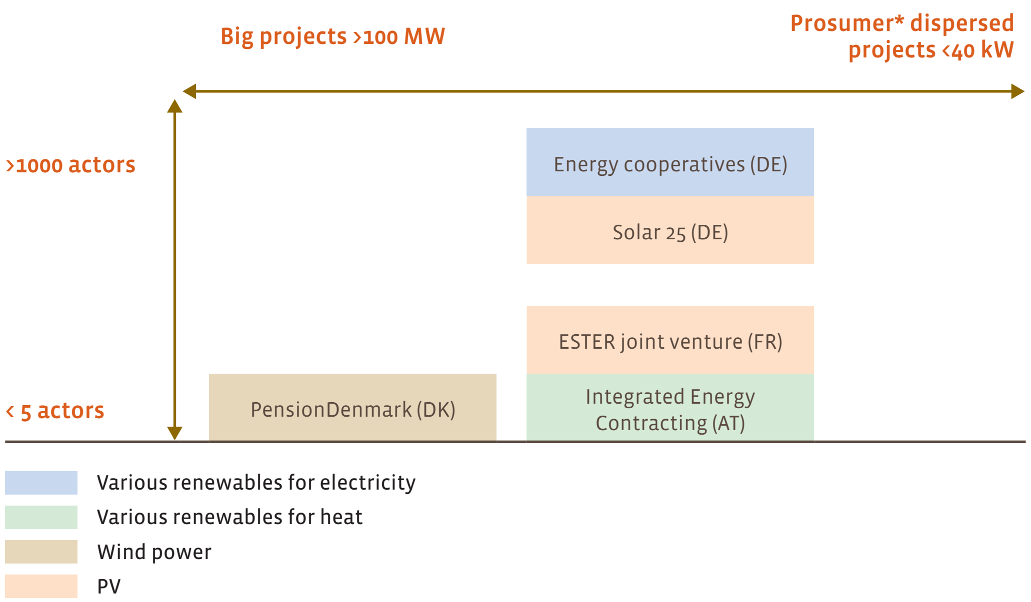
The schemes mobilised financial resources of various actors, starting with the PensionDenmark, which decided to dedicate 10% of its total assets in the future to big infrastructural projects related to green power (mainly wind). Other projects were much smaller below 30 MW of total capacity but involved numerous actors such as the Odenwald energy cooperative (Germany), which boasts c. 2.5 thousand members and has operated various technologies: wind, PV, biomass cogeneration and hydro power. Unfortunately, no innovative schemes were identified for the smallest, prosumer dispersed technologies (below 40 kW).

In all cases the alleviation of investment risk was stressed, for example in the French PV case the project financing period was prolonged to as long as 30 years.

The applicability of some schemes will have to be adjusted to the future market conditions that will be brought about by the changes in current policy schemes in the EU member states (e.g. by the discontinuation of FIT), but these schemes already give interesting routes for the future.

1

Breakdown of innovative financing schemes according to size of RES projects and of organisations



**prosumer = consumer and green energy producer*

SOURCES

EUROPEAN AND INTERNATIONAL ORGANISATIONS, PRESS

- AEBIOM – European Biomass Association *(www.aebiom.org)*
- Biofuel Digest *(www.biofuelsdigest.com)*
- BiogasIN - Sustainable Biogas Market
- Development in Central and Eastern Europe *(www.biogasin.org)*
- BNEF – Bloomberg New Energy Finance *(www.bnef.com)*
- EBRD – European Bank of Reconstruction and Development *(www.ebrd.com)*
- CEWEP – Confederation of European Waste-to-Energy Plants *(www.cewep.eu)*
- EBA – European Biogas Association *(www.european-biogas.eu)*
- EBB – European Biodiesel Board *(www.ebb-eu.org)*
- European Biofuels Technology Platform *(www.biofuelstp.eu)*
- EC – European Commission *(www.ec.europa.eu)*
- ECN – Energy Research Centre of the Netherlands, NREAP summary report *(www.ecn.nl/nreap)*
- EC – European Commission Directorate General for Energy and Transport *(www.ec.europa.eu/dgs/energy_transport/figures/trends_2030/index_en.htm)*
- EGEC – European Geothermal Energy Council *(www.egec.org)*
- EGC 2013 *www.geothermalcongress2013.eu*
- EHPA – European Heat Pump Association *(www.ehpa.org)*
- EmployRES *(www.ec.europa.eu/energy)*
- EMPRES – European Management Program on Renewable Energy Sources *(www.empres.eu)*
- EPIA – European Photovoltaic Industry Association *(www.epia.org)*
- ePURE – European Renewable Ethanol *(www.epure.org)*
- EREC – European Renewable Energy Council *(www.erec.org)*
- ESHA – European Small Hydropower Association *(www.esha.be)*
- ESTELA – European Solar Thermal Electricity Association *(www.estelasolar.eu)*
- ESTIF – European Solar Thermal Industry Federation *(www.estif.org)*
- EU-OEA – European Ocean Energy Association *(www.eu-oea.com)*
- Eurostat – Statistique européenne/European Statistics *(www.ec.europa.eu/Eurostat)*
- EVCA – European Private Equity and Venture Capital Association *(www.evca.eu)*
- EWEA – European Wind Energy Association *(www.ewea.org)*
- EUWID – Europäischer Wirtschaftsdienst *(www.euwid-energie.de)*
- FO Licht *(www.agra-net.com)*
- GEA – Geothermal Energy Association *(www.geo-energy.org)*
- GeoTrainNet *(www.geotrainet.eu/moodle)*
- GWEC – Global Wind Energy Council *(www.gwec.net)*
- IEA – International Energy Agency *(www.iea.org)*
- IEA PVPS – IEA Photovoltaic Power Systems Program *(www.iea-pvps.org)*
- IEA – RETD: Renewable Energy Technology Deployment *(www.iea-retd.org)*
- IEE – Intelligent Energy Europe *(www.ec.europa.eu/energy/intelligent/index_en.html)*
- IGA – International Geothermal Association *(www.geothermal-energy.org)*
- ILO – International Labour Organization *(www.ilo.org)*
- ISF/UTS Institute for Sustainable Futures/ University of Technology Sydney *(www.isf.uts.edu.au)*
- JRC – Joint Research Centre, Renewable Energy Unit *(www.ec.europa.eu/dgs/jrc/index.cfm)*
- IRENA – International Renewable Energy Agency *(www.irena.org)*

- IWR – Institute of the Renewable Energy Industry *(www.iwr.de)*
- National Renewable Energy Action Plans (NREAPs) Transparency Platform on Renewable Energy *(www.ec.europa.eu/energy/en/topics/renewable-energy)*
- NIB – Nordic Investment Bank *(www.nib.int)*
- OEC – Ocean Energy Council *(www.oceanenergycouncil.com)*
- Photon International – Solar Power Magazine *(www.photon-magazine.com)*
- PV Employment *(www.pvemployment.org)*
- PVPS – IEA Photovoltaic Power Systems Programme *(www.iea-pvps.org)*
- REN 21 – Renewable Energy Policy Network for the 21st Century *(www.ren21.net)*
- Renewable Energy Magazine *(www.renewableenergymagazine.com)*
- Renewables International *(www.renewablesinternational.net)*
- Reuters *(www.reuters.com)*
- RES Legal *(www.res-legal.eu)*
- Solarthermal World *(www.solarthermalworld.org)*
- Stream Map *(www.streammap.esha.be)*
- Sun & Wind Energy *(www.sunwindenergy.com)*
- UNEP – United Nations Environment Program *(www.unep.org)*
- WGC 2010 – Proceedings World Geothermal Congress 2010 *(www.geothermal-energy.org)*
- WWEA – World Wind Energy Association *(www.wwindea.org)*
- WWF – World Wild Life Fund *(www.wwf.org)*

AUSTRIA

- AEE Intec – Institute for Sustainable Technologies *(www.aee-intec.at)*
- Austria Solar – Austrian Solar Thermal Industry Association *(www.solarwaerme.at)*
- ARGE Biokraft – Arbeitsgemeinschaft Flüssige Biokraftstoffe *(www.biokraft-austria.at)*
- ARGE Kompost & Biogas – Austrian Biogas Association *(www.kompost-biogas.info)*
- BIOENERGY 2020+ *(www.bioenergy2020.eu)*
- Bundesverband Wärmepumpe Austria – National Heat-Pump Association Austria *(www.bwp.at)*
- BMVIT – Federal Ministry for Transport, Innovation and Technology *(www.bmvit.gv.at)*
- Dachverband Energie-Klima – Umbrella Organization Energy-Climate Protection *(www.energieklima.at)*
- E-Control – Energie Control *(www.econtrol.at)*
- EEG (Energy Economics Group)/Vienna University of Technology *(www.eeg.tuwien.ac.at)*
- IG Windkraft – Austrian Wind Energy Association *(www.igwindkraft.at)*
- Kleinwasserkraft Österreich – Small Hydro Association Austria *(www.kleinwasserkraft.at)*
- Lebensministerium – Federal Ministry of Agriculture, Forestry, Environment and Water Management *(www.lebensministerium.at)*
- Nachhaltig Wirtschaften *(www.nachhaltigwirtschaften.at)*
- Österreichischer Biomasse-Verband – Austrian Biomass Association *(www.biomasseverband.at)*
- OeMAG – Energy Market Services *(www.oekb.at/en/energy-market/oemag/cz)*
- ProPellets Austria – Pellets Association Austria *(www.propellets.at)*
- PV Austria – Photovoltaic Austria Federal Association *(www.pvaustria.at)*
- Statistik Austria – Bundesanstalt Statistik Österreich *(www.statistik.at)*
- Umweltbundesamt – Environment Agency Austria *(www.umweltbundesamt.at)*

BELGIUM

- ATTB – Belgium Thermal Technics Association *(www.attb.be/index-fr.asp)*
- APERe – Renewable Energies Association *(www.apere.org)*

- Belsolar *(www.belsolar.be)*
- BioWanze – CropEnergies *(www.biowanze.be)*
- Cluster TWEED – Technologie Wallonne Énergie Environnement et Développement durable *(www.clusters.wallonie.be/tweed)*
- CWaPE – Walloon Energy Commission *(www.cwape.be)*
- EDORA – Renewable and alternative energy federation *(www.edora.be)*
- ICEDD – Institute for Consultancy and Studies in Sustainable Development *(www.icedd.be)*
- SPF Economy – Energy Department – Energy Observatory *(http://economie.fgov.be/fr/spf/structure/Observatoires/Observatoire_Energie)*
- ODE – Sustainable Energie Organisation Vlaanderen *(www.ode.be)*
- Valbiom – Biomass Valuation asbl *(www.valbiom.be)*
- VEA – Flemish Energy Agency *(www.energiesparen.be)*
- VWEA – Flemish Wind Energy Association *(www.vwea.be)*
- Walloon Energie Portal *(www.energie.wallonie.be)*

BULGARIA

- ABEA – Association of Bulgarian Energy Agencies *(www.abea-bg.org)*
- APEE Association of Producers of Ecological Energy *(www.apee.bg/en)*
- BGA – Bulgarian Geothermal Association *(www.geothermalbg.org)*
- Bulgarian Wind Energy Association *(bgwea.org.server14.host.bg/English/Home_EN.html)*
- CL SENES BAS – Central Laboratory of Solar Energy and New Energy Sources *(www.senes.bas.bg)*
- EBRD – Renewable Development Initiative *(www.ebrdrenewables.com)*
- Invest Bulgaria Agency *(www.investbg.government.bg)*
- NSI National Statistical Institute *(www.nsi.bg)*
- SEC – Sofia Energy Centre *(www.sec.bg)*
- SEDA - Sustainable Energy Development Agency *(www.seea.government.bg)*

CYPRUS

- Cyprus Institute of Energy *(www.cie.org.cy)*
- MCIT – Ministry of Commerce, Industry and Tourism *(www.mcit.gov.cy)*
- CERA Cyprus Energy Regulatory Authority *(www.cera.org.cy)*

CROATIA

- Croatian Bureau of Statistics *(www.dzs.hr/default_e.htm)*
- University of Zagreb *(www.fer.unizg.hr/en)*
- HEP-Distribution System Operator *(www.hep.hr)*
- CROATIAN ENERGY MARKET OPERATOR - HROTE *(www.hrote.hr)*
- Croatian Ministry of Economy *(www.mingo.hr/en)*

CZECH REPUBLIC

- MPO – Ministry of Industry and Trade – RES Statistics *(www.mpo.cz)*
- Czech RE Agency – Czech Renewable Energy Agency *(www.czrea.org)*
- ERU – Energy Regulatory Office *(www.eru.cz)*
- CzBA – Czech Biogas Association *(www.czba.cz)*
- CZ Biom – Czech Biomass Association *(www.biom.cz)*
- Czech Wind Energy Association *(www.csve.cz/en)*

DENMARK

- DANBIO – Danish Biomass Association *(www.biogasbranchen.dk)*
- Dansk Solvarme Forening - Danish Solar Association *(www. dansksolvarmeforening.dk)*
- Energinet.dk – TSO *(www.energinet.dk)*
- ENS – Danish Energy Agency *(www.ens.dk)*
- PlanEnergi *(www.planenergi.dk)*
- SolEnergi Centret – Solar Energy Centre Denmark *(www.solenergi.dk)*

- WindPower – Danish Wind Industry Association *(www.windpower.org)*

ESTONIA

- EBU – Estonian Biomass Association *(www.eby.ee)*
- Espel (Estonia) – MTÜ Eesti Soojuspumba Liit *(www.soojuspumbaliit.ee)*
- EWPA – Estonian Wind Power Association *(www.tuuleenergia.ee/en)*
- Ministry of Finance *(www.fin.ee)*
- Ministry of Economics *(www.mkm.ee/eng/)*
- MTÜ – Estonian Biogas Association
- STAT EE – Statistics Estonia *(www.stat.ee)*
- TTU – Tallinn University of Technology *(www.ttu.ee)*

FINLAND

- Finbio – Bio-Energy Association of Finland *(www.finbio.org)*
- Finnish Board of Customs *(www.tulli.fi/en)*
- Finnish Biogaz Association *(http://biokaasuyhdistys.net)*
- Metla – Finnish Forest Research Institute *(www.metla.fi)*
- Pienvesivoimayhdistys ry – Small Hydro Association *(www.pienvesivoimayhdistys.fi)*
- Statistics Finland *(www.stat.fi)*
- SULPU – Finnish Heat Pump Association *(www.sulpu.fi)*
- Suomen Tuulivoimayhdistys – Finnish Wind Power Association *(www.tuulivoimayhdistys.fi)*
- TEKES – Finnish Funding Agency for Technology and Innovation *(www.tekes.fi/en)*
- Teknologiateollisuus – Federation of Finnish Technology Industries *(www.teknologiateollisuus.fi)*
- VTT – VTT Technical Research Centre of Finland *(www.vtt.fi)*

FRANCE

- ADEME – Environment and Energy Efficiency Agency *(www.ademe.fr)*
- AFPAC – French Heat Pump Association *(www.afpac.org)*
- AFPG – Geothermal French Association *(www.afpg.asso.fr)*
- CDC – Caisse des Dépôts *(www.caissedesdepots.fr)*
- Club Biogaz ATEE – French Biogas Association *(www.biogaz.atee.fr)*
- DGEC – Energy and Climat Department *(www.industrie.gouv.fr/energie)*
- Enerplan – Solar Energy organisation *(www.enerplan.asso.fr)*
- FEE – French Wind Energy Association *(www.fee.asso.fr)*
- France Énergies Marines *(www.france-energies-marines.org)*
- In Numeri – Consultancy in Economics and Statistics *(www.in-numeri.fr)*
- Observ'ER – French Renewable Energy Observatory *(www.energies-renouvelables.org)*
- SVDU – National Union of Treatment and Recovery of Urban and Assimilated Waste *(www.incineration.org)*
- SER – French Renewable Energy Organisation *(www.enr.fr)*
- SOeS – Observation and Statistics Office – Ministry of Ecology *(www.statistiques.developpement-durable.gouv.fr)*

GERMANY

- AEE – Agentur für Erneuerbare Energien - Renewable Energy Agency *(www.unendlich-viel-energie.de)*
- AGEB – Arbeitsgemeinschaft Energiebilanzen *(www.ag-energiebilanzen.de)*
- AGEE-Stat – Working Group on Renewable Energy-Statistics *(www.erneuerbare-energien.de)*

- AGORA Energiewende - Energy Transition Think Tank *(www.agora-energiewende.de)*
- BAFA – Federal Office of Economics and Export Control *(www.bafa.de)*
- BBE – Bundesverband Bioenergie *(www.bioenergie.de)*
- BBK – German Biogenous and Regenerative Fuels Association *(www.biokraftstoffe.org)*
- Fachverband Biogas - German Biogas Association *(www.biogas.org)*
- BEE – Bundesverband Erneuerbare Energie - German Renewable Energy Federation *(www.bee-ev.de)*
- BDEW - Bundesverband der Energie- und Wasserwirtschaft e.V *(www.bdew.de)*
- Biogasregister – Biogas Register and Documentation *(www.biogasregister.de)*
- Biomasseatlas *(www.biomasseatlas.de)*
- BMUB – Federal Ministry for the Environment, Nature Conservation and Nuclear Safety *(www.bmu.de)*
- BMWi – Federal Ministry for Economics and Energy *(http://www.bmwi.de/EN/root.html*
- BWE – Bundesverband Windenergie - German WindEnergy Association *(www.wind-energie.de)*
- BSW-Solar – Bundesverband Solarwirtschaft - PV and Solarthermal Industry Association *(www.solarwirtschaft.de)*
- BWP – Bundesverband Wärmepumpe - Heat Pump Association *(www.waermepumpe.de)*
- Bundesnetzagentur – Federal Network Agency *(www.bundesnetzagentur.de)*
- Bundesverband Wasserkraft – German Small Hydro Federation *(www.wasserkraft-deutschland.de)*
- CLEW -Clean Energy Wire - *(www.cleanenergywire.org)*
- Dena – German Energy Agency *(www.dena.de)*
- DGS – EnergyMap Deutsche Gesellschaft für Solarenergie *(www.energymap.info)*
- DBFZ – German Biomass Research Centre *(www.dbfz.de)*
- DEWI – Deutsches Windenergie Institut *(www.dewi.de)*
- EEG Aktuell *(www.eeg-aktuell.de)*
- Erneuerbare Energien *(www.erneuerbare-energien.de)*
- EuPD Research *(www.eupd-research.com)*
- Exportinitiative Erneuerbare Energien – Export Initiative Renewable Energies *(www.exportinitiative.de)*
- Fraunhofer-ISE - Institut für Solare Energiesysteme *(www.ise.fraunhofer.de/)*
- Fraunhofer-IWES - Institute for Wind Energy and Energy System Technology *(www.iwes.fraunhofer.de/en.html)*
- FNR – Fachagentur Nachwachsende Rohstoffe - Agency for Sustainable Resources *(http://international.fnr.de/)*
- FVEE – Forschungsverbund Erneuerbare Energien – Renewable Energy Research Association *(www.fvee.de)*
- GTAI – Germany Trade and Invest *(www.gtai.de)*
- GtV – Bundesverband Geothermie *(www.geothermie.de)*
- GWS – Gesellschaft für Wirtschaftliche Strukturforschung *(www.gws-os.com/de)*
- ITAD – Interessengemeinschaft der Thermischen Abfallbehandlungsanlagen in Deutschland *(www.itad.de)*
- KfW – Kreditanstalt für Wiederaufbau *(www.kfw.de)*
- UFOP – Union zur Förderung von Oel und Proteinpflanzen *(www.ufop.de)*
- UMSICHT – Fraunhofer Institute for Environmental, Safety and Energy Technology *(www.umsicht.fraunhofer.de)*
- VDB – Verband der Deutschen Biokraftstoffindustrie *(www.biokraftstoffverband.de)*
- VDMA – Verband Deutscher Maschinen und Anlagenbau *(www.vdma.org)*
- WI – Wuppertal Institute for Climate, Environment and Energy *(www.wupperinst.org)*
- ZSW – Centre for Solar Energy and Hydrogen Research Baden-Württemberg *(www.zsw-bw.de)*

GREECE

- CRES – Center for Renewable Energy Sources and Saving *(www.cres.gr)*
- DEDDIE Hellenic Electricity Distribution Network Operator S.A.*(www.deddie.gr)*
- EBHE – Greek Solar Industry Association *(www.ebhe.gr)*
- HELAPCO – Hellenic Association of Photovoltaic Companies *(www.helapco.gr)*
- HELLABIOM – Greek Biomass Association c/o CRES *(www.cres.gr)*
- HWEA – Hellenic Wind Energy Association *(www.eletaen.gr)*
- Small Hydropower Association Greece *(www.microhydropower.gr)*
- LAGIE - Operator of Electricity Market S.A. *(www.lagie.info)*

HUNGARY

- Energiaklub – Climate Policy Institute *(www.energiaklub.hu/en)*
- Energy Centre – Energy Efficiency, Environment and Energy Information Agency *(www.energycentre.hu)*
- Ministry of National Development *(www.kormany.hu/en/ministry-of-national-development)*
- Hungarian Wind Energy Association *(www.mszet.hu)*
- Hungarian Heat Pump Association *(www.hoszisz.hu)*
- Hungarian Solar Energy Society
- Magyar Pellet Egyesület – Hungarian Pellets Association *(www.mapellet.hu)*
- MBE – Hungarian Biogas Association *(www.biogas.hu)*
- MGTE – Hungarian Geothermal Association *(www.mgte.hu/egyesulet)*
- Miskolci Egyetem – University of Miskolc Hungary *(www.uni-miskolc.hu)*
- MMESZ – Hungarian Association of Renewable Energy Sources *(www.mmesz.hu)*
- MSZET – Hungarian Wind Energy Association *(www.mszet.hu)*
- Naplopó Kft. *(www.naplopo.hu)*
- SolarT System *(www.solart-system.hu)*

IRELAND

- Action Renewables *(www.actionrenewables.org)*
- IRBEA – Irish Bioenergy Association *(www.irbea.org)*
- Irish Hydro Power Association *(www.irishhydro.com)*
- ITI – InterTradeIreland *(www.intertradeireland.com)*
- IWEA – Irish Wind Energy Association *(www.iwea.com)*
- REIO – Renewable Energy Information Office *(www.seai.ie/Renewables/REIO)*
- SEAI – Sustainable Energy Authority of Ireland *(www.seai.ie)*

ITALY

- AIEL – Associazione Italiana Energie Agroforestali *(www.aiel.cia.it)*
- ANEV – Associazione Nazionale Energia del Vento *(www.anev.org)*
- APER – Associazione Produttori Energia da Fonti Rinnovabili *(www.aper.it)*
- Assocostieri – Unione Produttorri Biocarburanti *(www.assocostieribiodiesel.com)*
- Assosolare – Associazione Nazionale dell'Industria Solar Fotovoltaica *(www.assosolare.org)*

- Assolterm – Associazione Italiana Solare Termico *(www.assolterm.it)*
- CDP – Cassa Depositi e Prestiti *(www.cassaddpp.it)*
- COAER ANIMA Associazione Costruttori di Apparecchiature ed Impianti Aeraulici *(www.coaer.it)*
- Consorzio Italiano Biogas – Italian Biogas Association *(www.consorziobiogas.it)*
- Energy & Strategy Group – Dipartimento di Ingegneria Gestionale, Politecnico di Milano *(www.energystrategy.it)*
- ENEA – Italian National Agency for New Technologies *(www.enea.it)*
- Fiper – Italian Producer of Renewable Energy Federation *(www.fiper.it)*
- GIFI – Gruppo Imprese Fotovoltaiche Italiane *(www.gifi-fv.it/cms)*
- GSE – Gestore Servizi Energetici *(www.gse.it)*
- ISSI – Instituto Sviluppo Sostenible Italia
- ITABIA – Italian Biomass Association *(www.itabia.it)*
- MSE – Ministry of Economic Development *(www.sviluppoeconomico.gov.it)*
- Ricerca sul Sistema Energetico *(www.rse-web.it)*
- Terna – Electricity Transmission Grid Operator *(www.terna.it)*
- UGI Unione Geotermica Italiana *(www.unionegeotermica.it)*

LATVIA

- CSB – Central Statistical Bureau of Latvia *(www.csb.gov.lv)*
- IPE – Institute of Physical Energetics *(www.innovation.lv/fei)*
- LATbioNRG – Latvian Biomass Association *(www.latbionrg.lv)*
- LBA – Latvijas Biogazes Asociacija *(www.latvijasbiogaze.lv)*
- LIIA – Investment and Development Agency of Latvia *(www.liaa.gov.lv)*
- Ministry of Economics *(www.em.gov.lv)*

LITHUANIA

- EA – State Enterprise Energy Agency *(www.ena.lt/en)*
- LAIEA – Lithuanian Renewable Resources Energy Association *(www.laiea.lt)*
- LBDA – Lietuvos Bioduju Asociacija *(www.lbda.lt/lt/titulinis)*
- LEEA – Lithuanian Electricity Association *(www.leea.lt)*
- LEI – Lithuanian Energy Institute *(www.lei.lt)*
- LHA – Lithuanian Hydropower Association *(www.hidro.lt)*
- Lietssa *(www.lietssa.lt)*
- LITBIOMA – Lithuanian Biomass Energy Association *(www.biokuras.lt)*
- LIGRID AB, Lithuanian Electricity Transmission System Operator *(www.litgrid.eu)*
- LS – Statistics Lithuania *(www.stat.gov.lt)*
- LWEA – Lithuanian Wind Energy Association *(www.lwea.lt/portal)*

LUXEMBOURG

- Biogasvereenegung – Luxembourg Biogas Association *(www.biogasvereenegung.lu)*
- Chambre des Métiers du Grand-Duché de Luxembourg *(www.cdm.lu)*
- Enovos *(www.enovos.eu)*
- NSI Luxembourg – Service Central de la Statistique et des Études Économiques
- Solarinfo *(www.solarinfo.lu)*
- STATEC – Institut National de la Statistique et des Études Économiques *(www.statec.public.lu)*

MALTA

- MEEREA – Malta Energy Efficiency & Renewable Energies Association *(www.meerea.org)*
- MIEMA – Malta Intelligent Energy Management Agency *(www.miema.org)*
- Ministry for Energy and Health *(http://energy.gov.mt)*
- MRA – Malta Resources Authority *(www.mra.org.mt)*
- NSO – National Statistics Office *(www.nso.gov.mt)*
- University of Malta – Institute for Sustainable Energy *(www.um.edu.mt/iet)*

NETHERLANDS

- Netherlands Enterprise Agency (RVO) *(www.rvo.nl)*
- CBS – Statistics Netherlands *(www.cbs.nl)*
- CertiQ – Certification of Electricity *(www.certiq.nl)*
- ECN – Energy Research Centre of the Netherlands *(www.ecn.nl)*
- Holland Solar – Solar Energy Association *(www.hollandsolar.nl)*
- NWEA – Nederlandse Wind Energie Associatie *(www.nwea.nl)*
- Platform Bio-Energie – Stichting Platform Bio-Energie *(www.platformbioenergie.nl)*
- Stichting Duurzame Energie Koepel *(www.dekoepel.org)*
- Vereniging Afvalbedrijven – Dutch Waste Management Association *(www.verenigingafvalbedrijven.nl)*
- Bosch & Van Rijn *(www.windstats.nl)*
- Stichting Monitoring Zonnestroom *(www.zonnestroomnl.nl)*

POLAND

- CPV – Centre for Photovoltaicsat Warsaw University of Technology *(www.pv.pl)*
- Energy Regulatory Office *(www.ure.gov.pl)*
- Federation of Employers Renewable Energy Forum *(www.zpfeo.org.pl)*
- GUS – Central Statistical Office *(www.stat.gov.pl)*
- IEO EC BREC – Institute for Renewable Energy *(www.ieo.pl)*
- IMP – Instytut Maszyn Przepływowych *(www.imp.gda.pl)*
- PBA – Polish Biogas Association *(www.pba.org.pl)*
- PGA – Polish Geothermal Association *(www.pga.org.pl)*
- PIGEO – Polish Economic Chamber of Renewable Energy *(www.pigeo.org.pl)*
- POLBIOM – Polish Biomass Association *(www.polbiom.pl)*
- Polska Organizacja Rozwoju Technologii Pomp Ciepła PORT PC *(www.portpc.pl)*
- PSG – Polish Geothermal Society *(www.energia-geotermalna.org.pl)*
- PSEW – Polish Wind Energy Association *(www.psew.pl)*
- TRMEW – Society for the Development of Small Hydropower *(www.trmew.pl)*
- THE - Polish Hydropower Association (PHA) *(www.tew.pl)*

PORTUGAL

- ADENE – Agência para a Energia *(www.adene.pt)*
- APESF – Associação Portuguesa de Empresas de Solar Fotovoltaico *(www.apesf.pt)*
- Apisolar – Associação Portuguesa da Indústria Solar *(www.apisolar.pt)*
- Apren – Associação de Energies Renováveis *(www.apren.pt)*
- CEBio – Association for the Promotion of Bioenergy *(www.cebio.net)*
- DGEG – Direcção Geral de Energia e Geologia *(www.dgeg.pt)*
- EDP – Microprodução *(www.edp.pt)*
- SPES – Sociedade Portuguesa de Energia Solar *(www.spes.pt)*

ROMANIA

- Association Biofuels Romania *(www.asociatia-biocombustibili.ro)*
- CNR-CME – World Energy Council Romanian National Committee *(www.cnr-cme.ro)*
- ECONET Romania *(www.econet-romania.com/)*

- ENERO – Centre for Promotion of Clean and Efficient Energy *(www.enero.ro)*
- ICEMENERG – Energy Research and Modernising Institute *(www.icemenerg.ro)*
- ICPE – Research Institute for Electrical Engineering *(www.icpe.ro)*
- INS – National Institute of Statistics *(www.insse.ro)*
- Romanian Wind Energy Association *(www.rwea.ro)*
- RPIA -Romanian Photovoltaic Industry Association *(rpia.ro)*
- University of Oradea *(www.uoradea.ro)*
- Transelectrica *(www.transelectrica.ro)*

SPAIN

- AEE – Spanish Wind Energy Association *(www.aeeolica.es)*
- ADABE – Asociación para la Difusión del Aprovechamiento de la Biomasa en España *(www.adabe.net)*
- AEBIG – Asociación Española de Biogás *(www.aebig.org)*
- AIGUASOL – Energy consultant *(www.aiguasol.coop)*
- APPA – Asociación de Productores de Energías Renovables *(www.appa.es)*
- ASIF – Asociación de la Industria Fotovoltaica *(www.asif.org)*
- ASIT – Asociación Solar de la Industria Térmica *(www.asit-solar.com)*
- ANPIER – Asociación Nacional de Productores-Inversores de Energías Renovables *(www.anpier.org)*
- AVEBIOM – Asociación Española de Valorización Energética de la Biomasa *(www.avebiom.org/es/)*
- CNE – National Energy Commission *(www.cne.es)*
- FB – Fundación Biodiversidad *(www.fundacion-biodiversidad.es)*
- ICO – Instituto de Crédito Oficial *(www.ico.es)*
- IDAE – Institute for Diversification and Saving of Energy *(www.idae.es)*
- INE – Instituto Nacional de Estadística *(www.ine.es)*
- Infinita Renovables *(www.infinita.eu)*
- MITYC – Ministry of Industry, Tourism and Trade *(www.mityc.es)*
  - OSE – Observatorio de la Sostenibilidad en España *(www.forumambiental.org)*
- Protermosolar – Asociación Española de la Industria Solar Termoeléctrica *(www.protermosolar.com)*
- Red Eléctrica de Espana *(www.ree.es)*

UNITED KINGDOM

- ADBA – Anaerobic Digestion and Biogas Association – Biogas Group (UK) *(www.adbiogas.co.uk)*
- BHA – British Hydropower Association *(www.british-hydro.org)*
- BSRIA – The Building Services Research and Information Association *(www.bsria.co.uk/)*
- DECC – Department of Energy and Climate Change *(www.decc.gov.uk)*
- DUKES – Digest of United Kingdom Energy Statistics *(www.gov.uk/government)*
- GSHPA – UK Ground Source Heat Pump Association *(www.gshp.org.uk)*
- HM Revenue & Customs *(www.hmrc.gov.uk)*
- National Non-Food Crops Centre *(www.nnfcc.co.uk)*
- Renewable UK – Wind and Marine Energy Association *(www.renewableuk.com)*
- Renewable Energy Centre *(www.TheRenewableEnergyCentre.co.uk)*
- REA – Renewable Energy Association *(www.r-e-a.net)*
- RFA – Renewable Fuels Agency *(www.data.gov.uk/publisher/renewable-fuels-agency)*
- Ricardo AEA *(www.ricardo-aea.com)*
- Solar Trade Association *(www.solar-trade.org.uk)*
- UKERC – UK Energy Research Centre *(www.ukerc.ac.uk)*

SLOVAKIA

- ECB – Energy Centre Bratislava Slovakia *(www.ecb2.sk)*
- Ministry of Economy of the Slovak Republic *(www.economy.gov.sk)*
- SAPI – Slovakian PV Association *(www.sapi.sk)*
- Slovak Association for Cooling and Air Conditioning Technology *(www.szchkt.org)*
- SK-BIOM – Slovak Biomass Association *(www.4biomass.eu/en/partners/sk-biom)*
- SKREA – Slovak Renewable Energy Agency, n.o. *(www.skrea.sk)*
- SIEA – Slovak Energy and Innovation Agency *(www.siea.sk)*
- Statistical Office of the Slovak Republic *(http://portal.statistics.sk)*
- The State Material Reserves of Slovak Republic *(www.reserves.gov.sk/en)*
- Thermosolar Ziar ltd *(www.thermosolar.sk)*
- URSO Regulatory Office for Network Industries *(www.urso.gov.sk)*

SLOVENIA

- SURS – Statistical Office of the Republic of Slovenia *(www.stat.si)*
- Eko sklad – Eco-Fund-Slovenian Environmental Public Fund *(www.ekosklad.si)*
- Slovenian Environment Agency - ARSO *(www.arso.gov.si/en/)*
- JSI/EEC The Jozef Stefan Institute – Energy Efficiency Centre *(www.ijs.si/ijsw)*
- Tehnološka Platforma za Fotovoltaiko – Photovoltaic Technology Platform *(www.pv-platforma.si)*
- ZDMHE – Slovenian Small Hydropower Association *(www.zdmhe.si)*

SWEDEN

- Avfall Sverige – Swedish Waste Management *(www.avfallsverige.se)*
- ÅSC – Angstrom Solar Center *(www.asc.angstrom.uu.se)*
- Energimyndigheten – Swedish Energy Agency *(www.energimyndigheten.se)*
- SCB – Statistics Sweden *(www.scb.se)*
- SERO – Sveriges Energiföreningars Riks Organisation *(www.sero.se)*
- SPIA – Scandinavian Photovoltaic Industry Association *(www.solcell.nu)*
- Energigas Sverige – *(www.energigas.se)*
- Uppsala University *(www.uu.se/en/)*
- Svensk Solenergi – Swedish Solar Energy Industry Association *(www.svensksolenergi.se)*
- Svensk Vattenkraft – Swedish Hydropower Association – *(www.svenskvattenkraft.se)*
- Svensk Vindenergi – Swedish Wind Energy *(www.svenskvindenergi.org)*
- Swentec – Sveriges Miljöteknikråd *(www.swentec.se)*
- SVEBIO – Svenska Bioenergiföreningen/Swedish Bioenergy Association *(www.svebio.se)*
- SVEP – Svenska Värmepump Föreningen *(www.svepinfo.se)*

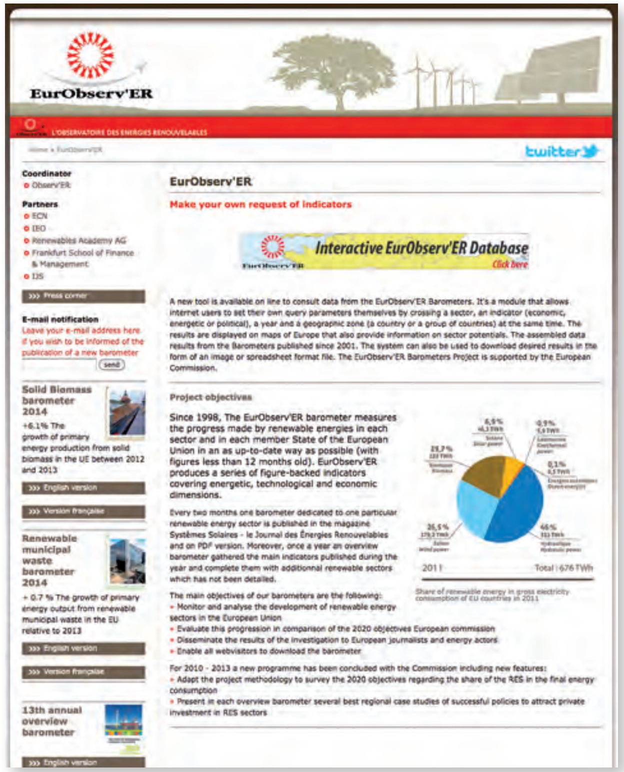
EUROBSERV'ER – THE STATE OF RENEWABLE ENERGIES IN EUROPE – 2014 EDITION

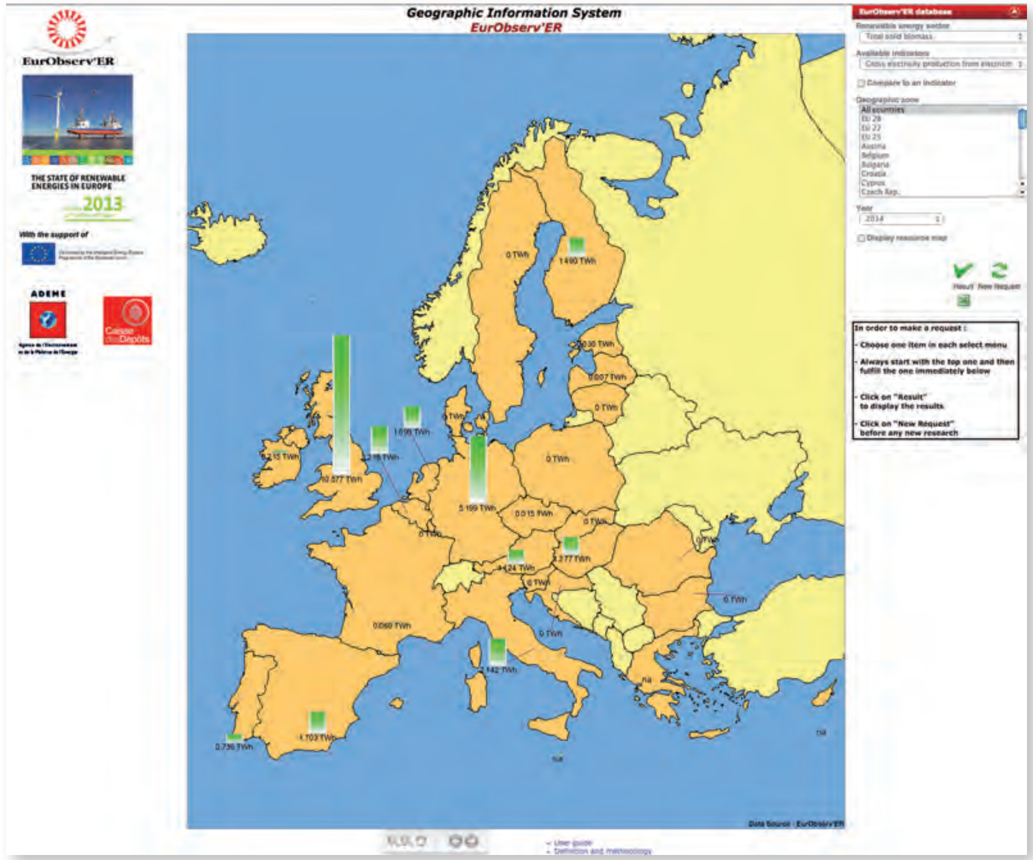
EUROBSERV'ER BAROMETERS ONLINE

***EurObserv'ER barometers** can be downloaded in PDF format at the following addresses:*

www.energies-renouvelables.org
www.rcp.ijs.si/ceu
www.ieo.pl/pl/projekty.html
https://www.ecn.nl/expertise/policy-studies/current-projects
www.fs-unep-centre.org/projects
www.renac.de/en/current-projects/eurobserver.html

Home page of the website:
www.eurobserv-er.org





THE EUROBSERV'ER INTERNET DATABASE

All EurObserv'ER Barometer data are downloadable through a cartographic module allowing internet users to configure their own query by crossing a renewable energy sector with an indicator (economic, energetic or political), a year and a geographic zone (a country or a group of countries) at the same time. The results appear on a map of Europe that also provides information on the potentials of the different sectors. The system also makes it possible to download desired results in PDF or Excel format files and to compare two indicators at the same time via a crosstab query.

INFORMATION

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Schedule for the next EurObserv'ER barometers

Wind power	›› **February 2015**
Photovoltaic	›› **April 2015**
Solar thermal and concentrated solar power	›› **May 2015**
Biofuels	›› **July 2015**
Ground source heat pumps	›› **September 2015**
Solid biomass	›› **Novembre 2015**
The State of Renewable Energies in Europe 15th EurObserv'ER Report	›› **December 2015**

Editorial director: Vincent Jacques le Seigneur
Deputy editor-in-chief: Laurence Augereau
Editorial coordination: Romain David
Editors: Observ'ER (FR), Renac (DE), Institute for Renewable Energy (IEO/EC BREC, PL), Jožef Stefan Institute (SI), ECN (NL), Frankfurt School of Finance & Management (DE)
Copy editor: Cécile Bernard
Translation: Odile Bruder, Shula Tennenhaus
Graphic design: Lucie Baratte/kaleidoscopeye.com
Production: Marie Agnès Guichard, Alice Guillier
Pictograms: bigre! et Lucie Baratte/kaleidoscopeye.com
Cover photo credit: Patrick Piro
Printed by Imprimerie Graphius, December 2014
ISSN 2101-9622
39 euros

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