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THE STATE OF RENEWABLE ENERGIES IN EUROPE

EDITION 2013

13th EurObserv'ER Report

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RÉMI CHABRILLAT,
Director Sustainable Productions and Energies (Ademe)

In its thirteenth annual barometer, EurObserv'ER provides a full review of the state of renewable energies for all the European Union countries at the end of 2012. The cross-referencing of energy, socioeconomic and now financial investment indicators, gives an enlightening assessment of the efforts made together with the remaining ground to be covered by 2020.

After a year marked by an exceptionally mild winter in 2011 and hydroelectricity restrained by low rainfall, 2012 witnessed the return to more normal weather conditions in Northern Europe. This return to normality highlights the results of major investments made in Europe since the beginning of the decade. The main beneficiaries are the wind energy and photovoltaic sectors, in addition to biomass co-firing and cogeneration plants.

Taken together, the various renewable energies covered 14% of final gross energy consumption in 2012 against 12.9% in 2011. This significant growth puts European Union only 6 percentage points away from its target for 2020. As for France, its indicative trajectory for renewable input by the end of 2012 was 12.8%; thus at 13.7% it is ahead of target.

The energy considerations of many European countries are mirrored by the emerging economic clout of renewable energies. For example in France, renewables provided almost 190 000 direct and indirect jobs and more than 11 billion euros' worth of turnover in 2012.

These heartening figures prompt us to lay the foundations for the next round of challenges. A major focus will be placed on preparing for the future Energy/Climate Package for 2030, whose renewable energy targets need to be particularly ambitious if they are to keep up the current momentum, and provide the visibility and stability required by market players to stay on course despite the continuing tight European economic context.

In the interim, this *2013 State of renewable energies* brings good news and encourages us to go further.

WILLIAM GILLETT
William Gillett was Head of Unit responsible for Renewable Energy projects funded by Intelligent Energy Europe in the Commission's Executive Agency for Small and Medium Enterprises (previously EACI).

As we go into 2014, the EU has a new 7 year multi-annual framework for its spending, and EU policy makers are focussing attention on maintaining investor confidence in renewable energies (RE) beyond 2020. The data on EU renewable energy markets, which are prepared by EurObserv'ER, have been shown year after year to be very close to those which are later confirmed by Eurostat[1], and therefore offer valuable insights for decision makers who are responsible for future RE policies and spending. It is encouraging to read the analyses presented in this EurObserv'ER publication. In particular, it is welcome news that in 2012 almost all Member States exceeded the targets foreseen in their 2020 trajectories.

There will be more EU funding for sustainable energies in the coming 7 years than before, notably from regional and cohesion policy funds, the new "Horizon 2020" framework programme, and special financing instruments such as those which are managed together with the European Investment Bank.

Renewable energy targets are defined as a percentage of final energy consumption, and this year's EurObserv'ER demonstrates very visibly the important synergies which exist between investing in energy efficiency and investing in the use of renewable energy sources.

Looking to the future, the effects of the cut backs in national support schemes, made because of difficult financial situations in many EU Member States, will become more visible. Indeed, it is already clear that, despite substantial technology cost reductions, some solar PV markets in the EU have stagnated following cut backs of national support schemes. Fortunately, whilst RE markets are struggling in the EU, other RE markets across the globe are experiencing rapid growth and providing exciting new opportunities for EU businesses, as well as permitting future EU markets to benefit from global economies of scale.

Support schemes for renewable heating and cooling are still much less mature in the EU than those for renewable electricity, but the growth which is reported in this EurObserv'ER publication and the growing share of bio-energy is encouraging.

No more funding will be available from the Intelligent Energy Europe (IEE) programme, which, with its predecessors, has supported the work of EurObserv'ER for the past 15 years but there will be new EU funding for the market up-take of RE from the "Horizon 2020" framework programme.

1. Editor's Note: Eurostat publishes consolidated data on year n in year n +1 or n + 2, after EurObserv'ER publishes its estimations on the same year.

SO WHAT IS HAPPENING IN EUROPE?

Alain Liébard, Président of Observ'ER

If we take in the overall situation of the EU, the 2013 edition of "The state of renewable energies in Europe" gives us a fairly positive picture for 2012 – renewable energies covered 14% of gross final energy consumption compared to 12.9% in 2011. Various countries are performing well on their indicative trajectories towards 2020 with some measure of advance on their intermediate targets. Generally, employment is holding up (in all 1.2 million full-time equivalent jobs), and job losses in the photovoltaic sector are being made up for in the wind energy sector.

In contrast, we get quite another impression when we read the new chapter on renewable energy investment indicators and look at financing arrangements that the sectors secured in 2012. Between 2011 and 2012, investments in renewable energy projects contracted by 38% with the upshot that the new production capacities funded by these investments in the coming years will be 29% lower… which equates to 6 100 MW less capacity than in 2011. Yet it is the investments being made now that will enable our European targets to be met.

In many member states with the downsizing of support policies, it has to be admitted that the lights have turned to red for investors, in particular for wind energy and photovoltaic – the two sectors that have provided in 2012 the most input to renewable production apart from hydropower. The signals coming from Europe are no better. The Intelligent Energy for Europe programme that has contributed so much to the development of the EurObserv'ER barometers has been watered down, in the galaxy of the framework programme for R&D, "Horizon 2020". What is worse is that renewable energies have been relegated to the rank of low carbon technologies, namely alongside CO_2 capture. Even shale gas is covered by "Low Carbon Energy" actions…

If the 2030 targets to be shortly adopted also demonstrate great apathy towards renewable energies, it will hardly come as a surprise if this indicates to the Member States that the 2020 targets are not so binding after all…

I should like to close this preface by expressing my great appreciation for the work of William Gillett who headed the unit responsible for renewable energy projects within the former Executive Agency for Competitiveness & Innovation. The Intelligent Energy for Europe programme owes a great deal to him not to mention the projects it supported! While EACI is changing[1], the projects that it co-finances continue and the thematic barometers will be published throughout 2014 at their normal timing.

1. It has become the Executive Agency for Small and Medium-sized Enterprises (EASME)

EUROBSERV'ER – THE STATE OF RENEWABLE ENERGIES IN EUROPE – 2013 EDITION

ENERGY INDICATORS

For fourteen 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 2013 in *Systèmes Solaires* (*Journal de l'Éolien* no 12, *Journal du Photovoltaïque* nos 9 and 10 and *Journal des Énergies Renouvelables* nos 215, 216 and 218).

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 fourth 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 and biofuels 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 biogas and municipal solid waste, which were not focus study topics in 2013, has been updated for this edition.

*Some country data updates have been made also 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 (among which Belgium, Danemark, Italy and Poland).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**.*

On 1 July 2013, Croatia became the 28th European Union Member State. The EurObserv'ER consortium has added figures on this country's sectors where available, on a single line at the end of each table below the total for the European Union of 27 as a start to its integration in the forthcoming theme-based barometers. From 2014 onwards, Croatia will be fully integrated into our European Union statistics for data relating to 2013.

WIND POWER

The European Union wind power market turned out fine in 2012. According to EurObserv'ER, net newly-installed capacity connected to the grid over the Twelve months reached 12 086 MW, which took the European Union comfortably over the 100-GW installed capacity mark (106 396 MW at the end of 2012).

Very high-capacity wind farms were connected to the grid in 2012 both offshore in the North Sea and onshore like the Fântâ-nele -Cogealac farms in Romania (600 MW), Whitelee Windfarm (539 MW in all, 217 MW of which was hooked up in 2012) and Clyde Wind Farm (350 MW), both in Scotland. Another contributory factor that stimulated the emerging markets to the East of the European Union (Poland, Romania and Austria in particular) was the sharp rise in the price of gas in 2012. The German and Swedish markets also turned in good performances, better than their Spanish, Portuguese and French counterparts.

MARK TURNER/LONDON ARRAY LIMITED

THE OFFSHORE MARKET MATURES

Data provided by the official statistics bodies of the main offshore wind energy producer countries draws EurObserv'ER to the conclusion that 1 472.4 MW of capacity has been connected since 2011, raising total EU on-grid capacity to 5021.8 MW at the end of 2012.

DECC (the Department of Energy & Climate Change), claims that the UK added 1157 MW of operational capacity offshore over the TWelve months of 2012, so raising its offshore capacity to-date to 2 995 MW. The new wind farms that went on-grid include Greater Gabbard (504 MW), Walney Phase 2 (183.6 MW), Sheringham Shoal (316.8 MW) and Ormonde (150 MW).

Denmark is runner-up to the UK in this segment and is close to the one-GW threshold. According to the Danish Energy Agency, its offshore capacity at the end of 2012 was 921.9 MW.

The first two phases of Belgium's Thorntonbank offshore wind farm are now fully operational (215 MW), which takes the country's offshore wind energy capacity to 380 MW. Phase 3 of the project planned for 2013 will add a further 110 MW.

FRANCIS CORMON/NORDEX

For the time being the German market is running fourth in the European Union offshore league. ZSW reports that it only connected 16 wind turbines for total capacity of 80 MW (from the Bard 1 offshore farm) which took the operational capacity of its offshore fleet to 280.3 MW. Lift-off is scheduled for 2013 with an expected 1 GW. However it seems the new coalition government plans to lower the country's targets for the coming years.

MORE THAN 200 TWH OF WIND POWER GENERATED IN 2012

Expectations for wind-sourced electricity output were matched in 2011, and the same goes for 2012. EurObserv'ER confirms that wind energy production exceed the 200-TWh, threshold (203.1 TWh) in 2012, aided by the capacity build-up of British offshore installations. The output level amounts to 12% year-on-year growth and covers 6% of the European Union's gross electricity consumption.

NEWS FROM THE MAIN EU PRODUCER COUNTRIES

GERMANY BANKING ON A GREEN FUTURE

The German market consolidated its recovery in 2012, despite its offshore segment lagging behind. The Deutsche WindGuard report states that Germany installed an impressive 2439.5 MW in 2012 (2007.4 MW in 2011), which once decommissioned turbines are subtracted from the equation (178.6 MW), takes its wind turbine capacity to 31 331.9 MW. In terms of production, it reached 50.7 TWh in 2012 against 48.9 TWh in 2011.
Clear energy policy and strategy are responsible for the turnaround, as the March 2011 nuclear catastrophe at Fukishima convinced the government once and for all to pull out of nuclear power (by 2022) and boost the renewable energy share of its electricity mix.

UK OFFSHORE VYING WITH ONSHORE ON-GRID CAPACITY MW FOR MW

In 2012, the UK had practically as much offshore wind energy capacity as onshore capacity connected. DECC says that its operational wind turbine capacity rose by 2 413 MW including 1 157 MW offshore. The government has set an 18-GW target for offshore wind energy capacity by 2020.
At the end of 2012, it continued work on setting up its new incentive system planned for 2014 which will take the form of a Feed-in Tariff system coupled with Contracts for Differences ("FiT CFD"). Under the system, producers will be paid when the market price is lower than a pre-agreed "strike price" and will have to repay the difference when market prices are higher. The system aims to iron out overpayments.

1

Wind power installed net capacities in European Union at the end of 2011 and 2012 (MW)

	2011	2012
Germany	29 071.0	31 331.9
Spain	21 529.0	22 775.0
United Kingdom	6 476.0	8 889.0
Italy	6 918.0	8 102.0
France*	6 809.0	7 594.0
Portugal	4 378.0	4 531.0
Denmark	3 952.1	4 163.0
Sweden	2 769.0	3 607.0
Poland	1 800.0	2 564.0
Netherlands	2 316.0	2 434.0
Romania	988.0	1 941.0
Ireland	1 631.0	1 763.0
Greece	1 640.0	1 749.0
Belgium	1 069.0	1 364.0
Austria	1 079.7	1 315.9
Bulgaria	541.0	657.0
Hungary	331.0	331.0
Estonia	180.0	266.0
Czech Republic	213.0	258.0
Finland	199.0	257.0
Lithuania	202.0	225.0
Cyprus	134.0	147.0
Latvia	36.0	68.0
Luxembourg	45.0	58.0
Slovakia	3.1	3.1
Slovenia	0.0	2.3
Total EU	94 309.9	106 396.2
Croatia	131.0	180.0

** Overseas departments included for France.* ***Source: EurObserv'ER 2013***

2

Wind offshore power installed capacities in European Union at the end of 2011 and 2012 (MW)

	2011	2012*
United Kingdom	1 838.0	2 995.0
Denmark	871.5	921.9
Belgium	195.0	380.0
Germany	200.3	280.3
Netherlands	228.0	228.0
Sweden	163.4	163.4
Finland	26.0	26.0
Ireland	25.2	25.2
Portugal	2.0	2.0
Total EU	3 549.4	5 021.8

** Estimation.* ***Source: EurObserv'ER 2013***

MARK TURNER/LONDON ARRAY LIMITED

SPAIN MOVES THE GOALPOSTS AGAIN

Spain remained in 2012 the second wind producer of the Europeen Union with 47.6 TWh (44.6 TWh in 2011). IDAE puts Spanish wind energy capacity at 22 775 MW at the end of the year, compared to 21 529 MW TWelve months earlier. In February 2013, the Spanish government passed a law amending the wind energy sector's incentive system yet again. The new law abolishes payment of the premium in addition to the market price, and forces all Spanish wind farms to accept the Feed-in Tariff while back-dating the measure to the start of 2013.

THE FRENCH MARKET FAILS TO DELIVER

The installation figures published by the Service of Observation and Statistics (SOeS) have borne out the warnings expressed by the French wind energy trade.
Net additional wind energy capacity connected to the grid during 2012 amounted to 785 MW, as the market suffered its second successive dip (1253 MW in 2010, 830 MW in 2011). Net installed capacity stood at 7 594 MW at the end of 2012, 42 MW of which is in the overseas territories.
The layers of administrative procedures, following enactment of the Grenelle 2 law, are the main reason for this slowdown. Some of the obstacles have been lif-

ted through the Brottes Law passed on 15 April 2013, which abolished TWo major hurdles to onshore wind turbine installation – the wind power development zones (ZDE) where turbines had to be erected to benefit from the purchase obligation rate, and the “five masts” rule that forced the installation of a minimum of five wind turbines on all projects, thereby reducing the number of new wind farms.

HALF-WAY TO TARGET

In the end, the 2012 European Union wind energy market was bigger than expected, but prospects for growth over the next TWo years are much less promising, because the climate of political uncertainty shrouding Europe in 2011 has prompted many governments to revise their incentive systems, or to give inadequate guarantees and visibility to investors for the coming years. The outcome is that today the onshore turbine manufacturers’ order books are much lighter than previously, which threatens a slower installation pace in 2013, if not 2014.
If we look at the National Renewable Energy Action Plans (NREAPs), the European Union is now half-way to meeting its installation target for 2020 of 213 563 MW including 44 224 MW of offshore capacity. The EWEA calculates that progress on the NREAP trajectory was 107 602 MW (101 773 MW onshore and 5 829 MW offshore). If we compare this to the installation data that EurObserv’ER possesses, the European Union has fallen 1.2 GW behind the indicative trajectory and the

3

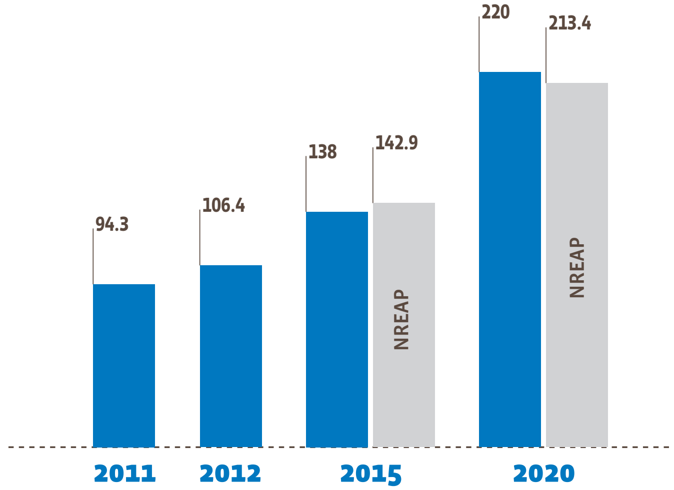
Gross electricity production from wind power in European Union in 2011 and 2012 (TWh)*

	2011	2012
Germany	48.883	50.670
Spain	44.644	47.560
United Kingdom	15.510	19.584
France**	12.294	15.001
Italy	9.856	13.407
Denmark	9.774	10.270
Portugal	9.162	10.260
Sweden	6.078	7.165
Netherlands	5.100	4.999
Poland	3.205	4.746
Ireland	4.380	4.010
Greece	3.315	3.259
Romania	1.390	2.923
Belgium	2.312	2.750
Austria	1.934	2.463
Bulgaria	0.861	1.061
Hungary	0.626	0.768
Lithuania	0.475	0.500
Finland	0.481	0.494
Estonia	0.369	0.434
Czech Republic	0.397	0.417
Cyprus	0.114	0.185
Latvia	0.071	0.122
Luxembourg	0.065	0.075
Slovakia	0.005	0.005
Slovenia	0.000	0.001
Total EU	181.3	203.1
Croatia	0.201	0.328

** Estimation. ** Overseas departments included.* ***Source: EurObserv’ER 2013***

4

Comparison of the current trend against the NREAP (National Renewable Energy Action Plans) roadmap (GW)
Source: EurObserv’ER 2013



expected slowdown in installation in 2013 should hold back progress even further.
Notwithstanding, the situation is full of contrasts across the Member States. While a number of countries like France, Spain, Portugal and Greece are now clearly below target, other countries such as Germany, Sweden, Italy and Poland are driving EU growth upwards.
While it is now clear that certain countries will have to react very fast if they want to meet their 2020 obligations, the sector’s growth prospects are still attractive in the long run and reaching the NREAP targets is still feasible. □

PHOTOVOLTAIC

The European Union remained the main focus of solar photovoltaic installation in the world in 2012, but it accounted for only a little over one half of the global market (about 58% out of a total of 28.9 GWp) whereas the previous year its share was almost three-quarters (of a total of 30 GWp). EurObserv'ER puts newly-connected capacity in the European Union at 16 693 MWp, which is a 24.4% year-on-year slide. At the end of 2012 the installed capacity to date in the European Union was 68 902 MWp.

This additional capacity naturally implies an increase in PV solar power output, which rose to 67.1 TWh in 2012 (48.0% more than in 2011) which currently covers more than 2% of European Union electricity consumption.

The news on the European market was not all doom and gloom in 2012 as the forecast market decline turned out to be over-pessimistic. Certain markets stood up well despite offering less attractive tariffs, such as France and Greece which are close to or have passed the one-GWp mark. The Danish and Dutch markets also took off in 2012, through the success of net metering. This also applied to the Bulgarian market, even though its growth will not continue through 2013, because of the sharp drop in the Feed-in Tariff (halved on 1 July 2012) and the introduction of taxes on completed plants. Another source of satisfaction is that yet again, Germany broke its own installation record and clung to its top world slot for one more year.

NEW INSTALLATION RECORD FOR GERMANY

According to the Working Group on Renewable Energy-Statistics for the German Environment Ministry, AGEE-Stat, the country set a new installation record, beating 2011's figure of 7 485 MWp by connecting up 7 604 MWp to the grid in 2012. Germany's on-grid PV capacity is now 32 643 MWp. The installation corridor of 2.5–3.5 GWp provided for in the EEG law was yet again underestimated. A 2.2% monthly decrease in the February, March and April Feed-in Tariff automatically triggered the installation level rise. The German market kept its appeal as the continued drop in system prices outstripped the drop in FiT. BSW, the German Solar Industry Association, says that the average purchase price to the final consumer of a roof-mounted photovoltaic system up to 10 kWp was 1 751 euros per kWp in the 4th quarter of 2012 compared to 2 197 euros per kWp in the 4th quarter of 2011 … a drop of more than 20% in twelve months. Nonetheless, the country is braced for significant market contraction in 2013 when anti-dumping measures are implemented against Chinese imports of modules and cells.

THE ITALIAN MARKET HAS DRAINED ITS PROGRAMME

The Italian 2012 photovoltaic market surpassed expectations, which may be the last piece of good news for a long time. According to the Ministry of economic development, grid connected capacity reached 16 420 MWp end of 2012, ie 3 647 MWp more than 2011. Installed capacity in 2012 is a long way from the 2011 level when 9 303 MWp of new capacity was connected. The Italian market should contract considerably in 2013, for the simple reason that the funding ceiling of the new Conto Energia programme has been reached mid 2013.

ONE MORE SOLAR GWP INSTALLED IN FRANCE

France just managed to maintain its market status over the one-GWp threshold, primarily through the commissioning of very high-capacity plants like those of Crucey-Villages in Eure-et-Loir (60 MWp) and Toul-Rosières in Meurthe-et-Moselle (115 MWp), both of which were developed by EDF Énergies Nouvelles. The latter, connected in November 2012, is one of the world's ten highest-capacity ground-based PV plants. According to the Service of Observation and Statistics (SOeS), France hooked up 1 079 MWp to the grid during 2012, including 47 MWp in the Overseas Territories. The on-grid PV panel base thus risen to 4 003 MWp of capa-

1

Photovoltaic capacity installed and connected in the European Union during the years 2011 and 2012 (MWp)*

	2011			2012*		
	On grid	Off grid	Total	On grid	Off grid	Total
Germany	7 485.0	5.0	7 490.0	7 604.0	0.0	7604.0
Italy	9 303.0	0.0	9 303.0	3 647.0	1.0	3 648.0
France**	1 755.4	0.5	1 755.9	1 079.0	0.0	1 079.0
Greece	425.8	0.1	425.9	912.0	0.0	912.0
Bulgaria	179.5	0.4	179.9	721.0	0.0	721.0
United Kingdom	899.0	0.3	899.3	713.0	0.0	713.0
Belgium	995.6	0.0	995.6	530.5	0.0	530.5
Denmark	8.6	1.0	9.6	382.3	0.0	382.3
Austria	91.0	0.7	91.7	234.5	0.0	234.5
Netherlands	58.0	0.0	58.0	219.0	0.0	219.0
Spain	431.0	1.0	432.0	251.0	1.3	252.3
Slovenia	54.9	0.0	54.9	116.9	0.0	116.9
Czech Republic	0.0	0.0	0.0	109.0	0.0	109.0
Portugal	38.0	0.1	38.1	70.0	0.1	70.1
Luxembourg	11.2	0.0	11.2	33.0	0.0	33.0
Slovakia	313.1	0.1	313.1	30.0	0.0	30.0
Malta	2.8	0.0	2.8	12.1	0.0	12.1
Sweden	3.6	0.8	4.3	7.3	0.8	8.1
Cyprus	3.8	0.1	3.8	7.0	0.0	7.1
Lithuania	0.0	0.0	0.0	6.0	0.0	6.0
Romania	1.6	0.0	1.6	2.9	0.0	2.9
Poland	0.8	0.0	0.8	0.1	1.1	1.2
Hungary	0.8	0.2	1.0	0.9	0.0	0.9
Finland	0.0	1.5	1.5	0.0	0.0	0.0
Latvia	1.5	0.0	1.5	0.0	0.0	0.0
Estonia	0.0	0.1	0.1	0.0	0.0	0.0
Ireland	0.0	0.0	0.0	0.0	0.0	0.0
Total EU	22 064.1	11.6	22 075.7	16 688.5	4.4	16 692.9
Croatia	n. a.	n. a.	n. a.	3.6	0.0	3.6

** Estimate. ** Overseas departements included. n.a. : non available.* ***Source: EurObserv'ER 2013***

2

Connected and cumulated photovoltaic capacity in the European Union countries at the end of 2011 and 2012 (MWp)*

	2011			2012*		
	On grid	Off grid	Total	On grid	Off grid	Total
Germany	25 039.0	55.0	25 094.0	32 643.0	55.0	32 698.0
Italy	12 773.0	10.0	12 783.0	16 420.0	11.0	16 431.0
Spain	4 352.0	23.3	4 375.3	4 603.0	24.6	4 627.6
France**	2 924.0	24.6	2 948.6	4 003.0	24.6	4 027.6
Belgium	2 050.5	0.1	2 050.6	2 581.0	0.1	2 581.1
Czech rep	1 913.0	0.4	1 913.4	2 022.0	0.4	2 022.4
United Kingdom	993.0	2.3	995.3	1 706.0	2.3	1 708.3
Greece	624.3	7.0	631.3	1 536.3	7.0	1 543.3
Bulgaria	211.5	0.7	212.2	932.5	0.7	933.2
Slovakia	487.2	0.1	487.3	517.2	0.1	517.3
Austria	182.7	4.5	187.2	417.2	4.5	421.7
Denmark	15.0	1.7	16.7	397.3	1.7	399.0
Netherlands	141.0	5.0	146.0	360.0	5.0	365.0
Portugal	168.8	3.2	172.0	238.7	3.3	242.0
Slovenia	100.3	0.1	100.4	217.3	0.1	217.4
Luxembourg	41.0	0.0	41.0	74.0	0.0	74.0
Sweden	9.3	6.5	15.7	16.5	7.3	23.8
Malta	6.6	0.0	6.6	18.7	0.0	18.7
Cyprus	9.3	0.8	10.1	16.4	0.8	17.2
Finland	0.2	11.0	11.2	0.2	11.0	11.2
Romania	2.9	0.6	3.5	5.8	0.6	6.4
Lithuania	0.0	0.1	0.1	6.0	0.1	6.1
Hungary	2.3	0.4	2.7	3.2	0.5	3.7
Poland	1.3	1.0	2.2	1.4	2.0	3.4
Latvia	1.5	0.0	1.5	1.5	0.0	1.5
Ireland	0.1	0.6	0.7	0.1	0.6	0.7
Estonia	0.0	0.1	0.2	0.0	0.1	0.2
Total EU	52 049.8	159.0	52 208.8	68 738.3	163.4	68 901.7
Croatia	0.3	0.5	0.8	3.9	0.5	4.4

** Estimate. ** Overseas departements included.* ***Source: EurObserv'ER 2013***

EUROBSERV'ER – THE STATE OF RENEWABLE ENERGIES IN EUROPE – 2013 EDITION

3

Electricity production from solar photovoltaic power in European Union in 2011 and 2012 (in GWh)*

	2011	2012*
Germany	19 340.0	26 380.0
Italy	10 795.7	18 862.0
Spain	7 441.0	8 193.0
France**	2 358.0	4 445.0
Czech Republic	2 182.0	2 173.0
Belgium	1 169.6	2 148.3
Greece	610.0	1 232.0
United Kingdom	244.3	1 187.9
Slovakia	397.0	561.0
Bulgaria	101.0	534.0
Portugal	280.0	393.0
Austria	174.1	337.5
Netherlands	100.3	253.8
Slovenia	65.0	163.0
Denmark	15.0	103.9
Luxembourg	25.7	38.3
Cyprus	12.0	19.8
Sweden	11.0	19.0
Malta	8.4	15.0
Hungary	1.0	7.0
Finland	5.0	5.4
Poland	2.6	4.1
Romania	1.0	4.0
Latvia	1.2	1.2
Lithuania	0.1	2.0
Estonia	0.1	0.6
Ireland	0.5	0.6
Total EU	**45 341.5**	**67 084.3**
Croatia	0.1	2.3

** Estimate. ** Overseas departements included.* ***Source: EurObserv'ER 2013***

city (including 311 MWp in the Overseas Territories), despite a sharp slowdown in the installation pace at the end of the year

NET METERING TRIUMPHS IN DENMARK

Denmark is one of the few European Union countries to have enjoyed spectacular growth of its collector base. It reached 399 MWp at the end of 2012 according to Energynet.dk. The reason for this success is its net metering system that exempts solar power producers with photovoltaic plants <6 kWp) from paying the very high taxes on the electricity they produce. Under this system, when PV-sourced current is fed into the grid, the electricity meter runs backwards. The electricity bill inclusive of taxes only applies to the difference between production and consumption. Although the system is efficient it is deemed too lavish given the drop in module prices. Since the new energy law was enacted, only the part of the photovoltaic electricity directly consumed during production will benefit from exemption.

PARADIGM SHIFT IN EUROPE BEFORE 2020

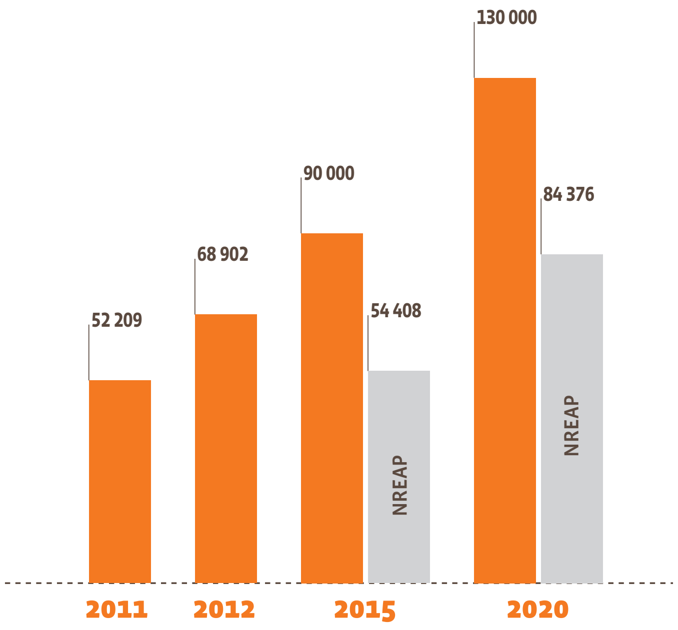
The situation regarding the current consolidation of the world industry must be put into perspective if we are to analyse the future of Europe's photovoltaic sector. As the major losses of the sector's large group testify, the current market price level does not square with the sector's real production costs, but is explained by prevailing overproduction. On the other hand there are promising prospects for reducing these costs be it through crystalline silicon or thin film technologies. Given the current electricity market price trends in Europe, it has become inevitable that solar electricity should compete with other "conventional" production sectors. That being so, it has to be said that the European sector is coming to the end of a cycle and will be unable to develop further at the same pace or on the same bases as before.

The guaranteed Feed-in Tariffs for high-capacity plants will gradually approach market prices, as investment decisions will no longer be driven by speculation but by coherent and long-term energy strategies. This is what is currently happening in Spain with the construction of the first plants with no Feed-in Tariffs.

4

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

Source: EurObserv'ER 2013



In the roof-mounted installation segment, invoicing through "net metering" will gradually become generalized because it no longer makes sense to subsidise production when grid parity is effective. As electricity prices differ from one country to the next this paradigm shift will have to be introduced gradually and TWeaked to the specifics of each individual country.

The National Renewable Energy Action Plan scenario from the ECN report forecasts PV contributing 2.4% in 2020, equivalent to 83.4 TWh of output and installed capacity standing at 84 376 MWp. EurObserv'ER feels this scenario is clearly understated given the progress made by some countries on their commitments, such as Germany and Italy. However, growth will be much slower-paced in coming years, and EurObserv'ER reckons it should be even weaker than forecast at the start of the year with a stage point at 90 GWp in 2015 and another of 130 GWp in 2020. The new low-incentive European Union policies will take their toll. Another factor – and the European Council confirmed its decision on 2 December 2013 – is the long-awaited introduction of antidumping measures against Chinese imports of crystalline and silicon photovoltaic cells for TWo-years (wafers have escaped the restriction).

SOLAR THERMAL

The market for solar thermal systems designed to produce hot water and heating is struggling to gain a new lease on life in Europe. The findings of the EurObserv'ER survey show that the market in 2012 contracted for the fourth consecutive time since 2009. The current estimate for 2012 is about 3 395 420 m^2, compared to 3 594 580 m^2 in 2011 – a year-on-year drop of 5.5%. The surface area covered by solar thermal collectors in service is about 42.3 million m^2 that equates to 29.6 GWth of capacity.
This new contraction comes as a disappointment for the sector, as 2011 raised the hope of a turnaround in the European market after TWo very difficult years 2009 and 2010. European Union market sales have slipped 1.2 million m^2 in just four years. Germany – the only EU country to install more than 1 million m^2 per annum – no longer sets the pace. The slight pick-up witnessed in the market in 2011 petered out in 2012. In Southern Europe (Spain, Italy and Portugal), which enjoys the highest solar thermal potential, the unabated recession combined with the construction sector crash is stifling solar thermal development... and this, despite the implementation of encouraging technical standards. The Austrian market, is giving rise to even more concern, for the increase in incentives in 2012 has not stemmed the decline, while the British market's contraction comes as a further blow. However the picture is not all black as the French market managed to hold up thanks to the development of the multi-occupancy sector and the solar thermal market is on an upswing in Greece, Poland, Hungary and Denmark, triggered by the increase in energy (gas and heating oil) prices. The Benelux market (Belgium, Netherlands and Luxembourg) is also on the way up, but cannot reverse the trend in Europe.

THE GERMAN MARKET IS HESITANT

The German market, which has been relatively spared by the recession, has not confirmed the return to growth initiated in 2011. The ZSW (Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg), that works with the Environment Ministry's renewable statistics task force (AGEE-Stat) claims that 1 170 000 m^2 of solar thermal collectors were installed in the German market during 2012, as against 1 290 000 m^2 in 2011 – a 9.3% contraction. An estimate of the surface area of unglazed collectors put at 20 000 m^2 in 2011 and 2012 is included in this figure. The decline raises questions in the sector as over this 12-month period heating appliance sales (all technologies taken together) increased by about 6% (i.e. 537 500 heating appliances sold in 2012), according to data from BDH, the heating appliance manufacturers' association. The reason for this increase is the sharp rise in the price of heating oil, which has persuaded buyers to replace their oil-fired boilers by gas-fired boilers, gas being the most popular energy in Germany. Figures coming from the German Solar Industry Association (BSW) confirm the drop in installation numbers from 149 000 in 2011 to 145 000 in 2012.

HEAT FEED-IN TARIFF IN PLACE IN ITALY

The European Union's major markets have clearly not escaped the recession. First available estimates suggest that the Italian market shrank by at least 15.4% in 2012 to 330 000 m^2. Assotermica says that the main reason for this market contraction is the financial crisis hitting the building market. The other reason is the delay in enacting the new incentive system, which creates a feed-in tariff for heat produced by solar thermal systems. After several years of gestation the "Conto Termico" support scheme, as it is known, was finally approved in January 2013.
The upside of this Heat Feed-in Tariff is that investors are paid straight away, whereas under the former system they had to wait 10 years to get the full benefit of the 55% tax rebate. The downside of the support scheme is that it does not discriminate positively for the high-performance systems because the payment amount is calculated on the basis of the installed surface, without taking into account effective energy production. Systems of less than 50 m^2 will be eligible for 170 euros per m^2 per annum for TWo years and systems of more than 50 m^2 will get an annual subsidy of 55 euros per m^2 for 5 years. As real production monitoring would have been too costly to set up, this choice was made to simplify the support system.

POLAND ON THE EUROPEAN PODIUM

There are still countries in the trouble-hit European market where solar thermal is gaining market shares, and Poland is one of them. It became the third largest European Union market by passing the 300 000 m^2 mark (302 074 m^2 according to the renewable energies institute). Some of the growth momentum has been lost (it was 73.7% between 2010 and 2011), but it is still in TWo figures (19.2% between 2011 and 2012), and as last year (see 2012 solar thermal barometer), growth is driven by the sharp hike in the price of gas from Russia and the success of the subsidy programme financed by the National Fund for Environmental Protection and Water Management (NFOŚiGW).

1

Annual installed surfaces in 2011 per type of collectors (m²) and power equivalent (MWth)

	Glazed collectors		Unglazed collectors	Total (m²)	Equivalent power (MWth)
	Flat plate collectors	Vacuum collectors			
Germany	1 080 000	190 000	20 000	1 290 000	903.0
Italy	331 500	58 500	–	390 000	273.0
Spain	249 730	17 250	8 610	275 590	192.9
Poland	187 000	66 500	–	253 500	177.5
Austria	221 495	8 694	5 700	235 889	165.1
France*	200 813	17 537	6 625	224 975	157.5
Greece	228 500	1 500	–	230 000	161.0
Czech Republic	49 000	16 000	65 000	130 000	91.0
Portugal	127 198	742	202	128 142	89.7
United Kingdom	72 953	18 826	–	91 779	64.2
Denmark	62 401	–	–	62 401	43.7
Netherlands	32 705	–	25 000	57 705	40.4
Belgium	35 500	10 000	–	45 500	31.9
Cyprus	26 794	1 643	142	28 579	20.0
Ireland	16 200	10 800	–	27 000	18.9
Hungary	10 920	8 935	5 050	24 905	17.4
Slovakia	19 550	3 450	100	23 100	16.2
Sweden	15 654	5 153	–	20 807	14.6
Romania	8 500	7 000	–	15 500	10.9
Slovenia	8 205	2 407	–	10 612	7.4
Bulgaria	7 400	600	–	8 000	5.6
Finland	6 600	–	–	6 600	4.6
Malta	4 169	–	–	4 169	2.9
Latvia	1 000	800	–	1 800	1.3
Lithuania	600	1 200	–	1 800	1.3
Estonia	900	900	–	1 800	1.3
Luxembourg	1 427	–	–	1 427	1.0
Total EU	3 006 714	448 437	136 429	3 591 580	2 514.1
Croatia	n. a.	n. a.	n. a.	n. a.	n. a.

** Overseas departments included. n.a. : non available.* ***Source: EurObserv'ER 2013***

2

Annual installed surfaces in 2012 per type of collectors (m²) and power equivalent (MWth)*

	Glazed collectors		Unglazed collectors	Total (m²)	Equivalent power (MWth)
	Flat plate collectors	Vacuum collectors			
Germany	977 500	172 500	20 000	1 170 000	819.0
Poland	216 168	85 906	–	302 074	211.5
Italy	290 400	39 600	–	330 000	231.0
Greece	241 500	1 500	–	243 000	170.1
Spain	213 060	12 623	3 591	229 274	160.5
France**	197 474	15 000	6 000	218 474	152.9
Austria	200 800	5 590	2 510	208 900	146.2
Denmark	133 122	–	–	133 122	93.2
Czech Republic	37 000	13 000	50 000	100 000	70.0
Portugal	90 896	–	–	90 896	63.6
Netherlands	42 470	–	26 000	68 470	47.9
Belgium	50 500	11 500	–	62 000	43.4
Hungary	44 200	5 800	1 650	51 650	36.2
United Kingdom	47 893	11 382	–	59 275	41.5
Cyprus	22 373	1 544	166	24 083	16.9
Ireland	14 057	6 250	–	20 307	14.2
Romania	20 000	–	–	20 000	14.0
Slovenia	10 596	2 897	–	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	–	–	8 000	5.6
Luxembourg	6 835	–	–	6 835	4.8
Finland	6 000	–	–	6 000	4.2
Malta	4 000	–	–	4 000	2.8
Latvia	1 800	–	–	1 800	1.3
Lithuania	1 800	–	–	1 800	1.3
Estonia	1 800	–	–	1 800	1.3
Total EU 27	2 894 995	389 098	111 327	3 395 420	2 376.8
Croatia	17 000	2 000	0	19 000	13.3

** Estimate. ** Overseas departments included.* ***Source: EurObserv'ER 2013***

2020: SOLAR NEEDS TO MAKE A PLACE FOR ITSELF

The uncertain economic environment has again postponed solar thermal market recovery by another year, and it has to be admitted that the beginning of 2013 gives no reason to cheer. The German and Austrian markets went through a bad patch at the beginning of this year, possibly because of the fickle weather that did not stimulate development of this technology. A reversal is still on the cards as the governments of both these countries have strengthened their support systems to the sector, but optimism is guarded to say the least. It is even harder to make efforts because solar thermal is already well developed in the TWo countries and naturally the growth prospects will dwindle as the years pass and the equipment rate rises. Austria is way ahead of its solar thermal roadmap set in its National Renewable Energy Action Plan (NREAP), and Germany has already met more than half of its targets.

The growth potential is much higher in the French and Italian markets, but the economic and financial crisis that is having a greater effect on these TWo countries is a major drag on market development. In France, the market situation is likely to improve because of the implementation of new mechanisms such as RT 2012, which now apply to the whole of the residential sector, and the buoyancy of the multi-occupancy market stimulated by the Heat Fund. In Italy, Conto Termico could revive the internal market after a difficult year. Some markets on the lines of the Polish market are holding up better because of the sharp hike in energy prices, but this is only part of the story. Generally, the markets reflect the fortunes of the construction market and households' financing capacities. If we take account of the current growth pace of solar thermal energy production, put at 6.7% between 2011 and 2012, and adopt the hypothesis that this pace will be maintained until 2020, the European Union will be at pains to achieve half its combined National Renewable Energy Action Plan targets. □

3

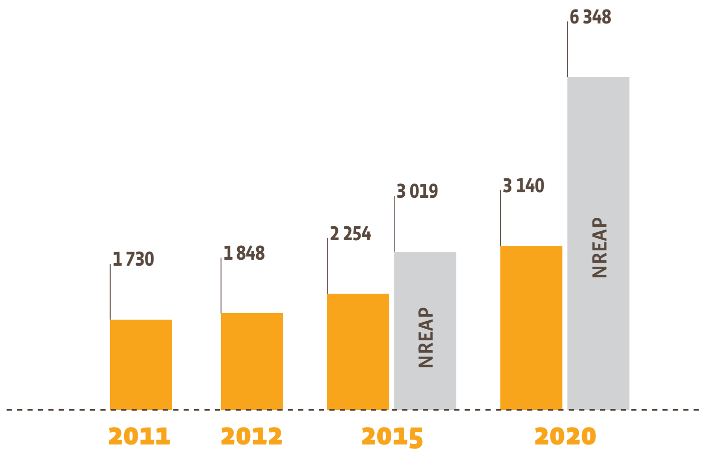
Cumulated capacity of thermal solar collectors installed in the European Union in 2011 and 2012** (m² and MWth)*

	2011		2012**	
	m²	MWth	m²	MWth
Germany	15 234 000	10 664	16 309 000	11 416
Austria	4 718 948	3 303	4 927 748	3 449
Greece	4 089 025	2 862	4 121 025	2 885
Italy	3 070 000	2 149	3 400 000	2 380
Spain	2 735 590	1 915	2 964 864	2 075
France***	2 204 051	1 543	2 396 313	1 677
Poland	909 423	637	1 211 497	848
Portugal	876 818	614	966 770	677
Czech Republic	792 768	555	892 768	625
Netherlands	843 000	590	868 970	608
Denmark	620 000	434	753 122	527
Cyprus	699 416	490	721 763	505
United Kingdom	607 822	425	650 497	455
Sweden	476 000	333	482 000	337
Belgium	416 447	292	477 115	334
Ireland	242 228	170	262 535	184
Slovenia	189 044	132	202 537	142
Hungary	127 691	89	179 858	126
Slovakia	146 350	102	154 350	108
Romania	123 000	86	143 000	100
Bulgaria	80 000	56	83 000	58
Malta	47 553	33	51 553	36
Finland	38 863	27	44 713	31
Luxembourg	31 607	22	38 442	27
Latvia	11 650	8	13 450	9
Lithuania	7 350	5	9 150	6
Estonia	4 320	3	6 120	4
Total EU	39 342 963	27 540	42 332 159	29 633
Croatia	100 600	70	119 600	84

** All technologies included unglazed collectors. ** Estimate. *** Overseas departments included.* ***Source: EurObserv'ER 2013***

4

Comparison of the current trend against the NREAP (National Renewable Energy Action Plans) roadmap (ktoe)
Source: EurObserv'ER 2013



SMALL HYDROPOWER

The small-size hydroelectricity sector groups together installations with capacities of up to 10 MW yet has a vital role to play in achieving the targets set by the European Union for 2020. It offers many advantages such as being readily available with a low per kWh cost. It thus contributes to supplying a stable, secure electricity supply. While it has many advantages, the sector has to contend with the implementation of increasingly binding environmental regulations such as the European Water Framework Directive and the protection of Natura 2000 listed areas, thus the possibilities for sector expansion have been reduced.


ROLF STURM/E.ON

After 2011's scant rainfall hit hydroelectricity production, 2012 saw a return to normality. According to EurObserv'ER, it increased by 9.7% in the European Union, taking output to 45.1 TWh, against the previous year's 41.1 TWh. Net installed capacity rose (by 197.1 MW year-on-year) near the 14-GW mark (13 928 MW at the end of 2012). Net capacity, is defined as the maximum capacity presumed to be exploitable that can be supplied continuously to the grid connection point when the whole installation is operating and must be differentiated from installed capacity.


ELEKTRIZITÄTSWERK MITTELBADEN AG & CO

ITALY – THE LEADING EUROPEAN PRODUCER AHEAD OF GERMANY

Once again Italy topped the European small hydropower producer country league. According to its Ministry of Economic Development, 9.4 TWh of gross output from plants with ≤10 MW of capacity in 2012 – a 6.4% drop – marks its second consecutive annual contraction since it peaked at about 11 TWh in 2010. Italy still has Europe's biggest generating base in operation with net capacity of 2 905 MW (2 819 MW at the end of 2011), and has a number of incentive systems to encourage small hydropower. Run-of-the-river installations of <1-MW are eligible for a conventional "all-inclusive" (tariffa onnicomprensiva) three-band Feed-in Tariff of € 0.0257/kWh (<20 kW), € 0.0219kWh (20–500 kW) and € 0.155/kWh (500–1000 kW). In addition producers can be remunerated directly by GSE (Gestore Servizi Energetici) that manages sales on their account, which saves the producers having to sell their electricity directly into the market. The minimum rate is then € 150/MWh for the first 250 MWh, on a sliding scale dropping to € 95/MWh for 251–500 MWh produced, then € 82/MWh for 501–1 000 MWh, and finally € 76.2/MWh for 1 001–2 000 MWh. Above that output, the market price applies. This system can be combined with the green certificate system in force, but only applies to new plants or plants that have been redeveloped or modernized with new generators. Alternatively, the producers may opt for a market price plus premium arrangement that is particularly attractive to run-of-the-river plants.

1

Total small hydraulic net capacity (<10 MW) running in the European Union countries in 2011 and 2012 (MW)*

	2011	2012*
Italy	2 819.0	2 905.0
France**	2 021.0	2 025.0
Spain	1 931.0	1 942.0
Germany	1 788.0	1 780.0
Austria	1 163.0	1 184.0
Sweden	956.0	953.0
Bulgaria	451.0	451.0
Romania	389.0	425.0
Portugal	377.0	380.0
Finland	315.0	315.0
Czech Republic	297.0	311.0
United Kingdom	272.0	283.0
Poland	268.0	273.0
Greece	206.0	218.0
Slovenia	159.0	160.0
Slovakia	99.0	102.0
Belgium	64.0	62.0
Ireland	41.0	41.0
Luxembourg	34.0	34.0
Latvia	26.0	26.0
Lithuania	26.0	26.0
Hungary	14.9	15.0
Denmark	9.0	9.0
Estonia	5.0	8.0
Total EU	13 730.9	13 928.0
Croatia	28.0	28.0

** Estimate. ** Overseas departments not included. **Source: EurObserv'ER 2013***

In 2012 Germany moved back up into second place with 7.2 TWh of output according to AGEE-Stat, the Ministry of Environment's Working Group on Renewable Energy Statistics, a 22.8% increase and approaching its 2008 level. Net installed capacity was fairly static, contracting by 8 MW to 1 780 MW over the year. New plants and redeveloped plants in Germany are only eligible for the new Feed-in Tariff if they comply with the Federal Water Management Act. The FiT ranges from € 0.034–0.127/kWh in line with the plant's capacity and its start-up date. Alternatively, the producers may opt for a market price plus premium arrangement, the latter being subject to monthly review.

THE ROADMAP TO 2020

As it stands, the small hydropower sector is in line with the NREAP targets, both in terms of installed capacity and output. 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


AGENTUR FÜR ERNEUERBARE ENERGIEN

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 (European Small Hydropower Association). 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. 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. □

2

Small hydraulic gross electricity production (<10 MW) in the European Union in 2011 and 2012 (GWh)

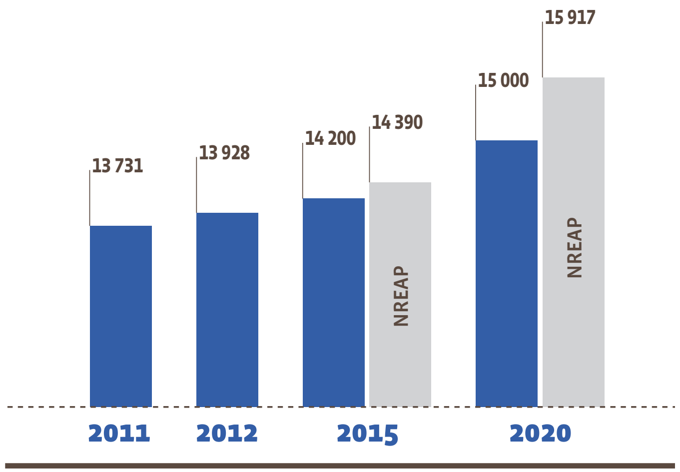
	2011	2012
Italy	10 047	9 409
Germany	5 870	7 206
France*	4 767	5 756
Austria	4 739	5 745
Sweden	3 615	4 366
Spain	4 097	4 316
Finland	1 147	1 733
Poland	943	940
Czech Republic	895	917
United Kingdom	1 053	883
Greece	581	669
Bulgaria	678	649
Portugal	938	627
Romania	614	576
Slovak Republic	334	375
Slovenia	292	297
Belgium	123	206
Ireland	83	108
Luxembourg	58	97
Lithuania	90	96
Latvia	64	64
Estonia	30	42
Hungary	52	40
Denmark	17	17
Total EU	**41 128**	**45 135**
Croatia	63	77

* Overseas departments not included. **Source: EurObserv'ER 2013**

3

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

Source: EurObserv'ER 2013



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.

ELECTRICITY PRODUCTION

The net geothermal electricity capacity of all the European Union countries increased slightly in 2012 (by 0.5% to 783 MW (or 4 MW more than in 2011). This contrasts with gross electricity output, which contracted slightly on its 2011 performance (by 2.1% year-on-year), down to 5.8 TWh in 2012.
Italy's geothermal capacity is concentrated in two main production areas, Larderello, Travale-Radicondoli and Monte Amiata. Terna (the Italian power grid manager) claims that net capacity has not changed since 2010, but has stabilized at 728.1 MW, while output has dropped slightly (1.1%) from 5 654 to 5 592 GWh.
In Portugal, geothermal resources have been harnessed to produce electricity in the Azores volcanic archipelago, on São Miguel Island, to be exact. According to the DGGE (Directorate General for Energy and Geology), the net operable capacity has also stabilized at 25 MW. However Portuguese geothermal production electricity has been badly hit by maintenance operations and dropped 30.5% year-on-year to 146 GWh in 2012.
In France, most of the high-temperature geothermal energy potential is in the overseas territories with two plants at Bouillante, Guadeloupe, with 16 MW of net capacity. A 20-MW extension is planned in the next few years. The DGEC (Directorate General for Energy and Climate) put output from these plants at 51 GWh in 2012. France also has a pilot plant with net capacity of 1.5 MW on the Soultz-sous-Forêts site that uses hot dry rock geothermal energy.
In Germany, according to AGEE-Stat (the Ministry of Environment working group on renewable energy statistics), net installed geothermal capacity increased by 4 MW in 2012 because the Insheim plant came on stream. The country now has four geothermal cogeneration plants at Insheim, Landau and Bruchsal in the Rhine Valley and Unterhaching in Bavaria. German geothermal output is thus rising and reached 25 GWh in 2012 (a 31.6% year-on-year increase). Two more plants were commissioned in 2013, at Dürrnhaar (5.5 MW) and Kirchstockach (5.5 MW), both in Bavaria, raising nominal electricity capacity to 23.3 MW. Germany intends to significantly increase its geothermal electricity capacity stimulated by an attractive Feed-in Tariff (of € 0.25/kWh over twenty years). A sliding 5% reduction in the tariff will be applied from 2018 onwards, which explains the current popularity for new projects to take up the best tariff before it expires. There are currently about ten projects under construction in Germany for more than 36 MW of capacity, and even more at the development stage. According to the EGEC, German geothermal

1

Capacity installed and net capacity usable of geothermal electricity plants in the EU in 2011 and 2012 (MWe)*

	2011		2012*	
	Capacity installed	Net capacity	Capacity installed	Net capacity
Italy	882.5	728.1	875.5	728.1
Portugal	29.0	25.0	29.0	25.0
France**	17.2	17.2	17.2	17.2
Germany	8.0	8.0	12.0	12.0
Austria	1.4	0.7	1.4	0.7
Total EU	**938.1**	**779.0**	**935.1**	**783.0**

** Estimate. ** Overseas departments included. The net capacity is the maximum power assumed to be solely active power that can be supplied, continuously, with all plant running, at the point of outlet to the network.* ***Source: EurObserv'ER 2013***

2

Gross electricity generation from geothermal energy in the European Union countries in 2011 and 2012 (GWh)*

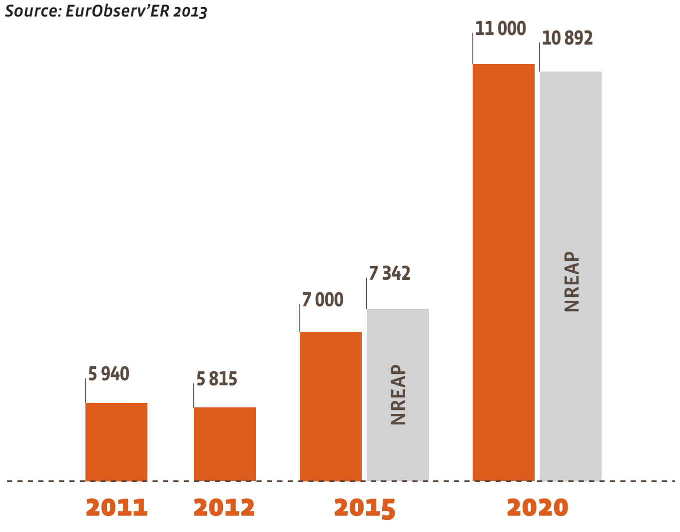
	2011	2012*
Italy	5 654.0	5 592.0
Portugal	210.0	146.0
France**	56.0	51.0
Germany	19.0	25.0
Austria	1.1	0.7
Total EU	**5 940.1**	**5 814.7**

** Estimate. ** Overseas departments included.* ***Source: EurObserv'ER 2013***

EUROBSERV'ER – THE STATE OF RENEWABLE ENERGIES IN EUROPE – 2013 EDITION

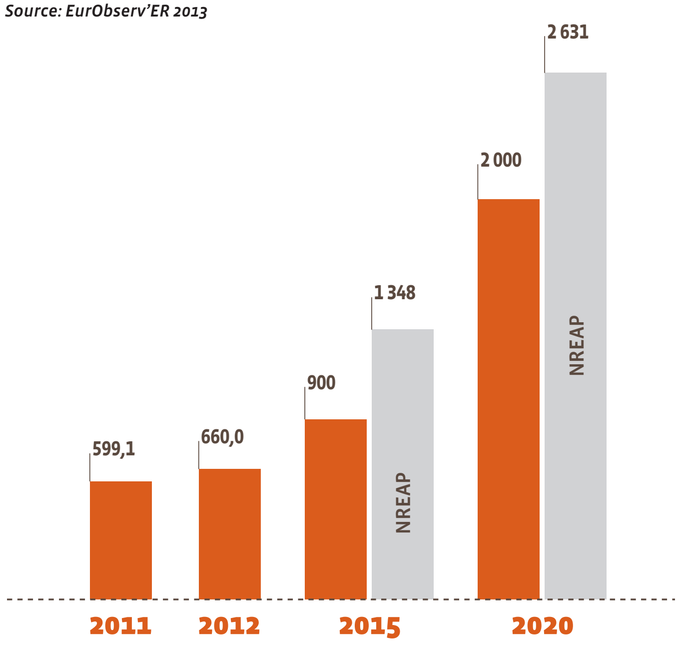
3

Comparison of the current geothermal electricity generation trend against the NREAP (National Renewable Energy Action Plan) roadmap (GWh)
Source: EurObserv'ER 2013



4

Comparison of the geothermal heat generation trend against the NREAP (National Renewable Energy Action Plan) roadmap (ktoe)
Source: EurObserv'ER 2013



electricity capacity could rise to 60-70 MW by the end of 2015.

MORE THAN 10 TWH OF OUTPUT EXPECTED IN 2020

The National Renewable Energy Action Plans forecast that the electrical applications of geothermal energy should almost double their output in 2020, i.e. 10.9 TWh, with 1 613 MW of installed capacity. To achieve this target, not only should the geothermal producer countries expand their existing installed capacities significantly (Italy to 920 MW, Germany to 298 MW, France to 80 MW and Portugal to 75 MW), but new countries should develop their own sectors such as Greece (120 MW), Hungary (57 MW), Spain (50 MW) and Slovakia (4 MW). Most of this development will be achieved by operating binary cycle plants.

HEAT PRODUCTION

LOW- AND MEDIUM-ENERGY APPLICATIONS

The capacity of applications linked to direct uses of heat (excluding heat pumps) in the European Union is put at 2 975.7 MW in 2012 for energy recovery in the order of 660 ktoe. These estimates come both from the recent work by sector experts who met at the European Geothermal Congress (EGC 2013) and from the official estimates of the national statistics offices EurObserv'ER favours when the information is available. The statistics demonstrate a sharp increase compared to the data published in the last edition of the State of Renewable Energies, which is explained by better calculation of the geothermal capacity used in balneology, especially in Italy.

5

Direct uses of geothermal energy (except geothermal heat pumps) in 2011 and 2012 in the European Union countries*

	2011		2012*	
	Capacity (MWth)	Energy using (ktoe)	Capacity (MWth)	Energy using (ktoe)
Italy	418.0	139.3	778.7	133.8
Hungary	654.0	108.0	714.0	120.0
France	391.0	89.0	365.0	94.0
Slovakia	130.6	76.0	163.9	83.6
Germany	120.5	26.4	171.0	62.7
Romania	153.2	32.1	176.0	31.1
Sweden	48.0	23.2	48.0	23.2
Austria	97.0	17.8	97.0	19.0
Poland	60.6	13.0	115.4	16.0
Slovenia	66.8	18.5	66.8	15.8
Greece	91.2	15.9	104.9	13.1
Netherlands	16.0	7.5	39.0	11.8
Portugal	27.8	10.3	27.8	10.3
Spain	22.3	8.3	22.3	8.3
Denmark	21.0	4.0	21.0	6.9
Czech Republic	4.5	2.1	4.5	2.1
Lithuania	48.0	1.6	48.0	1.9
Belgium	3.9	3.9	7.0	4.3
Bulgaria	3.5	1.3	3.5	1.3
United Kingdom	2.0	0.8	2.0	0.8
Latvia	0.0	0.0	0.0	0.0
Total EU	**2 379.8**	**599.1**	**2 975.7**	**660.0**
Croatia	36.7	6.8	37.2	7.0

** Estimate. Source: EurObserv'ER 2013*

The data published during the EGC 2013 has the advantage of breaking down the figures between the three major direct heat application uses, namely heating networks, heat use in agriculture and industry, and balneology and other uses in last place. On the basis of these figures and if we add the data from Slovakia, which is not covered by this study, heating networks are the main use with 42.3% of the thermal capacity ahead of balneology (34.9%) followed by agricultural and industrial uses with 22.9%.

The EurObserv'ER European Union thermal capacity ranking puts Italy in first place for direct uses of heat (excluding heat pumps) with 778.7 MW broken down between balneology with 400 MW, agricultural and industrial uses with 298 MW leaving 80.7 MW for heating networks. Hungary is in second place with 714 MW (breakdown unavailable) which is 60 MW more than in 2011. France comes third with thermal capacity put at 365 MW, with 295 MW in heating networks, 50 MW in balneology and only 20 MW in agriculture and industry.

If we turn to energy recovery, Italy stays in first place (133.8 ktoe according to the Ministry of economic development) ahead of Hungary (120 ktoe). France comes third with energy recovery put at 94 ktoe according to the Ministry of Environment's Service of Observation and Statistics (SOeS).

LOW- AND MEDIUM-ENERGY: 2 631 KTOE IN 2020?

The ECN summary of National Renewable Energy Action Plans published in November 2011 highlights that energy output from geothermal installations should increase significantly by 2020, with expected heat output at 2 630.7 ktoe with an interim target of 1 348.1 ktoe in 2015. If these targets are to be achieved, they will call for heavy investment in production plants and heating networks. They will also call for incentive policies to give clear preference to geothermal heat over fossil fuel-sourced heat, and thus be much more proactive than the current policies. □

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, that include the technologies using the ground's energy, namely all the groundwater and ground-air heat pumps. The hydrothermal HPs include those that use water as their heat source; namely water-to-water HPs and water-air HPs. Air source HPs that cover the technologies that use air as their heat source, they are said to be air-air, air-water, exhaust air-air and exhaust air-water. The latter two technologies use the exhaust air (indoor air) of dwellings whereas the first two use ambient air (outside the building).

1.653 MILLION HPS SOLD IN THE EUROPEAN UNION

The momentum of the European Union heat pump market for heating buildings has been exceptional since 2005. EHPA (the European Heat Pump Association) comments that it surged until 2008, then after a very difficult year in 2009 when the European market was hit head on by the financial crisis, it took off again in 2010 and managed to stay buoyant through 2011. The EurObserv'ER study findings show that the European Union market plunged in 2012 as HP sales tumbled by 7.9%.

The drop was indiscriminate as it hit the air source HP sector, whose unit sales dropped by 7.8%, from 1.686 million to 1.545 million, and the ground source HP sector which contracted by 8.9%, with sales dropping from 108 477 in 2011 to 98 807 in 2012.

It should be pointed out that the market figures for GSHPs and ASHPs are not strictly comparable because the clear lead by ASHPs is that all reversible air-air HPs have been factored into the figures, including those installed in Southern Europe that are mainly used for air-conditioning.

The situation is even more blatant in Italy which has chosen to include low-capacity reversible (split and multi-split) systems in its official statistics. These systems are not usually considered as HPs whose main purpose is to produce heat, but given that part of their production can be considered as renewable in the sense of the European Directive, their inclusion is justified. The Italian market figures cannot be directly compared with those of the other EU countries as they present a different picture.


Bundesverband Wärmepumpe/BWP

WHAT IS BEHIND THIS DRAMATIC MARKET DECLINE?

The European HP market for heating dropped sharply between 2011 and 2012, yet the drop did not pervade the whole of the European Union with the result that there is no clear market trend. Half of the countries witnessed market development (of the 23 markets monitored, 12 increased and 11 contracted), yet in 2012 some of these markets varied wildly. Contraction was particularly severe in Spain, Portugal, Italy and Bulgaria and also in Sweden, Finland, France and Hungary. The reverse is true in Denmark, Estonia, Belgium, Germany and Austria that enjoyed two-figure growth.

If we recall the main HP market variation factors we arrive at the main reasons for these fluctuations. Firstly the health of the new build market, secondly the change in the price of electricity compared to the energy used by other heat producing systems and thirdly political developments, be they statutory changes (e.g.: thermal regulations) or incentive mechanisms (e.g.: grants, tax concessions).

The HP market, and in particular the GSHP market is still highly dependent on the new construction market. In many European Union countries the latter is at its lowest point or slipped again in 2012. According to Euroconstruct, which monitors the new construction market in 19 European countries, there were 4.7% fewer new build projects in 2012 and they are set to dip by a further 2.8% in 2013. The organisation forecasts that the number of new dwellings constructed will drop by 125 000 to 1.3 million in 2013. The construction slump hit Spain and Portugal particularly hard in 2012, and also Sweden.

In the renovation sector where ASHPs have a major role to play, the sharp increase in the price of

1

Market of heat pumps[1] in 2011 and 2012 (sold units)

	2011				2012			
	Geothermal HP	Aerothermal HP	*including air-water HP*	HP total	Geothermal HP	Aerothermal HP	*including air-water HP*	HP total
Italy[2]	1 050	1135800	*15 800*	1136850	1 050	1071600	*14 600*	1072650
France	10 365	152 200	*55 300*	162 565	8 230	134 150	*52 800*	142 380
Sweden	31 384	75 391	*8 958*	106 775	24 520	70 587	*6 384*	95 107
Finland	13 941	58 326	*992*	72 267	13 000	47 900	*1 000*	60 900
Germany	20 200	27 500	*27 500*	47 700	20 800	33 300	*33 300*	54 100
Spain	387	74 748	*2 090*	75 135	511	49 625	*1 374*	50 136
Netherlands	5 858	32 403	*32 403*	38 261	5 786	30 849	*30 849*	36 635
Denmark	4 172	20 462	*2 421*	24 634	3 191	27 191	*2 350*	30 382
Bulgaria	1 071	47 576	*6 898*	48 647	604	26 849	*3 893*	27 453
United Kingdom	2 255	16 245	*12 765*	18 500	2 294	15 505	*14 455*	17 799
Austria	6 699	5560	*5 393*	12 259	6 412	7 198	*7 083*	13 610
Estonia	1 020	10 786	*710*	11 806	1 200	12 295	*790*	13 495
Portugal	24	14 072	*430*	14 096	39	8 035	*521*	8 074
Czech Republic	2 361	4 631	*4 631*	6992	2 529	5 128	*5 128*	7 657
Poland	4 765	1 505	*1 240*	6 270	5 121	1 995	*1 680*	7 116
Belgium	1 300	4 631	*4 631*	5 931	1 418	5 135	*5 135*	6 553
Slovenia	246	2 100	*2 100*	2 346	475	4 950	*4 950*	5 425
Ireland	548	678	*646*	1 226	479	905	*886*	1 384
Slovakia	180	357	*277*	537	245	511	*395*	756
Hungary	236	608	*97*	844	293	402	*177*	695
Lithuania	404	193	*193*	597	450	195	*195*	645
Romania	0	0	*0*	0	160	0	*0*	160
Luxembourg	11	0	*0*	11	0	0	*0*	0
Total EU	108 477	1685772	185 475	1794249	98 807	1554305	18 7945	1653112

[1] Designed for heating with or without cooling function. [2] The high figure for the air-air reversible heat pump market in Italy is not directly comparable to others and can be explained by the fact that systems with cooling as main function are included. ***Source: EurObserv'ER 2013***

2

Total number of heat pumps in operation in 2011 in the European Union and associated renewable energy production (ktoe)

	Aerothermal HP	*Renewable heat aero. (ktoe)*	Geothermal HP	*Renewable heat geo. (ktoe)*	Total HP in operation	Total renewable heat (ktoe)
Italy[1]	14 950 000	*2 388*	9 300	*53*	14 959 300	2 442
France	849 960	*795*	114 815	*150*	964 775	945
Sweden	583 646	*248*	218 538	*398*	802 184	646
Finland[2]	399 833	*169*	60 631	*104*	460 464	273
Germany	161 500	*196*	244 000	*319*	405 500	515
Denmark	297 619	*76*	34 216	*45*	331 835	121
Netherlands	118 080	*86*	36 048	*87*	154 128	174
Spain	146 364	*29*	5 500	*18*	151 864	47
Bulgaria	125 798	*61*	3146	*1*	128 944	62
Austria	4 202	*1*	101 058	*104*	105 260	105
Portugal	103 340	*21*	652	*1*	103 992	21
United Kingdom	53 140	*26*	15 366	*20*	68 506	45
Estonia	46 802	*16*	4 755	*9*	51 557	25
Czech Republic	21 599	*31*	15 711	*21*	37 310	52
Poland	3 450	*3*	15 500	*31*	18 950	34
Belgium	7 460	*8*	2 628	*3*	10 088	11
Slovenia	2 523	*2*	4 194	*23*	6 717	25
Slovakia	4 133	*9*	1 974	*4*	6 107	13
Ireland	1 627	*2*	1 824	*2*	3 451	4
Hungary	1 805	*1*	756	*1*	2 561	2
Lithuania	495	*1*	1 173	*2*	1 668	2
Romania	0	*0*	970	*1*	970	1
Luxembourg	503	*1*	106	*0*	609	1
Total EU	17 883 879	4 170	892 861	1 398	18 776 740	5 569

[1] The high figure for the air-air reversible heat pump market in Italy is not directly comparable to others and can be explained by the fact that systems with cooling as main function are included. [2] Renewable energy production from exhaust air HP not included for Finland. ***Source: EurObserv'ER 2013***

3

Total number of heat pumps in operation in 2011 in the European Union and associated renewable energy production (ktoe) in 2012

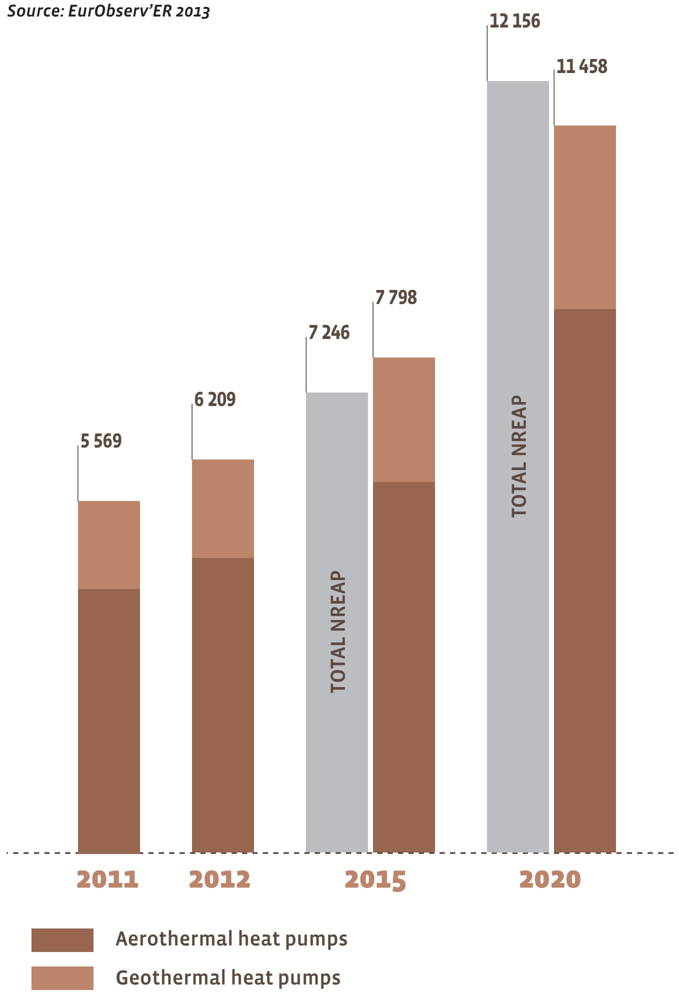
	Aerothermal HP	Renewable heat aero. (ktoe)	Geothermal HP	Renewable heat geo. (ktoe)	Total HP in operation	Total renewable heat (ktoe)
Italy[1]	15 972 000	2580	10 300	61	15 982 300	2 640
France	1 136 310	879	123 045	161	1 259 355	1 040
Sweden	654 233	274	243 058	442	897 291	717
Finland[2]	445 787	212	72 420	140	518 207	352
Germany	194 800	235	264 800	344	459 600	579
Denmark	308 119	79	36 335	48	344 454	127
Spain	195 989	39	6 011	20	202 000	59
Netherlands	147 815	100	41 253	98	189 068	198
Bulgaria	149 962	79	3 749	2	153 711	81
Austria	4 317	1	113 633	114	117 950	115
Portugal	111 374	22	691	1	112 065	23
United Kingdom	68 645	34	17 760	23	86 405	56
Estonia	59 097	21	5 955	11	65 052	32
Czech Republic	26 727	39	18 240	24	44 967	63
Poland	5 373	6	20 621	41	25 994	47
Belgium	12 595	13	4 046	5	16 641	18
Slovenia	7 473	5	4 669	25	12 142	30
Slovakia	4 616	13	2 221	6	6 837	19
Ireland	2 532	3	2 303	3	4 835	6
Hungary	2 207	1	1 049	1	3 256	2
Lithuania	690	1	1 623	2	2 313	3
Romania	–	0	1 250	1	1 250	1
Luxembourg	503	1	106	0	609	1
Total EU	**19 511 164**	**4 636**	**995 138**	**1 574**	**20 506 302**	**6 209**

[1] The high figure for the air-air reversible heat pump market in Italy is not directly comparable to others and can be explained by the fact that systems with cooling as main function are included. [2] Renewable energy production from exhaust air HP not included for Finland. ***Source: EurObserv'ER 2013***

electricity across Europe hit the market, primarily where the rises were sharpest (France, Germany, Portugal, Italy, the UK and Belgium). The severity of this impact can be put down to the funding of renewable energies, the increase in the price of gas, but above all the investments in infrastructures. Lastly, some markets such as Finland saw their incentive system overhauled, which led to a mechanical drop in sales volume.

4

Comparison of the current trend of the renewable energy from heat pumps against the NREAP (National Renewable Energy Action Plan) roadmap (ktoe)
Source: EurObserv'ER 2013



ONE OF THE BEST PLACED SECTORS FOR THE FUTURE

In 2013, market development should improve. EHPA reckons that the European market should return to its 2011 (peak) level based on the first two quarters' sales figures, and posits expected growth of about 8%.

While players are cautious about the growth prospects for the coming years, they are generally more optimistic about the longer-term growth fundamentals. They say that HP technologies are among the best placed for potential growth in the individual residential sector, and also in the tertiary, collective and industrial sectors.

Forecasting is a hard task because it is dependent on different parameters that are unknown quantities for the time being, such as the recovery time and level of economic activity. Back in 2009, the European Commission asked the Member States to conduct this work under their obligations through the Renewable Energy Directive. In fact, each Member State had to draw up a renewable energy action plan setting itself specific targets for each technology including HP technology. 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 7 246 ktoe in 2015 and 12 156 ktoe in 2020. The contribution 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, mean annual growth of 8% through to 2020 in unit sales is still realistic. The assumption is also made that all the HPs installed since 2005 will still be in service in 2020. These various factors bring us to estimate the European base at 37.9 million units in 2020 (including 1.8 million GSHPs). The renewable energy output of this base will be of the order of 11.5 Mtoe (including 2.8 Mtoe produced by GSHPs). □

BIOGAS

Energy recovery from biogas has taken a leap forward in the European Union. Primary energy production grew by 15,7% in 2012 compared to 2011, which is a 1.6 million toe increase (12 Mtoe produced in 2012). Purpose-designed energy recovery plants (decentralized farm biogas plants, centralized digester and multiproduct plants, solid waste methanization plants) collectively known as "other biogas" continue to dominate the biogas production spread, with more than two-thirds of the primary energy production (66.5% in 2012), a long way ahead of landfill biogas (23.7%) and biogas from sewage plants (9.9%). Output by the latter two rose very slightly over the twelve months from 2011 (landfill biogas by 0.1% and sewage plant biogas by 3.1%), thus the bulk of the increase in output came from the "other biogas" plants (+24.9%).
The extent to which these sources are developed varies from country to country. In the UK, France and Spain, landfill biogas is the main source, and this trend may be ascribed in part to the fact that the proportion of fermentable waste consigned to landfill remains high, particularly in the UK and Spain. This contrasts with the penchant for "other biogas" primarily in Germany, Italy, the Netherlands, Czech Republic, Austria, Belgium, and Denmark.

A THIRD ENERGY RECOVERY TECHNIQUE

The two main biogas recovery techniques used in the European Union are electricity and heat production, be they through cogeneration or otherwise. Again the increase in primary energy output boosted electricity output, as 22.2% more biogas electricity was generated than in 2011, rising to 46.3 TWh, and 64.9% of this was from cogeneration plants (electricity only plants cannot benefit from the FIT).
The same applies to the increase in heat output. If heat sold to district heating networks is added (348.3 ktoe) to final energy consumption (1885.9 ktoe), biogas heat output rose to 2.2 Mtoe in 2012, which is a 2.2% year-on-year increase. Most of the heat produced is used directly on site for drying sludge, heating buildings and keeping the digester at an optimum temperature. While the sale of heat to a heating network is desirable, it is harder to implement because it requires the network to be close to the production plants which is not always the case.
A third recovery technique is emerging in the European Union in the form of biomethane injection (purified biogas) into the natural gas network. At the end of 2012, Dena (The German energy agency) put the number of methanization plants already injecting biogas into the natural gas network in Europe (Union European + Norway and Switzerland) at more than 152, with Germany clearly leading the European field. The German biomethane barometer (Branchenbarometer Biomethan) published by Dena counted 130 biogas enrichment plants injecting into the network in November 2013 (117 plants at the end of 2012), with 80 390 Nm³ (normal cubic metres) of combined injection capacity per hour. 28 plants were under construction and a further 33 planned. The publication claims that injection capacity should rise to 113 000 Nm³ by 2017. Biogas injection into the natural gas network is already a given in eight European Union countries – Germany, Austria, the Netherlands, the UK, France, Spain, Finland and Luxembourg.

1

Primary production of biogas in the European Union in 2011 and 2012 (ktoe)*

	2011				2012*			
	Landfill gas	Sewage sludge gas[1]	Others biogas[2]	Total	Landfill gas	Sewage sludge gas[1]	Others biogas[2]	Total
Germany	144.4	368.2	4 667.9	5 180.5	123.8	372.1	5 920.3	6 416.2
United Kingdom	1 515.7	285.0	0.0	1 800.7	1 533.9	277.3	0.0	1 811.2
Italy	377.4	21.3	705.2	1 103.9	364.7	42.0	772.0	1 178.8
France**	273.0	71.9	24.5	369.4	279.1	79.6	53.3	412.0
Czech Republic	31.3	38.3	180.3	249.8	31.7	39.4	303.8	374.9
Netherlands	32.6	51.5	208.8	292.9	29.9	53.1	214.5	297.5
Spain	145.0	32.0	110.0	287.0	131.6	28.8	100.1	260.5
Austria	4.3	20.4	144.4	169.1	3.8	18.2	185.5	207.5
Poland	55.5	66.3	15.1	136.9	53.7	79.3	34.9	168.0
Belgium	35.9	13.9	78.5	128.3	32.4	17.2	108.0	157.7
Sweden	12.4	68.9	37.9	119.3	12.6	73.6	40.6	126.8
Denmark	5.2	20.5	75.0	100.7	5.6	21.2	77.9	104.7
Greece	55.4	16.1	1.4	72.8	69.4	15.8	3.4	88.6
Hungary	11.0	17.7	31.9	60.7	14.3	18.6	46.8	79.8
Finland	26.3	20.3	6.4	53.0	31.6	13.9	12.4	57.9
Portugal	42.3	1.8	0.9	45.0	54.0	1.7	0.7	56.4
Ireland	43.8	8.2	5.6	57.6	43.0	7.5	5.4	55.9
Slovakia	3.0	13.6	29.3	45.8	2.4	11.9	29.1	43.5
Slovenia	7.1	2.7	26.2	36.0	6.9	3.1	28.2	38.1
Latvia	7.8	2.4	11.8	22.0	7.8	2.4	11.8	22.0
Luxembourg	0.1	1.4	12.0	13.5	0.1	1.2	14.4	15.7
Romania	1.1	0.1	12.0	13.2	1.4	0.1	12.0	13.4
Lithuania	5.9	3.1	2.1	11.1	6.1	3.1	2.3	11.6
Cyprus	0.0	0.0	11.0	11.0	0.0	0.0	11.0	11.0
Bulgaria	0.0	3.0	0.0	3.0	0.0	3.0	0.0	3.0
Estonia	2.2	1.1	0.0	3.3	2.2	0.7	0.0	2.9
Total EU	2 838.5	1 149.7	6 398.1	10 386.4	2 841.8	1 185.1	7 988.6	12 015.5
Croatia	0.0	0.0	6.9	6.9	0.0	0.0	11.4	11.4

** Estimate. ** Overseas departments not included. [1] Urban and industrial. [2] Decentralised agricultural plant, municipal solid waste methanisation plant, centralised co-digestion plant. **Source: EurObserv'ER 2013***

2

Gross electricity production from biogas in the European Union in 2011 and 2012 (GWh)*

	2011			2012*		
	Electricity only plants	CHP plants	Total electricity	Electricity only plants	CHP plants	Total electricity
Germany	4 752.0	16 436.0	21 188.0	5 917.0	21 322.0	27 239.0
United Kingdom	5 232.3	624.6	5857.0	5 243.1	631.3	5 874.4
Italy	1 868.5	1 536.2	3404.7	2 160.6	2 459.3	4 619.9
Czech Republic	59.0	869.0	928.0	55.0	1 412.0	1 467.0
France**	775.7	353.5	1 129.2	754.9	530.0	1 284.9
Netherlands	72.0	964.0	1 036.0	68.0	940.0	1 008.0
Spain	709.0	166.0	875.0	710.0	223.0	933.0
Austria	555.0	70.0	625.0	588.0	48.0	636.0
Poland	0.0	451.1	451.1	0.0	565.4	565.4
Belgium	115.3	411.6	526.9	90.4	573.1	663.5
Hungary	91.0	122.0	213.0	153.4	81.3	234.7
Denmark	1.8	346.5	348.3	2.5	375.7	378.2
Portugal	149.0	11.0	160.0	199.0	10.0	209.0
Greece	37.6	169.4	207.0	38.3	164.3	202.6
Ireland	180.9	22.4	203.3	174.6	21.4	196.0
Slovenia	5.7	121.0	126.7	4.9	148.2	153.1
Finland	84.8	48.9	133.7	57.2	82.3	139.4
Slovakia	39.0	74.0	113.0	34.0	72.0	106.0
Latvia	0.0	105.3	105.3	0.0	105.3	105.3
Luxembourg	0.0	55.3	55.3	0.0	57.8	57.8
Cyprus	0.0	52.0	52.0	0.0	52.0	52.0
Lithuania	0.0	37.0	37.0	0.0	42.0	42.0
Bulgaria	0.0	19.0	19.0	0.0	28.3	28.3
Sweden	0.0	33.0	33.0	0.0	22.0	22.0
Romania	0.0	14.2	14.2	0.0	19.7	19.7
Estonia	0.0	15.1	15.1	0.0	15.8	15.8
Total EU	14 728.7	23 128.1	37 856.8	16 250.9	30 002.1	46 253.0
Croatia	1.4	36.1	37.4	1.5	56.5	58.0

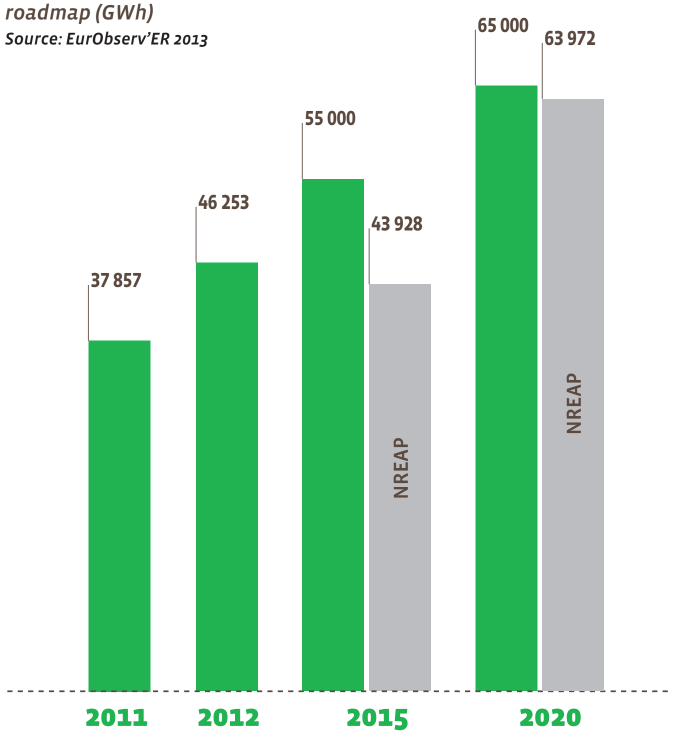
** Estimate. ** Overseas departments not included. **Source: EurObserv'ER 2013***

THE GOLDEN AGE OF GERMAN BIOGAS IS OVER

Primary biogas energy output in Germany increased sharply again and the country still produces more than half of the European Union's output. According to AGEE-Stat estimates (Ministry of Environment working group on renewable energies statistics) it increased 1.2 Mtoe between 2011 and 2012 to reach 6.4 Mtoe, which was essentially picked up by electricity production which rose 28,6% year-on-year (by 6.1 TWh) to reach 27.2 TWh by the end of 2012. However, the increase was fed by the number of biogas plants rocketing in 2011 as the result of a rush to install before the government's announced cut in Feed-in Tariffs came into force on 1 January 2012. The amendments to the renewable electricity law (EEG 2012) cut 1 to 2 euro cents off the price paid per kWh of biogas electricity. Naturally the tariff decrease affected the installation pace, which according to the German Biogas Association (Fachverband Biogas), dropped from 1270 new plants in 2011 to 340 in 2012. The association was only expecting 205 new plants in 2013 and a further drop in 2014. The number of biogas plants in Germany should thus rise from 7515 in 2012 to 7720 in 2013. The estimated power generating capacity of the plants is put at 3 352 MW in 2012 and 3 547 MW in 2013. The German sector's sales figure suffered from the slower activity, which affected employment as the number of jobs supported dropped from 52 900 in 2011 to 51 000 in 2012, while sales dwindled from € 2,28 billion in 2011 to € 2,075 billion in 2012, according to the BMU.

3

Comparison of the current trend of electricity biogas generation against the NREAP (National Renewable Energy Action Plans) roadmap (GWh)
Source: EurObserv'ER 2013



ITALY LOWERS ITS INCENTIVE LEVELS

Preliminary data coming from the Italian Ministry of Economic Development suggests that output should near 1.2 million toe (1.1 Mtoe in 2011). Most of the increase derives from purpose-built energy recovery plants (of the other biogas type). Terna, the energy transport operator in Italy, claims the number of biogas installations (all sources) has risen from 787 (773.4 MWe) in 2011 to 1 471 (1 342.7 MWe) in 2012. The growth can be primarily ascribed to biogas production from farming and plants operating with slurry whose number has more than doubled from 499 (387.4 MWe) to 1 168 plants (893.6 MWe). The sector should continue to expand, albeit at a slower pace as from 2013 onwards less attractive FiT rates will apply. Plants using biological products will see the rate drop to € 0.18/KWh up to 300 kW, to € 0.16/kWh up to 600 kW and € 0.14/kWh up to 1 MW. Plants using biological by-products (slurry, etc.), will see the rate drop to € 0.236/KWh up to 300 kW, € 0.206 up to 600 kW and € 0.178/kWh up to 1 MW. There are Feed-in Tariffs for higher-capacity plants, but they are much less attractive.

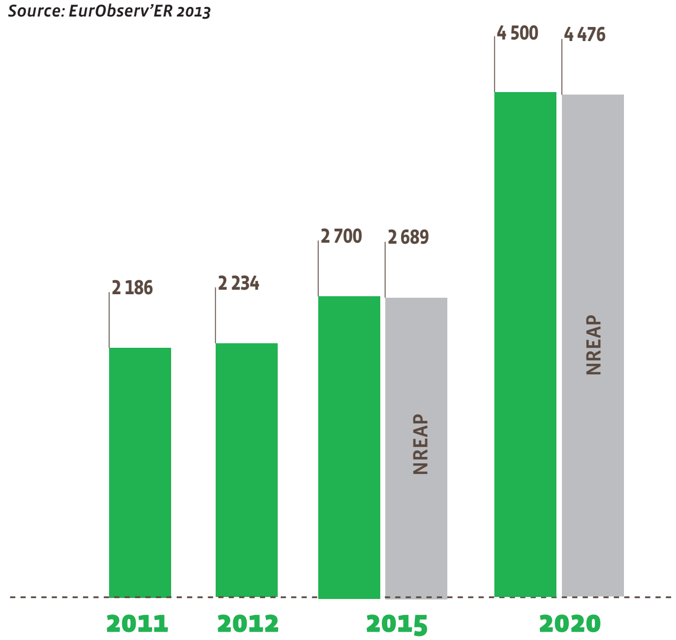
THE CZECH REPUBLIC PUTS ON 50%

Data supplied by the Ministry of Industry and Trade of the Czech Republic indicate a sharp rise in biogas output of around 50% between 2011 and 2012 (374.9 ktoe in 2012). Yet again the increase can be explained by significant development in farm methanization plants whose output rose from 180.3 ktoe in 2011 to 303.8 ktoe in 2012. The Czech biogas electricity incentive system is essentially based on a bonus paid in addition to the market price of electricity. Electricity must be produced as part of a cogeneration scheme with the use of energy crops capped at 70% and minimum energy yield of 50%.

From 1 January to 31 December 2013, the methanization plant premium was restricted to installations of up to 550 kW, levied at 2.49 CKZ/kWh (€ 0.096/kWh). The premium is lower for sewage treatment plants and landfill biogas, namely 0.9 CZK/kWh (€ 0.035/kWh). A conventional Feed-in Tariff of 3.55 CKZ/kWh (€ 0.137/kWh) is paid to <100-kW plants for methanization biogas and 1.9 CZK/kWh (€ 0.073/kWh) for landfill or sewage treatment plant biogas.

4

Comparison of the current trend of biogas heat consumption against the NREAP (National Renewable Energy Action Plans) roadmap (ktoe)
Source: EurObserv'ER 2013



THE PACE OVER THE NEXT FEW YEARS WILL BE SLOWER

So far, if we stick to the interim NREAP targets set by the Member States, biogas energy is making a good showing. In 2012 biogas electricity production was largely ahead of schedule with 46.3 TWh of output against a target of 43.9 TWh in 2015.

At the same time, thermal recovery (heat sold and final energy consumption) appears to be on target, with heat consumption measured at 2 234.2 ktoe (348.3 ktoe of heat sold to 1 885.9 ktoe of final energy consumption) in 2012 as against the 2 689-ktoe target for 2015. Nonetheless, the pace should begin to slacken over the next few years as the German powerhouse has decided to curb expansion. Consequently sector growth will have to be powered by investments in other European Union countries, the most promising of which are France, Spain, Poland, the Czech Republic, Hungary and also Denmark, Finland and the Netherlands.

Increasing the energy efficiency of biogas plants will be crucial for the sector's future growth as so far incentives for producing electricity have driven its growth, relegating thermal uses of biogas to the side lines. However this kind of growth cannot be sustained. Taking a leaf out of the UK situation with the RHI, the possibilities of heat recovery from biogas production must be tapped. Another potential application for development is injection, which enables output to be stored and it use relocated. This channel, when economically feasible (a network nearby), could give the sector new impetus. □

BIOFUELS

The European Union biofuel sector is currently under close scrutiny as a result of the European Commission's proposal to implement a new development strategy for biofuel use in transport. This proposed review of the renewable energy directives and biofuel quality primarily targets the effects of indirect land-use change (the ILUC effect) on biofuel production-related CO_2 emissions. Making allowance for this would result in reducing the first-generation biofuel incorporation rate in transport that would count towards a 10% renewable energy target in 2020. At the end of 2013 no political consensus had been reached between the European Parliament and the European Council on the scientific basis for allowing for the ILUC effect, which has delayed revision of the two directives.

Since 2011, biofuel consumption has been dependent on the implementation of binding sustainability criteria that are now compulsory for inclusion in the Renewable Energy Directive target calculations. These criteria not only apply to the whole biofuel production and distribution chain within the EU, but also to biofuel produced from raw materials sourced from third countries.

KIT/KARLSRUHER INSTITUT FÜR TECHNOLOGIE

SLOWING MARKET CONDITIONS IN EUROPE

As expected, 2012 confirmed the trend started in 2011, and European Union biofuel consumption growth just about held up. The EurObserv'ER survey points to consumption (both certified as sustainable and otherwise) at about 14.3 Mtoe in 2012 compared to 13.8 Mtoe in 2011 – equivalent to 4% growth over 2011 (3.6% between 2010 and 2011). This slowdown follows the strong build-up in biofuel consumption between 2005 and 2010 when consumption rose from 3.1 to 13.3 Mtoe. Measurement of the sustainably certified share of consumption was not available for all countries during the EurObserv'ER survey and there are still uncertainties about European Commission acceptance of the certification systems implemented in a number of countries. According to our estimates, it should be 11.7 Mtoe in 2012 (82% of total) it was only about 8.5 Mtoe in 2011 (61% of total). The reason for this increase is the build-up of certification and also the fact that a few countries, such as France, only started to certify their consumption in 2012.

The breakdown of biofuel consumption (certified or otherwise) was appreciably the same as in previous years, with biodiesel accounting for 79.0% of total energy content consumption, far ahead of bioethanol (20.1%). Pure vegetable oil and biogas accounted for less than 1% of total consumption.

NEWS FROM THE MAIN PRODUCER COUNTRIES

GERMANY STILL LEADS THE PACK

In 2012 Germany increased its biofuel consumption slightly after slipping in 2011. AGEE-Stat (the Ministry of the Environment's working group on renewable energy statistics) reported that 2 190 767 toe of biodiesel, 805 460 toe of bioethanol and 22 093 toe of pure vegetable oil were used in 2012 – which confirms its position as Europe's leading biofuel consumer. All this consumption (both in 2011 and 2012) was certified, meaning that the country can include it in its calculations towards meeting its renewable energy target. Germany's official biofuel share of total road fuel consumption rose 5.7% in 2012 from its 2011 level of 5.5%. The bioethanol incorporation rate should continue to increase as E10 fuel consumption rises in Germany. The BDBe industrial association claims that bioethanol output increased by 7.4% in 2012 to 613 381 tonnes partly thanks to stepped-up sugar beet processing. In its March 2013, AGEE-Stat reported the number of direct jobs in the biofuel sector at 22 700 in 2012 as against 23 200 in 2011.

FRANCE, THE TOP BIODIESEL CONSUMER

France is not Europe's leading biofuel consumer, but in 2012 it reclaimed its the top biodiesel

1

Biofuels consumption for transport in the European Union in 2011 (toe)

Country	Bioethanol	Biodiesel	Others*	Total consumption	% certified sustainable
Germany	795 142	2 143 929	17 675	2 956 746	100
France	395 651	2 010 570	0	2 406 221	0
Spain	227 038	1 474 331	0	1 701 369	0
Italy	85 608	1 286 450	0	1 372 059	100
United Kingdom	327 028	729 077	0	1 056 105	92
Poland	178 633	755 255	0	933 887	100
Austria	66 519	411 822	13 674	492 015	82
Sweden	203 139	212 979	64 372	480 489	98
Belgium	48 121	273 308	0	321 429	100
Netherlands	148 968	172 327	0	321 296	100
Portugal	4 611	310 253	0	314 864	3
Czech Republic	59 282	240 566	0	299 847	0
Hungary	47 721	138 746	9 721	196 188	32
Romania	54 123	110 003	0	164 126	100
Finland	91 693	42 419	143	134 255	0
Denmark	49 798	82 502	132	132 433	100
Slovakia	25 278	97 747	0	123 024	0
Greece	0	103 396	0	103 396	100
Ireland	29 628	67 704	119	97 452	100
Luxembourg	6 423	39 092	164	45 679	100
Lithuania	9 495	35 372	0	44 867	100
Slovenia	3 761	31 433	0	35 194	100
Latvia	7 649	14 644	0	22 293	100
Bulgaria	0	16 791	0	16 791	0
Cyprus	0	15 899	0	15 899	0
Total EU	2 865 309	10 816 616	106 000	13 787 925	61
Croatia	0	2 500	0	2 500	0

** Pure vegetable oils used for Germany, Austria, Ireland, Luxembourg and Romania, biogas fuel for Sweden, Denmark and Finland.* ***Source: EurObserv'ER 2013***

2

Biofuels consumption for transport in the European Union in 2012 (toe)*

Country	Bioethanol	Biodiesel	Others**	Total consumption	% certified sustainable
Germany	805 460	2 190 767	22 093	3 018 321	100
France	417 012	2 292 069	0	2 709 082	100
Spain	208 675	1 718 649	0	1 927 325	0
Italy	79 597	1 263 288	0	1 342 885	100
United Kingdom	388 722	499 713	0	888 435	99
Poland	153 888	669 437	0	823 326	100
Sweden	207 244	314 412	71 394	593 049	90
Austria	57 124	449 024	13 141	519 289	83
Belgium	48 366	281 026	0	329 393	100
Netherlands	123 818	202 374	0	326 192	98
Portugal	2 833	284 209	0	287 042	4
Czech Republic	59 965	221 169	0	281 134	100
Denmark	70 528	159 006	347	229 881	100
Finland	93 329	118 420	358	212 107	0
Romania	48 366	152 090	9 721	210 177	85
Greece	0	124 606	0	124 606	100
Hungary	45 787	76 885	0	122 671	100
Slovakia	23 789	76 566	502	100 856	94
Ireland	29 137	55 790	62	84 989	100
Lithuania	8 707	51 810	0	60 517	100
Slovenia	5 290	46 337	0	51 627	100
Luxembourg	1 286	45 582	119	46 987	100
Latvia	6 703	12 514	0	19 217	100
Cyprus	0	16 136	0	16 136	100
Bulgaria	0	9 809	0	9 809	0
Total EU 27	2 885 628	11 331 687	117 737	14 335 052	82
Croatia	0	33 379	0	33 379	0

** Estimation. ** Vegetable oils used pure for Germany, Austria, Ireland, Luxembourg and Romania, biogas fuel for Sweden, Denmark and Finland.* ***Source: EurObserv'ER 2013***

consumer slot. Statistics published by the Observation and Statistics Office (SOeS), show that France used 2 292 069 toe of biodiesel in 2012 and 417 012 toe of bioethanol, making for total consumption of 2 709 082 toe. French biofuel consumption thus increased by 12.6% year-on-year. If we factor in the premiums awarded to methyl esters of animal oils and used oil, the incorporation rate in mainland France's road transport is 6.8% – one of the highest rates in Europe. As for consumption certification, France was late in transposing the Directive (it happened in 2012, although it was scheduled for 2011). Accordingly, its biofuel was not covered by sustainability certificates in 2011 and thus could not be included in the year's calculations towards the Directive's target. This contrasts with 2012 when all the biofuel consumption was properly certified.

UK CONSUMPTION TAILS OFF

HM Revenue and Customs data based on road fuel taxation statistics, shows that 634 million litres of biodiesel (31% less than in 2011) and 775 million litres of bioethanol (19% more) were used in 2012. This same data, converted into energy content, indicates a sizeable drop … 15.9% between 2011 and 2012 (from 1 056 ktoe in 2011 to 888 ktoe in 2012). DECC (the Department of Energy and Climate Change) explains that only part of British consumption was certified. The percentage rose to around 92% in 2011 and near to 99% in 2012. Furthermore its biodiesel and bioethanol consumption evened out as the biodiesel share of energy content dropped from 72.3% in 2010, to 69.0% in 2011, slipping to 56.2% in 2012. DECC explains that the change in legislation from April 2012 onwards is responsible for this drop in biodiesel consumption. Since then, the credits granted under the RTFO framework (Renewable Transport Fuel Obligation) have been doubled for certain types of biofuel produced from used oil, which enabled distributors to reduce their incorporation level in 2012. DECC also points out that over the 12-month period, the renewable share in transport rose to 3.2% under the terms of the Directive.

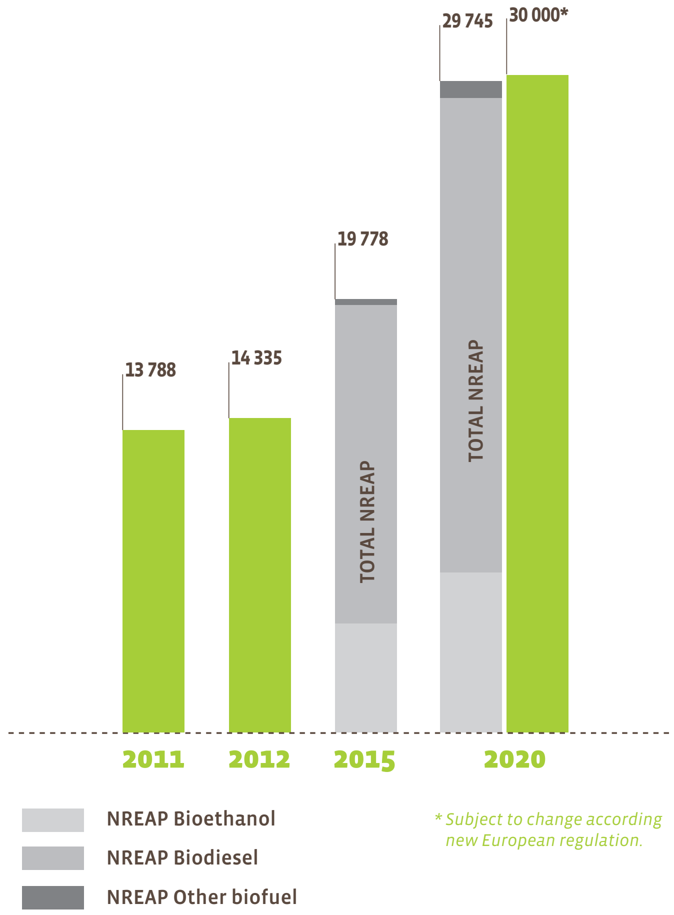
SWEDEN GOES FOR 100% CLEAN VEHICLES BY 2030

Sweden has the highest incorporation rate of all the European Union countries. Initial estimates of the

3

Comparison of the current biofuel consumption for transport trend against the NREAP (National Renewable Energy Action Plan) roadmaps (ktoe)

Source: EurObserv'ER 2013



sustainable biofuel share of fuel consumption in transport supplied by the national statistics (Statistics Sweden) and energy (Energimyndigheten) agencies indicate that it increased from 6.3% in 2011 to 7.8% in 2012. The energy agency claims that consumption of biofuel with sustainability certification rose to 327 556 tonnes of biodiesel in 2012, in addition to 271 438 tonnes of bioethanol and 83.3 million m3 of purified biogas (natural gas quality). When EurObserv'ER converts these values to energy equivalent, it puts the share of biofuel consumption with sustainability certification at 90%, or 593 ktoe of a total of 586.9 ktoe. Sweden no doubt harbours the most ambitious aims for clean transport. An official Swedish government report (Statens offentliga utredningar) from the commission responsible for drawing up the country's future energy legislation was started in 2012. It aims to find solutions to wean Swedish vehicles completely off fossil energy by 2030.

WHAT ARE THE IMPLICATIONS FOR CONSUMPTION IN 2020?

Current discussions revolving around the modification of the two directives will not affect the 10% renewable energy target for transport in 2020, but will affect the proportions of the types of biofuel involved in fulfilling this target. The issue of incorporation levels of first generation biofuels could also be raised when the final vote on the directive is made if a minimum incorporation rate for "advanced" biofuel is introduced and a mandatory percentage allocated for using renewably-sourced electricity in transport.

The targets set in the National Renewable Energy Action Plans and the planned contribution of the sectors serving the European targets could be revised. In these conditions, calculating incorporation volume projections to the 2020 timeline has turned into a minefield. Pending the European Union decisions, EurObserv'ER has decided to adhere to the consumption forecasts it made for 2020 that are in phase with the current National Renewable Energy Action Plans.

RENEWABLE URBAN WASTE

European legislation has been a major player in developing energy recovery from household waste, and has achieved this by gradually introducing several directives that deal with waste management, renewable energies and energy efficiency. One of the key reference texts is the Waste Framework Directive, 2008/98/EC that came into force on 12 December 2010, that called on incineration plant operators of the Member States to improve the energy efficiency of their facilities. In particular it established a "waste hierarchy" which should be pursued by all national waste management policies. This hierarchy, defined in article 4 of the Directive, implies that waste prevention is the best option, followed by re-use, recycling, recovery (especially energy recovery) and disposal in last place.

Each individual European Union country sets the amount of energy recovered by its incineration plants that it considers as renewable, depending on the biomass content of the incinerated waste. If we only take into account the renewable part, primary energy output from urban waste incineration in the European Union is put at 8.8 Mtoe in 2012, namely 345.4 ktoe more than in 2011. The preferred waste-to-energy mode is electricity production and is steadily rising. It was put at 18.9 TWh in 2012, which is a 3.7% year-on-year increase. Heat sales from incineration plants are naturally more common in countries where district heating networks are widespread (Germany, Sweden, Denmark, Netherlands) and are rising faster than electricity production (7.4% more than in 2011, with 2 199.4 ktoe in 2012) prompted by higher heating requirements due to the winter temperatures which reverted to normal after 2011. If final energy consumption in industry and the other sectors is factored in (i.e. 600.9 ktoe in 2012), total heat consumption produced from renewable waste rose to 2 800.3 ktoe in 2012 (7.1% more than in 2011).

1

Primary energy production of urban municipal waste in the European Union in 2011 and 2012 (ktoe)*

	2011	2012*
Germany	2 404.5	2 595.6
France**	1 186.4	1 261.7
Netherlands	876.3	849.7
Italy	843.0	806.8
United Kingdom	640.7	805.6
Sweden	713.5	769.5
Denmark	506.4	492.5
Belgium	482.4	333.1
Finland	139.6	193.0
Spain	174.0	158.8
Austria	138.4	143.7
Portugal	98.5	86.0
Czech Rep.	79.9	83.7
Hungary	42.0	55.6
Ireland	10.6	44.4
Poland	32.0	32.5
Slovakia	17.8	17.9
Luxembourg	11.1	10.7
Slovenia	6.2	7.5
Latvia	2.0	2.0
Total EU	**8 405.1**	**8 750.5**

** Estimate. ** Overseas departments not included.* ***Source: EurObserv'ER 2013***

GERMANY STILL A LONG WAY AHEAD

The transposition of the Waste Framework Directive in Germany in February 2012 by the Waste Management and Product Recycling Act (Kreislaufwirtschaftsgesetz–KrWG) did not result in a reduction in waste-to-energy recovery in favour of recycling – proof that the two handling systems are complementary. Data from AGEE-Stat (the Ministry of Environment working group on renewable energies statistics) shows that primary energy output increased from 2 404.5 ktoe in 2011 to 2 595.6 ktoe in 2012 (7.9% growth). This increase was naturally taken up by electricity production, which rose 4.1% generating almost 5 TWh of output (4 951 GWh to be precise) in 2012.

THE NETHERLANDS INCREASING ITS WASTE IMPORTS ALL THE TIME

The Netherlands is one of the most active European Union countries converting household waste to energy by incineration. According to Statistics Netherlands, primary energy output reached 849.7 ktoe in 2012, which is a 3% year-on-year drop, yet raw consumption increased by 6.5% over 2011 (from 892.4 to 950.6 ktoe). The reason for the disparity is that the Netherlands is a net importer of renewable waste, thus the net import balance rose from 16 ktoe in 2011 to 108 ktoe in 2012. It used these imports to generate 200 GWh more electricity in 2012, taking output to 2 235 GWh.

The situation is far from ideal for the industry's players as the country has in recent years invested in purpose-built waste-to-energy plants. Some view investments in ultra-modern incineration plants as being "over-generous" in their waste handling capacities. Waste deliveries to plant operators are lower than expected as a result of the new national waste management plan (NWMP) priority to develop the recycling sectors. The trend has been exacerbated by the economic recession which has reduced the amount of waste generated, leaving the operators to source waste fuels from abroad.

THE UK INCREASES ITS PRODUCTION

The UK has enjoyed one of the most remarkable increases in renewable waste-to-energy recovery across the EU. DECC, the Department of Energy & Climate Change, claims that the UK increased output by 25.7% in 2012 to 805.6 ktoe. Once again, recovery as electricity is the main beneficiary of the increase, as electricity output grew 31% year-on-year to 2278.8 GWh (adding 539.8 GWh). The reason for this growth can be primarily ascribed to the year-long operation of the cogeneration household waste-fed incineration plants of the London Boroughs (670 000 tonnes of treatment capacity, 72 MWe) and East Sussex (210 000 tonnes, 19 MWe), both of which went into service in 2011. However this sharp rise needs to be tempered against the country's delay in starting waste-to-energy operations. According to Eurostat, the UK only recovered energy from 11% of its household waste in 2011 (the latest available statistics). At the time half of this waste was still disposed of in landfills and 39% composted or recycled. As the UK's operators try to avoid the landfill tax, due to be levied at £ 72 per tonne in 2013, the country currently exports part of this waste to the Netherlands, Sweden and even Germany.

WHAT ROLE FOR INCINERATION IN 2020?

The growth potential for waste-to-energy recovery is still high. Every year about 90 million tonnes of household waste are disposed of in European Union landfills. According to Eurostat's statistics for 2011, only 23% of household waste was incinerated to recover energy, 40% was recycled or composted and 37% disposed of in landfills. The problem is that the growth potential is now left to those very countries that have yet to make the necessary investments to recover energy from waste. Despite European pressure, decisions to invest in new incineration plants are slow in coming through, primarily but not only in the countries of Eastern Europe which are lagging behind. Investment decisions are being put off because of the recession that has most of the European Union reeling. Sector development is also being tripped up by the prospects for heat sales, for the new plants must be constructed in places where heat sales are viable. This therefore implies the need to provide the right conditions to attract factories on site to use this heat and at the same time promote the building of district heating networks. In Southern Europe, where the winter heating needs are lower, these networks will struggle to catch on. Therefore this type of decision calls for time, even when the political will is there to set up these infrastructures. Accordingly, if it is to happen, development of waste-to-energy incineration plants will pick up speed during the second half of the decade. □

2

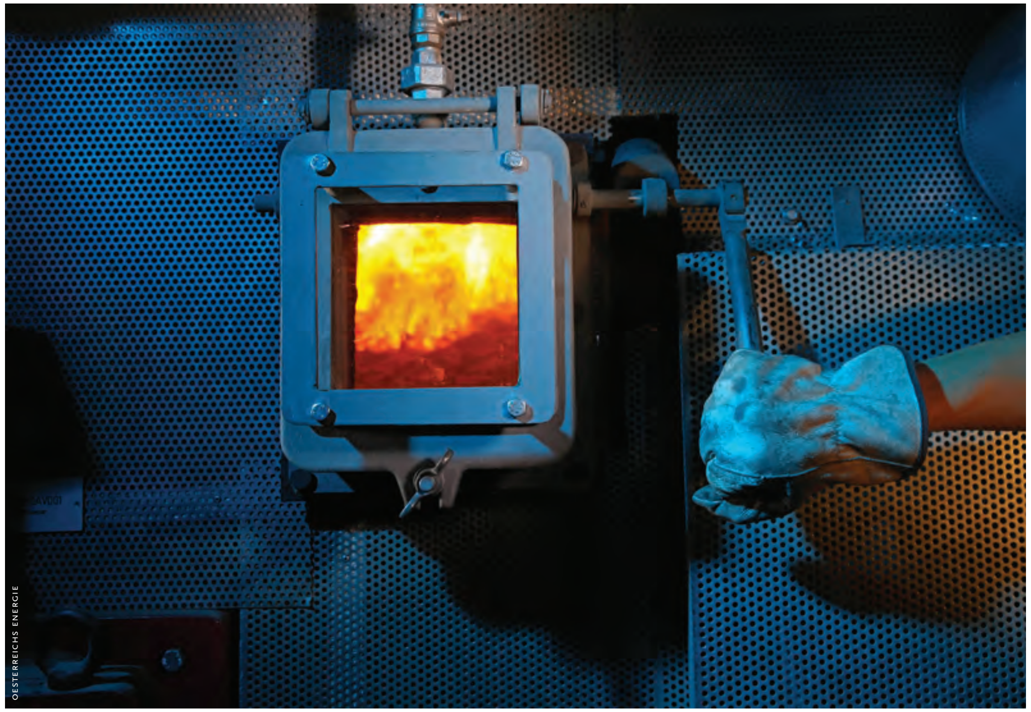
Gross electricity production from urban municipal waste in the European Union in 2011 and 2012 (GWh)*

	2011			2012*		
	Electricity only plants	CHP plants	Total electricity	Electricity only plants	CHP plants	Total electricity
Germany	3 215.0	1 540.0	4 755.0	3 119.0	1 832.0	4 951.0
United Kingdom	1 233.0	506.0	1 739.0	1 734.1	544.7	2 278.8
Netherlands	207.0	1 828.0	2 035.0	0.0	2 235.0	2 235.0
France**	1 333.7	770.8	2 104.5	1 283.4	943.5	2 226.9
Italy	1 191.0	1 017.1	2 208.0	1 201.5	961.6	2 163.2
Sweden	0.0	1 860.0	1 860.0	0.0	1 662.0	1 662.0
Denmark	0.0	951.2	951.2	0.0	892.1	892.1
Belgium	752.6	69.7	822.3	537.9	167.2	705.1
Spain	703.0	0.0	703.0	641.0	0.0	641.0
Finland	84.5	183.0	267.5	63.5	270.4	333.8
Portugal	296.0	0.0	296.0	245.0	0.0	245.0
Austria	104.0	107.0	211.0	149.0	91.0	240.0
Hungary	40.0	79.0	119.0	38.0	76.0	114.0
Czech Republic	0.0	90.0	90.0	0.0	87.0	87.0
Ireland	0.0	0.0	0.0	61.2	0.0	61.2
Luxembourg	37.7	0.0	37.7	36.2	0.0	36.2
Slovakia	0.0	24.0	24.0	0.0	22.0	22.0
Slovenia	0.0	7.0	7.0	0.0	6.1	6.1
Total EU	9 197.4	9 032.8	18 230.2	9 109.9	9 790.5	18 900.3

** Estimate. ** Overseas departments not included. **Source: EurObserv'ER 2013***

SOLID BIOMASS

An increasing part of European Union heat and electricity production is played by solid biomass, which includes wood, wood waste, pellets and other green or animal waste. The dip in production in 2011 turned out to be one-off because of the abnormally mild winter. In 2012, the solid biomass sector returned to growth, as output increased by 5.4% year-on-year, delivering an additional 4.2 Mtoe, for a total of 82.2 Mtoe. EurObserv'ER puts gross solid biomass primary energy consumption at 85.6 Mtoe in 2012, which takes into account imports and exports and amounts to a 5.9% rise (or 4.8 Mtoe). Imports of wood pellets from Canada, the United States and Russia primarily make up the differential between production and consumption. AEBIOM, the European Biomass Association claims that European Union wood pellet consumption rose to 15.1 million tonnes in 2012 for production put at 10.5 million tonnes (9.5 million tonnes in 2011), which means that about 30% of European consumption is imported.


OESTERREICHS ENERGIE

Our survey reveals that a large part of the rise in solid biomass consumption in 2012 was taken up by heat production in the processing sector (sales to heating networks) resulting in a 19% increase between 2011 and 2012 for 8.4 Mtoe of consumption. The processing sector is only one part of biomass heat, as in 2012, 87.6% of solid biomass heat was directly used by the domestic and industrial sectors... which amounts to 67.4 Mtoe of final energy consumption, a 4.2% increase. The solid biomass electricity production trend is less vulnerable than heating to annual temperature variations, as electricity usage is less dependent on temperature. Europe's electricity output according to EurObserv'ER data reached 80 TWh in 2012, which equates to 9.0% year-on-year growth, with particularly good performances from Poland and the UK, and also Germany, Sweden and Spain.

NEWS FROM THE MAIN SOLID BIOMASS COUNTRIES

SWEDEN & NORWAY – A COMMON MARKET FOR GREEN CERTIFICATES

In 2012, Sweden reverted to its 2010 output level. According to Statistics Sweden, it produced more than 9.4 Mtoe of solid biomass energy in 2012, which is a 5.8% increase. As no biomass is imported, all of this output was earmarked for national consumption. Most of the energy was used in the processing sector, through sales to heating networks (a 15.1% rise between 2011 and 2012, which is an increase of 308 ktoe), but also for producing electricity (6.2% more, or a 599 GWh increase). Heat consumption outside the processing sector consisting of direct consumption of wood logs and wood pellets by the forestry and paper pulp industries and domestic heating systems increased by only 1%.

In January 2012, Sweden and Norway launched a common market for green certificates to encourage investments in renewable electricity, and particularly in biomass cogeneration. This new common market aims to increase renewable electricity output by 26.4 TWh between 2012 and 2020, namely by 13.2 TWh in each country.

FRANCE'S HEAT FUND MAKES ITS MARK

The more normal weather conditions of winter 2012 resulted in solid biomass energy consumption and output picking up in France. The Sustainable Development Ministry's Observation and Statistics Office (SOeS) published preliminary solid biomass primary energy production figures suggesting that output increased by 9.3%, and near the 10 Mtoe bar (9.7 Mtoe, if the overseas territories are not included). Household wood-energy consumption was not alone in increasing its production of heat, but also the industrial and collective residential and services sectors ... In 2012,the total heat consumption was

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Primary energy production and inland consumption of solid biomass in the European Union in 2011 and 2012 (Mtoe)*

	2011		2012*	
	Production	Consumption	Production	Consumption
Germany	11.054	11.054	11.811	11.811
France**	8.895	8.895	9.723	9.723
Sweden	8.934	8.934	9.449	9.449
Finland	7.607	7.593	7.919	7.945
Poland	6.351	6.351	6.988	6.988
Spain	4.812	4.812	4.833	4.833
Austria	4.537	4.681	4.820	5.029
Italy	3.954	5.167	4.212	5.349
Romania	3.476	3.459	3.470	3.470
Portugal	2.617	2.617	2.342	2.342
Czech Republic	2.079	1.959	2.153	2.057
United Kingdom	1.623	2.240	1.810	2.473
Latvia	1.741	1.121	1.741	1.121
Denmark	1.499	2.384	1.489	2.473
Hungary	1.429	1.435	1.429	1.435
Belgium	1.105	1.516	1.404	1.983
Netherlands	1.000	1.322	1.099	1.350
Estonia	0.939	0.794	1.012	0.814
Greece	0.940	1.036	1.000	1.136
Lithuania	0.983	0.914	0.992	1.003
Bulgaria	0.834	0.961	0.974	1.275
Slovakia	0.784	0.760	0.717	0.717
Slovenia	0.566	0.566	0.560	0.560
Ireland	0.190	0.203	0.195	0.212
Luxembourg	0.046	0.042	0.048	0.043
Cyprus	0.005	0.012	0.005	0.012
Malta	0.001	0.001	0.001	0.001
Total EU	77.998	80.829	82.196	85.603
Croatia	0.641	0.462	0.697	0.498

** Estimate. ** Overseas departments not included.* ***Source: EurObserv'ER 2013***

2

Gross electricity production from solid biomass in the European Union in 2011 and 2012 (TWh)*

	2011			2012*		
	Electricity only plants	CHP plants	Total electricity	Electricity only plants	CHP plants	Total electricity
Germany	4.901	6.396	11.297	5.288	6.903	12.191
Finland	1.800	9.018	10.818	1.728	8.657	10.385
Sweden	0.000	9.641	9.641	0.000	10.240	10.240
Poland	0.000	7.148	7.148	0.000	9.529	9.529
United Kingdom	5.606	0.000	5.606	7.046	0.000	7.046
Netherlands	2.328	1.649	3.977	2.383	1.577	3.960
Austria	1.153	2.548	3.701	1.379	2.398	3.777
Spain	1.572	1.365	2.937	1.813	1.574	3.387
Denmark	0.000	3.078	3.078	0.000	3.176	3.176
Belgium	1.958	1.168	3.126	2.609	1.076	3.684
Italy	1.677	0.845	2.522	1.558	1.024	2.582
Portugal	0.745	1.722	2.467	0.786	1.710	2.496
France**	0.174	1.592	1.766	0.039	1.698	1.737
Czech Republic	0.756	0.928	1.684	0.468	1.348	1.816
Hungary	1.396	0.131	1.527	1.195	0.112	1.307
Estonia	0.327	0.439	0.766	0.404	0.581	0.985
Slovakia	0.000	0.682	0.682	0.000	0.636	0.636
Romania	0.085	0.104	0.189	0.095	0.116	0.211
Ireland	0.120	0.016	0.137	0.164	0.016	0.180
Lithuania	0.000	0.121	0.121	0.000	0.175	0.175
Slovenia	0.000	0.125	0.125	0.000	0.114	0.114
Bulgaria	0.000	0.037	0.037	0.000	0.037	0.037
Latvia	0.003	0.010	0.013	0.003	0.010	0.013
Total EU	24.602	48.763	73.365	26.450	53.535	79.986
Croatia	0.000	0.018	0.018	0.000	0.037	0.037

** Estimate. ** Overseas departments not included.* ***Source: EurObserv'ER 2013***

estimated at 9.2 Mtoe of which 0.4 Mtoe through district heating. The Ministry claims that the reason for this increase in final energy consumption in these sectors is the commissioning of Heat Fund projects. Since the Heat Fund support programme was implemented in 2008, the French Environment and Energy Management Agency (ADEME) has launched 5 calls for biomass projects in the industry, agriculture and services sectors, that have led to the start-up of 109 projects amounting to 1 150 MWth of thermal capacity and total energy production of 585 000 toe p.a.

GERMANY WANTS TO REFORM ITS RENEWABLE ENERGIES LAW

In 2012, Germany was the leading European Union country for solid biomass production and consumption with 11.8 Mtoe produced and used. This data, supplied by AGEE-Stat (the German Environment Ministry's working group on renewable energies statistics), testifies to a solid biomass electricity production increase of about 6.8% or 0.9 TWh to 12.2 TWh.
The announced overhaul of the current Feed-in Tariff-based incentive system is partly responsible for this as the Conservative and Social Democrat coalition government is preparing a major renewable energies law reform (Erneuerbare-Energien-Gesetz – EEG) to reduce energy transition-related costs in the short term. In particular the negotiators want to lower the offshore wind power targets, reduce onshore wind power aid and restrict biomass plant aid to projects converting waste and residue to energy.

NEW START, NEW RULES

Solid biomass' progress against the European Union targets is measured by the benchmark of the 27 individual National Renewable Energy Action Plans of its Member States. These plans earmark biomass (wood, waste, crops and farm waste) to provide almost half of the European 20% target of renewable

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Heat consumption from solid biomass in the countries of the European Union in 2011 and 2012** (Mtoe)*

	2011	of which district heating	2012**	of which district heating
France***	8.534	0.000	9.164	0.423
Germany	8.269	0.444	8.700	0.513
Sweden	7.485	2.047	7.846	2.356
Finland	5.904	1.471	6.322	1.631
Poland	4.787	0.333	4.928	0.476
Austria	3.802	0.801	3.999	0.819
Italy	3.987	0.246	4.159	0.345
Spain	3.776	0.000	3.776	0.000
Romania	3.470	0.048	3.206	0.048
Denmark	1.941	0.841	2.030	0.943
Portugal	2.149	0.000	1.802	0.000
Czech Republic	1.582	0.071	1.642	0.070
Bulgaria	0.946	0.009	1.265	0.012
Greece	1.033	0.000	1.133	0.000
Hungary	1.002	0.062	1.059	0.059
Latvia	1.048	0.090	1.048	0.090
United Kingdom	0.862	0.023	0.890	0.032
Lithuania	0.865	0.188	0.878	0.188
Belgium	0.814	0.007	1.173	0.008
Estonia	0.665	0.169	0.654	0.179
Slovenia	0.539	0.019	0.537	0.020
Slovakia	0.525	0.101	0.499	0.099
Netherlands	0.454	0.046	0.459	0.043
Ireland	0.172	0.000	0.175	0.000
Luxembourg	0.042	0.003	0.044	0.003
Cyprus	0.011	0.000	0.011	0.000
Malta	0.000	0.000	0.000	0.000
Total EU	**64.666**	**7.020**	**67.399**	**8.357**
Croatia	0.410	0.001	0.468	0.002

** End-user consumption (either as heat sold by the district heating or or self-consumed, or as fuels for the production of heat and cold). ** Estimate. *** Overseas departments not included.* ***Source: EurObserv'ER 2013***

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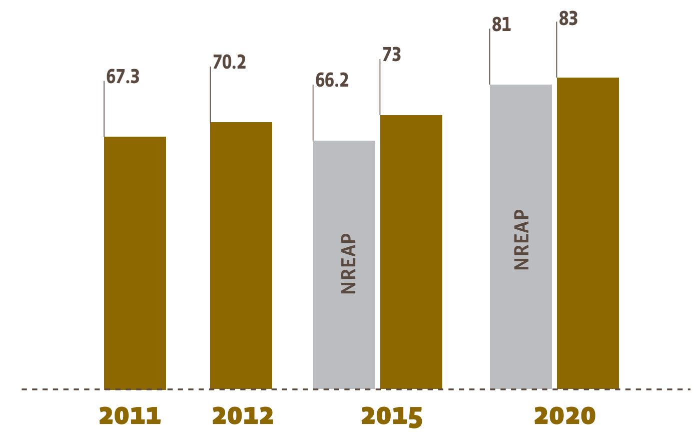
Comparison of the current trend of heat consumption from solid biomass against the NREAP (National Renewable Energy Action Plan) roadmap (Mtoe)

Source: EurObserv'ER 2013



Note

These data include an estimate of the renewable heat from incineration plants of municipal waste.

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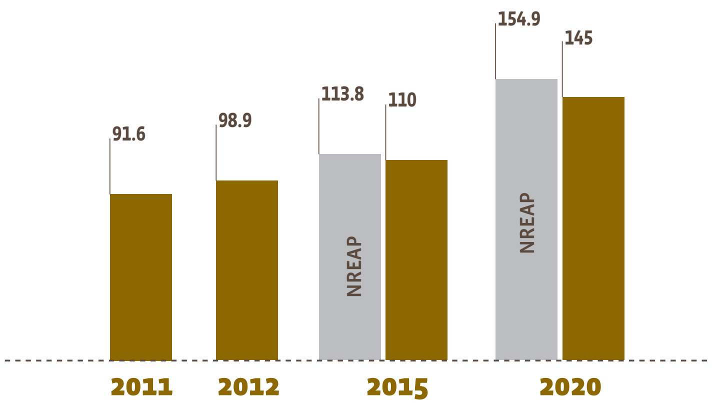
Comparison of the current trend of electricity production from solid biomass against the NREAP (National Renewable Energy Action Plan) roadmap (TWh)

Source: EurObserv'ER 2013



Note

These data include an estimate of the renewable electricity from waste incineration units.

energy in the 2020 energy mix. In the Action Plans, the solid biomass data includes renewable municipal waste incineration, which while technically similar to solid biomass, is dealt with in its own right in our barometers and by the statistics offices. Accordingly, the NREAP data cannot be compared directly to the data in this barometer. The electricity production and heat consumption figures for renewable municipal waste should be added in.

In the case of electricity production, it will be hard to achieve the 2020 NREAP targets of 155 TWh, as they call for regular, structural capacity build-up across the sector, of both generating capacities and infrastructures enabling the

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fuels to be produced and transported. However if uncertainties surrounding the funding of these conversions persist, the target production level will be unfeasible as the pick-up in the conversion pace after 2015, announced by most of the operators will no longer suffice.

The same applies to heat consumption. It is partly linked to the development of electricity-generating infrastructures that will be constructed by deploying cogeneration. In this case, the 2020 targets still seem achievable provided resource availability suffices. □

CONCENTRATED SOLAR POWER PLANTS

The European concentrated solar power plant market is steeling itself for hard times ahead. After a boom year in 2012 when 802 MW of additional capacity was installed, much leaner years will follow because of the drop in the number of projects under construction. Spain, the main country developing this technology, has applied a moratorium on renewable energy-producing plants.

SPAIN HAS NO NEW PROJECTS

Spain is the only European Union country to date to have developed a concentrated solar power production sector. It triggered the concentrated solar technology revival from the second half of the 2000s. The Spanish government's decision to encourage the emergence of a large-scale sector made it the first country to use this technology as early as 2010 and unseat the United States, the historical leader, which had developed its first plants in the mid-1980s.

The year 2012 was a boom year for plant commissioning, as 17 new plants went on grid with combined capacity of 802.5 MW... all but one of them of the parabolic trough type. The 22.5-MW Termosolar Borges CSP alone was coupled to a biomass generator and it runs round the clock, seven days a week. The Novatec Solar-built, Puerto Errado 2 (30 MW) plant uses Fresnel mirror technology and is currently the largest facility of its type in service.

Protermosolar, Spain's CSP industry association, claims that the combined capacity of the country's concentrated solar plants reached 1 953.9 MW at the end of 2012, i.e. almost 18 million m² of mirrors. This capacity is spread over 42 plants, 37 of the parabolic trough type, 3 tower plants and 2 Fresnel plants. Their design electricity-generating output over a full year in service is put at 5 138 GWh. In 2012, IDAE (Institute for Diversification and Saving of Energy) evaluated production at 3 775 GWh against 1 959 GWh in 2011. In 2013, REE (Red Eléctrica de España) estimated production at 4 554 GWh. Luis Crespo, Protermosolar's General Secretary, claims that concentrated solar plants already met more than 3% of Spain's electricity demand last July. New plants are due to go on stream in 2013. At the beginning of the year, two 50-MW parabolic trough type plants, Termosol 1 and 2 were connected. This additional capacity made Spain the first country to pass the 2-GW mark (2053.9 MW) for concentrated solar thermal power. Six further plants of the same type are currently being built (Solaben 1, Caceres, Casablanca, Enerstar, Solaben 6 and Arenales), potentially raising Spanish capacity to 2 354 MW. The construction of three new plants using parabolic disk technology is also awaited: Puertollano 5 (10 MW), 6 (10 MW) and 7 (12.4 MW). The plants are still on the advanced allocation register, meaning that they have escaped the moratorium that has cut off all financial aid for Spain's renewably-sourced power plants since 29 January 2012. As the moratorium occurred too early to enable the Spanish CSP sector to become as competitive as other energy sources the construction of new projects now hangs in the balance. The Spanish industry players, who are global leaders in this technology, have no option but to turn to other countries to develop their technology and bring down production costs.

IN ITALY THE CONDITIONS ARE NOW RIPE

Italy should be the EU's second country to develop a full-blown CSP sector. Its government's resolve materialised as a new, more attractive incentive system with a new Feed-in Tariff applicable from 31 December 2012, differentiated by total collector surface area, around the 2 500 m² threshold, and the share of solar electricity in the plants net electricity output. The details of the system are given as follows: the FiT is € 0.32/kWh for large plants (>2 500 m²) when the solar fraction is in excess of 85%, € 0.30 kWh in

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Concentrated solar power plant in operation at the end of 2012 (MW)

Project	Technology	Capacity	Commissionning date
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 1 (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 de Tiétar	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 2	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
Morón	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
Total Spain		**1 953.9**	
Italy			
Archimede (prototype)	Parabolic trough	5	2010
Total Italy		**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		**1 959.7**	

Source: EurObserv'ER 2013

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the 50–85% range, and € 0.27/kWh if it is less than 50%. These rates, which will be paid for 25 years, will be reduced by 5%, from 2016, and a further 5% from 2017. The FiT rates are still applied on the basis of the same solar fraction for small plants (<2 500 m²), namely € 0.36/kWh, € 0.32/kWh and € 0.30/kWh respectively, with the same sliding tariff mechanism. Subsidies will be available to a maximum of 2.5 million m² of total installed surface and plants with more than 10 000 m² will be obliged to have an energy storage system. The Feed-in tariff for hybrid plants (solar plus another source) only applies to the electricity generated by the solar source. Another important and by no means trivial point – the FiT is added to the electricity sales revenues to the grid. Thus the Italian incentive system has become one of the most attractive in the world, and even ANEST (the Italian Solar Thermal Energy Association) has acknowledged this. So the conditions are now ripe for constructing the first plants. Licensing applications for more than 200 MW of projects have already been filed, primarily the Archetype 30+ project at Catania, Sicily by Enel Green Power. Energo Green Renewables, controlled by the Fintel Energia group, is working on four projects in Sardinia: Campu Giavesu (30 MW), Flumini Mannu (50 MW), Gonnosfanadiga (50 MW) and Bornova (50 MW).

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2

Concentrated solar power plant in construction in the beginning of the year 2013 (MW)

Project	Technology	Capacity
Spain		
Termosol 1*	Parabolic trough	50
Termosol 2*	Parabolic trough	50
Solaben 1	Parabolic trough	50
Caceres	Parabolic trough	50
Casablanca	Parabolic trough	50
Enerstar	Parabolic trough	50
Solaben 6	Parabolic trough	50
Arenales	Parabolic trough	50
Total Spain		**400**
Total EU		**400**

** In operation in the beginning of the year 2013.* ***Source: EurObserv'ER 2013***

UNCERTAINTY OVER THE 2020 TARGETS

No doubt European industry would have preferred to gain more experience in the European market to consolidate its technological skills in preparation for its entry to the global market, which is wide open for development. The European Union market will shrink over the next couple of years, and the sector's ability to reduce its production costs will make or break its recovery from 2015 onwards.

When it comes to forecasting, we have to admit that most of the countries that set solar thermal targets in their National Renewable Energies Action Plan are drifting further and further away from their roadmap. Spain, the most ambitious country, had pencilled in 3 048 MW by 2015 yet will struggle to make 2 386.3 MW, if the last projects in the pipeline come to fruition. France, whose 2015 capacity target was 203 MW, will install 21 MW at the most in the next couple of years. The sector's kick-off in Portugal, Greece and Cyprus, which have also set targets, is on hold and nothing is planned before 2015. Only Italy seems to be geared up to launching its own sector with the first projects that could be completed by the end of 2015. The combined target of these six countries by the 2020 timeline is 7 044 MW, broken down by country as follows: Spain (5 079 MW), Italy (600 MW), France (540 MW), Portugal (500 MW), Greece (250 MW) and Cyprus (75 MW). As it stands, there is considerable doubt that these targets will be achieved, given the current political environment that is not particularly conducive to developing the sector, compounded by the absence of any specific programmes for future projects. Accordingly EurObserv'ER has lowered its forecasts yet again.

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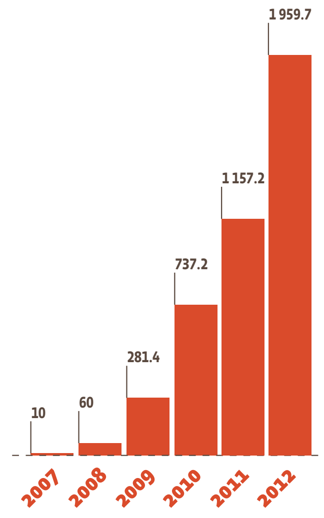
Evolution of the CSP plants capacity in the European Union (MW)
Source: EurObserv'ER 2013



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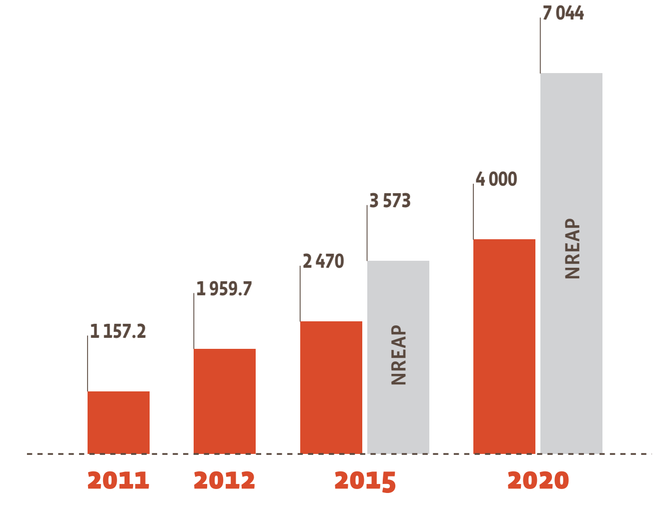
Comparison of the current trend against the NREAP (National Renewable Energy Action Plans) roadmap (MW)
Source: EurObserv'ER 2013



OCEAN ENERGY

Europe leads the way in marine energy operations both in terms of investments and installed capacity. In April 2013 the European Commission launched its second call for proposals for stakeholders for low-carbon projects, NER300. For its part, the MARINET project a European Commission FP7 programme, which gives access to 42 experimental installations across Europe, launched its last call for proposals in September. The Interreg IV programme, MERIFIC, to develop marine energy operation on the insular areas of Finistère in France and Cornwall in the UK, will publish its findings in June 2014.

Many electricity utilities have invested in the sector such as E.ON, EDF, EDP, SSE and Iberdrola as well as international industrial concerns including Alstom, DCNS, Voith Hydro and Andritz Hydro. SMEs are also highly active in technology development work.

The 240-MW French Tidal Power Plant of La Rance (Ille-et-Vilaine), built in 1966, still produces most of Europe's marine power, and is the only facility of its kind on the continent because of cost and environmental acceptance issues. Yet development on exploiting tides and currents is in full swing. Underwater generator technologies have reached the pre-commercialization phase although a number of steps must be completed before large-scale plants can be installed.

Wave energy conversion offers the highest theoretical energy potential. It has spawned a profusion of technologies, which are still at the demonstrator and prototype stage. Ocean thermal energy, which exploits the temperature difference between water at different depths, also has significant potential, mainly in tropical zones. In Europe's case, it is only relevant in the overseas territories. Osmotic energy technologies are still in early stages of development and primarily being examined by Norway and the Netherlands.

PRINCIPLE POWER INC

The United Kingdom, buoyed by strong political support and very high exploitable potential, has a significant lead with more than 10 MW of installed capacity. Many of these plants are at the European Marine Energy Centre (EMEC) created in Scotland in 2003 and that was awarded £ 3 million in 2013 to extend its sites.

Following consultations in October 2011 to attract investors, the British government decided to increase the number of ROCs (Renewables Obligation Certificates) per MWh for marine energies to 5 (approximately € 330/MWh) from April 2013 onwards until 2017 for <30-MW projects, while support for >30-MW projects remained at 2 ROCs/MWh.

Additionally four pilot underwater generator farms with capacities of eight to ten MW have been funded for 2015-2016 as part of a British government tender (MEAD) and the European NER300 programme. There are other (Scottish MRCF and Crown Estate) tenders open for four additional renewable marine energy farms.

In France, a major ministerial study on the prospects for marine energy development was conducted in 2012-2013, to speed up the support mechanisms for the sector. A call for EoI in "technology building blocks and demonstrators" for marine underwater energy conversion, floating wind turbines, marine thermal energy and wave energy conversion was launched in May, followed at the beginning of October, by a long awaited call for EoI in four pilot underwater turbine farms at Raz Blanchard in Lower-Normandy, and Brittany's Fromveur Passage. The farms will comprise 4–10 turbines, and are due to be commissioned at the end of 2016.

GDF Suez has signed agreements with Alstom, Voith Hydro and Sabella for the purpose, while EDF EN is involved with DCNS which has bought up the Irish start-up OpenHydro.

DCNS has also finalized a development agreement for a 1.5-MW experimental wave energy converter farm that could be constructed in the Bay of Audierne, Brittany in 2016-2017. For the time being, WEC and the OTEC conversion are earmarked for the French overseas territories.

Portugal is one of the most promising countries for wave energy, because of its high natural potential and the creation of the R&D Wave Energy Center (WavEC) in 2003. In the last years many wave energy converters were attracted by the high Feed-in Tariff for demonstrators, but the FiT was recently suspended by the Portuguese government pending the creation of a new support mechanism in 2014.

Ireland, which also has significant wave energy potential, is still waiting for the Feed-in Tariff for wave energy conversion and tidal

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energy power promised in 2009. A test centre known as “Beaufort Research” is funded by the Irish Maritime and Energy Research Cluster (IMERC). Last December, the WestWave experimental farm (5 MW in 2015) was awarded 19.8 million euros through the European NER300 programme.

In Spain, the recession put paid to the Feed-in Tariffs for renewable energies in January 2012. Work on installing two test sites, BIMEP (Biscay Marine Energy Platform) and PLOCAN (Oceanic Platform of the Canary Islands) is underway primarily for wave energy converters.

In Northern Europe, Finland is a major player in wave energy conversion technology along with Denmark that attracts prototypes and demonstrators. In Sweden, 35 organizations, industrialists and research bodies have launched a strategic innovation calendar in the fields of underwater generator and wave energy conversion.

In its 2013 report, the European Union Ocean Energy Association (EU-OEA) points out that installed capacities have tripled in four years rising from 3.5 to more than 10 MW. It forecasts that in 2020, marine energy capacities could reach 200–300 MW for the UK, 500 MW for Ireland, 380 MW for France, 250 MW for Portugal and 100 MW for Spain, and that Europe could install up to 100 GW by 2050. However it emphasizes the need for heavy levels of public and private investment to achieve this. Yet in a recent report that analysed the various European countries’ policies and markets in the Atlantic Circle – Denmark, France, Ireland, Portugal, Spain and the UK – RenewableUK warned of the cloud hanging over future financial support because of the recession. □

1

Installed units

United Kingdom			
Limpet	0.5 MW	2000	Connected
Open-Center Turbine	0.25 MW	2008	Connected
SeaGen	1.2 MW	2008	Connected
Pulse Stream 100	0.1 MW	2009	Connected
Oyster 2	0.8 MW	2009	Connected
E.ON Pelamis P2	0.75 MW	2010	Being tested
ScottishPower Pelamis P2	0.75 MW	2011	Being tested
Atlantis AK1000	1 MW	2010	Being tested
DeepGen Tidal Generation	0.5 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	n.a.	2012	Connected
Portugal			
Pico OWC	0.4 MW	1998	Connected
Pelamis	2.25 MW	2008	On hold
France			
Barrage de la Rance	240 MW	1966	Connected
OpenHydro, Paimpol-Bréhat	0.5 MW	2011	Being tested
Hydro Gen 2	0.01 MW	2010	Being tested
Spain			
Mutriku OWC – Voith Wavegen	0.3 MW	2011	Connected
Denmark			
Poseidon	0.13 MW	2008	Being tested
Wave Star	0.055 MW	2009	Being tested
Ireland			
OE Buoy	0.015 MW	2006	Being tested
Netherlands			
Tocardo	0.045 MW	n.a.	Being tested
C-Energy	0.03 MW	2009	Being tested
Finland			
Wave Roller	0.013 MW	2006	Connected
Sweden			
Lysekil	0.1 MW	2005	Being tested

n.a.: non available. ***Source: EurObserv’ER 2013***

2012 … RETURN ON INVESTMENT

Electricity output and final renewable energy consumption figures for 2012 showed strong improvement on those of 2011. It has to be remembered that the climate hit 2011 with a dual challenge, namely an exceptionally mild winter, which reduced fuel wood consumption and a dearth of hydropower across the European Union. Nonetheless, renewable energies succeeded in scoring an additional half-point in total gross final energy consumption thanks to the spectacular growth of the wind power and photovoltaic sectors. In 2012, the return to more normal climate conditions in Northern Europe clearly outlined the rewards of major investments in renewable energy production infrastructures decided on and completed during the previous years. The capacities commissioned in 2011 were thus able to deliver in full in 2012.

RENEWABLE ELECTRICITY SCORED POINTS IN 2012

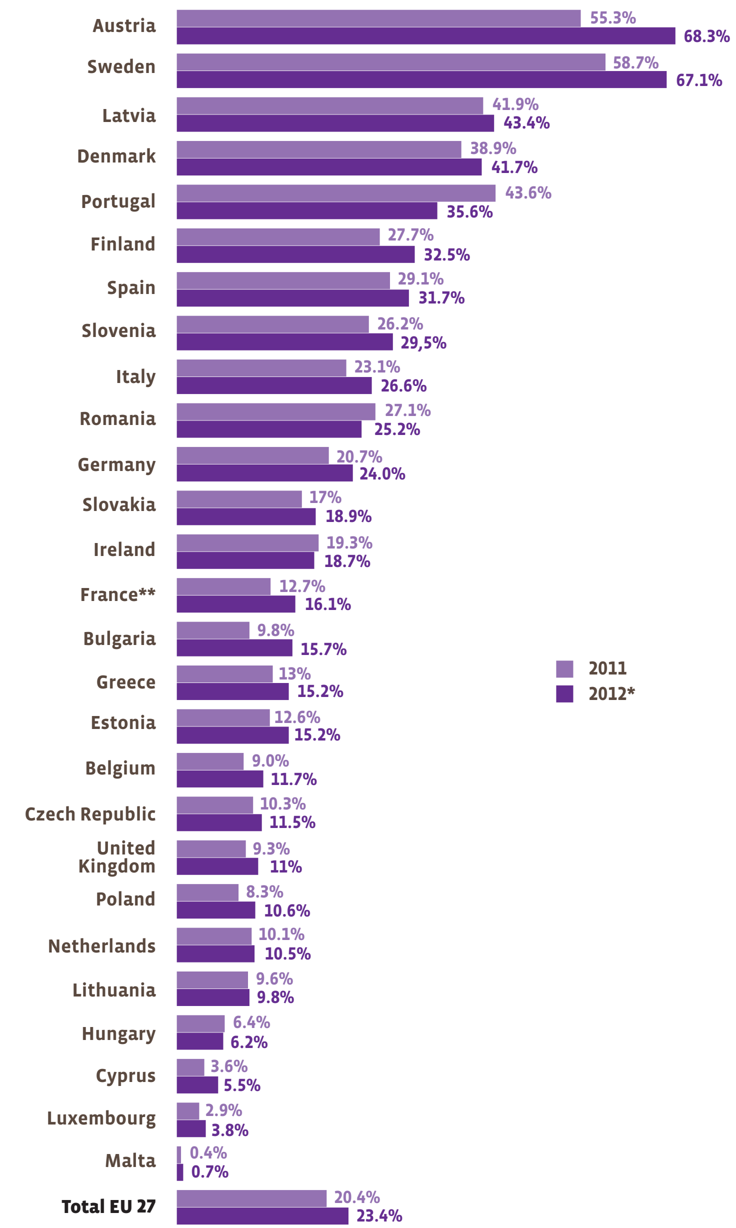
The recession that finally hit the renewable electricity generating sectors after a time lapse, has had no visible impact on output figures for 2012. The figures presented illustrate the result of investment decisions that were made at the start of the decade, in 2010 and 2011, and emphasize the impressive capacity of the renewable energy industry sectors in contributing to the European electricity mix. Thus EurObserv'ER puts the European Union's renewable electricity output (leaving aside pumped storage) at 763.5 TWh in 2012, which represents a 14.4% year-on-year increase (from 667.4 TWh). This rise added to a slight contraction in total electricity consumption in the European Union (3 279.3 TWh in 2011 compared to 3 269.4 TWh in 2012) drove the renewable share up 3 points in 2012 to 23.4%. This output level has at last taken the European Union past the 21% target set for 2010 in the first renewable electricity directive (2001/77/EC).

Significant investments made in the wind power and photovoltaic sectors, in addition to biomass co-firing and cogeneration plants are now delivering their full potential. This is even more salient as in 2012, in contrast to 2011, growth in renewable electricity output was positively affected by the increase in hydropower output, as the significant build-up of production levels in Northern Europe (including France, Germany and Austria) largely made up for declining production levels in parts of the Southern Europe (Portugal and Italy).
In order of importance, hydropower made the greatest contribution to the increase in renewable electricity production over the year gaining 36.5 TWh over 2011 (12.2%). The number TWo contributor in 2012 was solar (photovoltaic and CSP) with output 23.4 TWh higher than in 2011 (49.8%). The photovoltaic sector that accounts for 94.6% of solar power is now on the verge of grid parity in those European countries where electricity is at its most expensive (primarily Germany, Spain and Italy). In the coming years it will continue to increase albeit at a slower pace, as most of the European Union Member States have scaled down their incentives. Thus this year solar power is ahead

1

Share of renewable energy in gross electricity consumption of EU countries in 2011 and 2012 (in %)*

Source: EurObserv'ER 2013

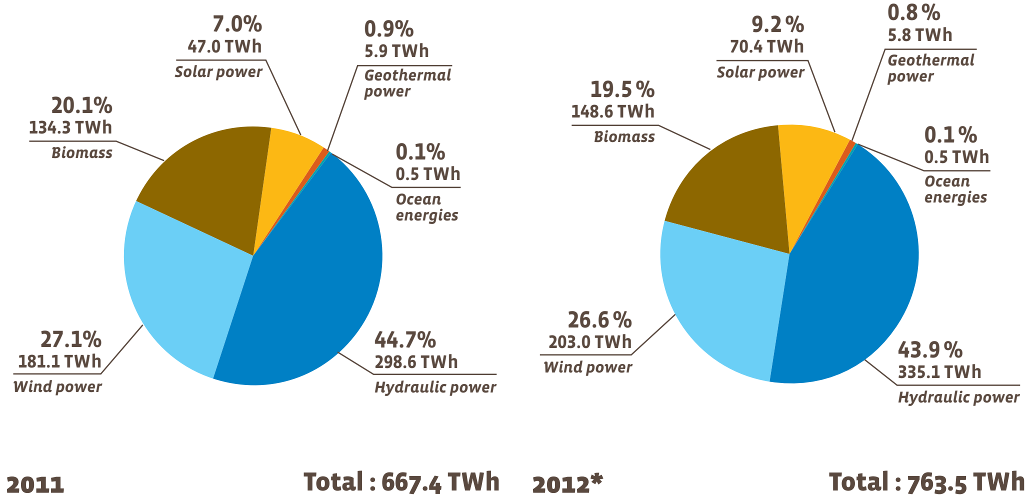


** Estimate. ** Overseas Departments not included for France.* ***Note:*** *Figures for actual hydraulic and wind generation (no normalisation)*

2

Share of each energy source in renewable electricity generation in the EU 27 (in %)

Source: EurObserv'ER 2013



** Estimate.* ***Note:*** *Figures for actual hydraulic and wind generation (no normalisation).*

of wind power, which lost a little of its former impetus, increasing output by 22.0 TWh in 2012 (12.1%). Biomass delivered significant output in 2012 (14.4 TWh, i.e. 10.7% more), thanks to increased output from its solid biomass (6.6 TWh), biogas (8.4 TWh) and renewable urban waste (0.7 TWh) components and despite the contraction of its liquid biomass component (by 1.4 TWh). The individual sector shares in renewable electricity production is shown in graph 2. Hydropower is still the European Union's main source of renewable electricity (43.9%), but shed 0.8 of a percentage point from its 2011 performance. Wind power is in second place with 26.6% (-0.5 point down) and the biomass sectors are ranked third with a combined share of 19.5% (0.7 point down). Solar was the big winner as it posted a 9.2% share by putting on 2.2 percentage points over its 2011 showing. The geothermal and marine energies share slipped slightly and now provides less than 1% of renewable electricity.

EUROPEAN TARGETS FOR 2020 – SO FAR SO GOOD ...

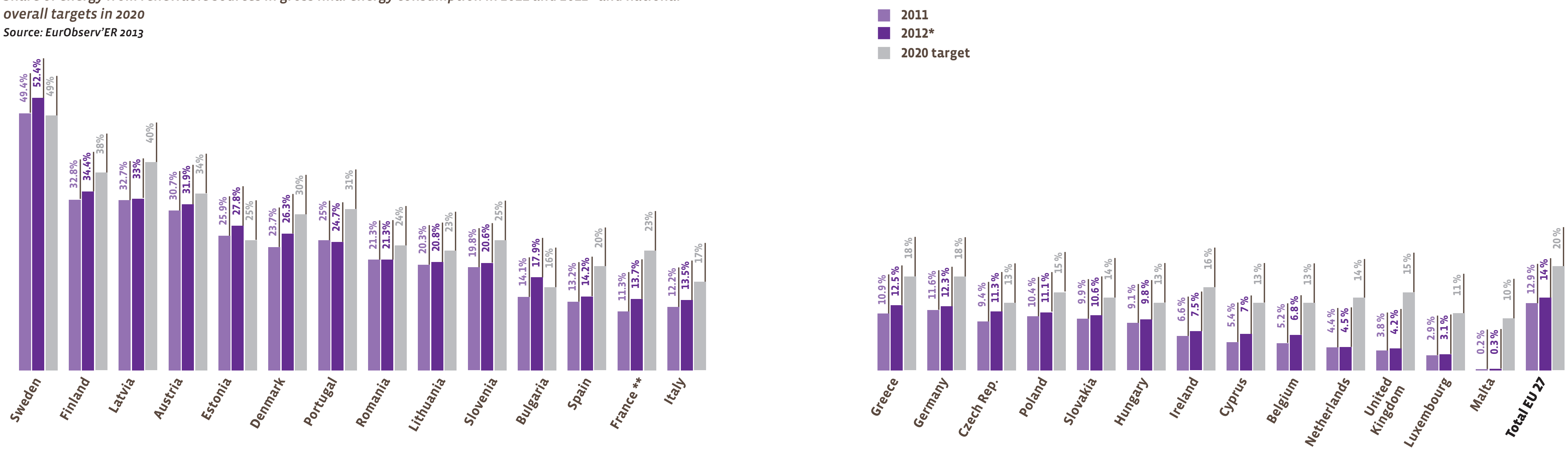
Assessing precisely how far the countries have progressed towards the targets set under the terms of the Renewable Energy Directive (2009/28/EC) is anything but simple. Bringing renewable energy accounting into line with the Directive's requirements currently obliges the countries to monitor the development of the sectors in more detail and adapt their working methods under the supervision of Eurostat.

These adjustments primarily entail the incorporation of biofuel sustainability criteria (article 17). So since 2011, the Member States can only factor in the consumption of certified biofuel for the purpose of target monitoring. This may lead to breaks in a number of sets of statistics, thereby affecting the renewable energy share calculated for the individual countries. These factors should be taken into account when analysing the indicators shown. In the biofuel sector the adoption of certification in 2012 was still underway in a few countries, while implementation was already complete in 2011 or 2012 elsewhere.

The calculations that EurObserv'ER has made to assess the Directive targets monitoring indicator (renewable energy share of gross final energy consumption) are

3

Share of energy from renewable sources in gross final energy consumption in 2011 and 2012* and national overall targets in 2020
Source: EurObserv'ER 2013

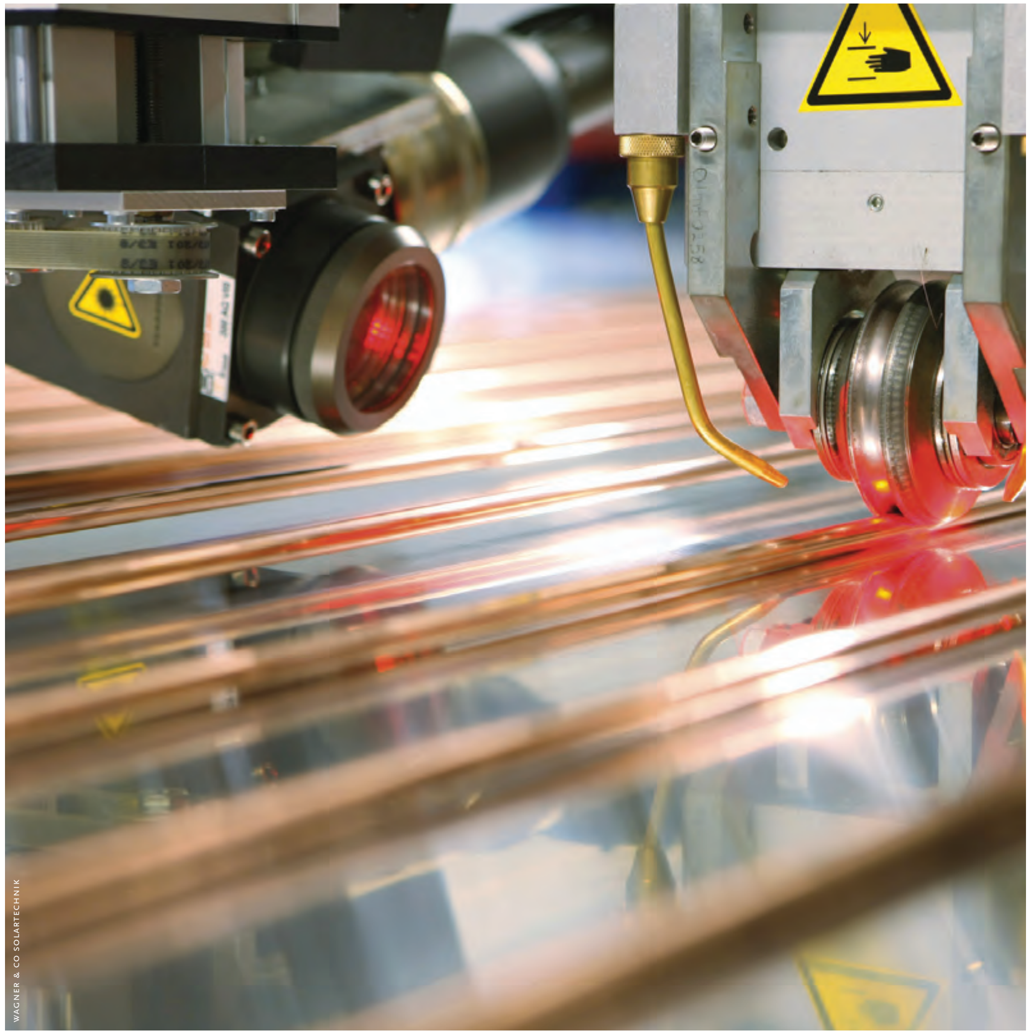


** Eurobserv'ER estimates, calculated on the basis of the project's data collection campaigns. ** Results for France calculated by EurObserv'ER don't include the overseas territories but for the purpose of Directive 2009/28/EC the accounting of energy from renewable sources for France has to include French overseas territories. According preliminary estimation published in July 2013 in the "Bilan énergétique de la France pour 2012", Service de l'observation et des statistiques, the preliminary figure including the overseas territories was 13.7% in 2012.* ***Note:*** *Calculations, defined by the Directive, use a normalized hydro and wind generation.*

based on data supplied by the official bodies (statistics offices and ministries), and by other national bodies. A considerable consolidation effort was made at the end of 2013 to ensure that the indicators are as reliable as possible. Nonetheless it should be pointed out that most of the data is provisional and is likely to be consolidated in the next few weeks. That is not to say that the indicators are of no use as they present valuable input for assessing the efforts made by the Member States to achieve their respective targets. In the case of France, the monitoring indicator shown does not include the overseas departments, but covers the mainland only. The target set for France for 2020 should also include the overseas territories. In the Service de l'Observation et des Statistiques publication "Bilan énergétique de la France 2012" published in July 2013, the renewable share including the overseas territories was provisionally put at 13.7% in 2012, which is the same percentage.

According to EurObserv'ER, final energy consumption from renewable energy sources increased in 2012 by 12.3 Mtoe over 2011 to reach 159.4 Mtoe (147.1 Mtoe in 2011). This positive trend was again produced in the context of lower gross final energy consumption, even though the phenomenon was less pronounced than in 2011 – 2 Mtoe less (1 135.8 Mtoe in 2012, as against 1 137.8 Mtoe in 2011). These contrary patterns naturally played into the hands of the renewable share, which rose from 12.9% in 2011 to 14.0% in 2012. Thus the European Union is only 6 points short of the target it has set itself for 2020. This relatively large increase (of 1.1 points) in the renewable share of gross final energy consumption deserves to be analysed in more detail. While it primarily stems from an increase in renewable energy consumption, other factors have played their part in supporting the trend. Better transposition of the European Directive has also contributed. The renewable share increased mechanically because the biofuel consumption share that complies with the Directive's requirements was much higher in 2012 than it was in 2011. Another factor is that the Member States can now incorporate part of the renewable heat output of reversible air-to-air heat pumps, even when they are mainly used for cooling. This possibility prompted a number of Southern European countries, such as Italy, to reassess the renewable energy contribution of their heat pump base. However, new revisions should be made in the coming weeks because in January 2014, the European Commission decided to change the renewable energy production calculation method for air-source reversible heat pumps in warm climates, by significantly reducing the default value of eligible load factor.
Another reason, already mentioned above, is climate-related. In 2011, an exceptionally mild winter resulted in reducing fuel wood consumption across the EU. Fuel wood is the main renewable energy used in Europe. In 2012, the return to normal weather conditions led to a catch-up phenomenon with a sharp increase in wood consumption.

By analysing the additional renewable energy input in the three main consumption sectors, namely electricity, heat and transport, we see that it is electricity once again that contributed most to the development of renewable energy sources with an additional gain of 5.1 Mtoe, i.e. combined production of 65.9 Mtoe. Renewable heat's additional contribution was 3.9 Mtoe. Heat consumption is higher than electricity with 81.8 Mtoe of total final energy in 2012. Certified biofuel consumption dedicated to transport has risen sharply (by 3.2 Mtoe) to 11.7 Mtoe in 2012, for the reasons previously mentioned.



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In 2012, and in contrast to 2011, the strongest increases in the renewable energy share in final energy consumption were made in Northern Europe: Sweden (up 3 points to 52.4%), Denmark (up 2.5 points to 26.3%), Estonia (up 1.9 points to 27.8%), mainly because of substantial growth in solid biomass consumption. The renewable energy share in a number of Central European countries also increased sharply (by 3.8 points in Bulgaria, to 17.9%), (by 1.9 points in the Czech Republic, to 11.3%), primarily thanks to their investments in the renewable electricity sectors. The renewable energy share also increased significantly in France (by 2.4 points, to 13.7%), mainly through the implementation of biofuel certification from 1 January 2012.

In the European Union, the current momentum driving the renewable energy share of gross final energy consumption is in phase with the indicative trajectories defined in Annex I of the Renewable Energies Directive ***(table 4)***, and this applies to most countries. Many of them are a long way ahead of their targets, such as Sweden, Finland, Denmark, Estonia, Lithuania, Bulgaria, Austria, Spain, Germany and Italy. The

4

Share of energy from renewable sources in gross final energy consumption in 2011 and 2012 and indicative trajectory*

	2011 (%)	2012* (%)	Indicative trajectory 2011-2012** (%)
Sweden	49.4	52.4	41.6
Finland	32.8	34.4	30.4
Latvia	32.7	33.0	34.1
Austria	30.7	31.9	25.4
Estonia	25.9	27.8	19.4
Denmark	23.7	26.3	19.6
Portugal	25.0	24.7	22.6
Romania	21.3	21.3	19.0
Lithuania	20.3	20.8	16.6
Slovenia	19.8	20.6	17.8
Bulgaria	14.1	17.9	10.7
Spain	13.2	14.2	11.0
France***	11.3	13.7	12.8
Italy	12.2	13.5	7.6
Greece	10.9	12.5	9.1
Germany	11.6	12.3	8.2
Czech Republic	9.4	11.3	7.5
Poland	10.4	11.1	8.8
Slovakia	9.9	10.6	8.2
Hungary	9.1	9.8	6.0
Ireland	6.6	7.5	5.7
Cyprus	5.4	7.0	4.9
Belgium	5.2	6.8	4.4
Netherlands	4.4	4.5	4.7
United Kingdom	3.8	4.2	4.0
Luxembourg	2.9	3.1	2.9
Malta	0.2	0.3	2.0
Total EU	**12.9**	**14.0**	**–**

** 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. According preliminary estimation published in July 2013 in the "Bilan énergétique de la France pour 2012", Service de l'Observation et des Statistiques, the preliminary figure including the overseas territories was 13.7 % in 2012.* ***Note:*** *Calculations, defined by the Directive, use a normalized hydro and wind generation.* ***Source: EurObserv'ER 2013***

European Union renewable energy share has already increased by 5 points since 2006, from 9% to 14%. Thus the EU could achieve its 2020 target if the annual rate of increase stays within 0.7 to 0.8 of a point. However while it is not out of reach, it must be remembered that the investment (and investment decision) level has plainly dropped since 2012. It follows that the rate of progress by renewable energies is bound to slow down in the coming years. Yet it is hard to be totally pessimistic about achieving the European targets in the next eight years, as they seem to be both technologically and industrially within reach. In this respect, the level of ambition for renewables energies that the European Union must set itself for 2030 in the new framework will be decisive. □

Methodological note

The Renewable Energy Directive (2009/28/EC) has put forward some specific features that the EurObserv'ER Consortium is gradually incorporating to provide indicators that are as reliable as possible and will closely match those published by Eurostat.
First of all, the new European directive uses the "gross final energy consumption" indicator as a benchmark. The directive defines this indicator as the energy commodities delivered for energy purposes to industry, transport, households, services (including public services), agriculture, forestry and fisheries, including consumption of electricity and heat by the energy branch energy for electricity and heat production and the losses of electricity and heat in distribution and transmission. This indicator, which has become more complex, seeks to reflect the energy that is actually consumed by the end-user, i.e. thus minus the losses incurred by the transformation sector that converts primary energy into heat, electricity or fuel.
The directive specifies that gross final consumption of energy produced from renewable sources must be calculated as being the sum of the gross final electricity consumption produced from renewable energy sources, the gross final consumption of energy produced from renewable sources for heating and cooling and the final consumption of energy produced from renewable sources in transport.
Producing this indicator is thus a fairly complicated task and calls for major data gathering work. Scores of different renewables indicators have been collected for gross electricity production, heat in the processing sector, final energy consumption for each sector and biofuel consumption in transports. In the case of this last indicator, EurObserv'ER has identified the amount of certified biofuel that complies with the Directive's requirements for the first time. Since 2011, Member States may only take into account certified biofuel consumption in their target monitoring exercise, which may lead to breaks in a number of sets of statistics, thereby affecting the renewable energy share calculated for individual countries.
The hydroelectricity and wind power data used to calculate the Directive monitoring indicators have been standardized applying the calculation rules defined by the Directive and the European Commission.
Another specific to be borne in mind is that the amount of thermal energy captured by heat pumps from the air, water or ground sources must meet efficiency criteria laid down by the Directive. Where EurObserv'ER has been unable to obtain calculated data directly from the Member State, it has calculated its own indicators using the calculation methods specified in the European Commission's guidelines (Decision 2013/114/EU). They also indicate that the production of renewable energy from reversible air source ground pumps can be factored in.
We point out that gross final energy consumption from renewable sources (the numerator) stems directly from the data gathered by EurObserv'ER. Total gross final energy consumption (the denominator) was produced by modelling under the terms of this project and takes the results published by the European Commission's SHARES programme for the year before last as its benchmark.

SOCIO-ECONOMIC INDICATORS

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

All 27 countries composing the European Union in 2012 are covered individually, detailing ten renewable sectors. The aggregates refer to the employment figures and sales turnover generated in 2011 and 2012.

Methodological note

For the fourth year, EurObserv'ER presents first estimations on economic volume and employment effects for all EU-27 member states and on all renewable sectors. The socio economic indicators published in the subsequent section are derived from a large variety of sources. All data and figures relate to 2011 and 2012. National statistical offices and national energy agencies provided the bulk of the energy data. Detailed national socioeconomic statistics are provided and were used for France (Ademe), Germany (BMU and AGEE-Stat), Austria (BMVIT/EEG), and Italy (Energy & Strategy Group) that conduct annual national surveys resulting in the publication of employment and economic activity figures for some or all RES sectors.

The methods used by individual countries, institutions and organizations dealing with socioeconomic impacts differ wildly. In many cases socioeconomic indicators were estimated. These estimations are either based on energy data (installed capacities or energy output), or on regularly updated and improved employment and investment ratios, as identified in the ongoing literature review (see sources and references). Major sources of investment and job coefficients are meta studies such as the Institute for Sustainable Futures (ISF 2009 and 2012; EREC and Greenpeace (2010 and 2012), IRENA (2012), 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).

Other sources were European surveys (Stream Map/ESHA, EmployRES 2009), IEE project outputs (BiogasIN or GeoTrainNET, GEOELEC) or dedicated reports from the international sphere such as the REN21 Global status report 2011, the IEA Photo-

voltaic 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.

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

- *Employment figures do not express job creation in the sectors concerned. The employment data should be understood as the expression on FTE (Full Time Equivalent) of the economic activity of each sector.*
- *Employment data covers both* ***direct and indirect jobs*** *and relate 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 euros, 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 the upstream part, 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.*

- *Unlike in last years edition socio economic indicators for the* ***geothermal sectors are split up between near surface applications (heat pumps)*** *and deep geothermal technologies.*
- *Socio-economic indicators for* ***wind 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 biofuels*** *were derived from averaged data from Italy, Germany and France as major producing countries.* ***Jobs and turnover in biofuels*** *are also considering growing import shares that diminish the European value creation.*
- *Socio-economic indicators for* ***Renewable Municipal Waste (RMW)*** *largely rely on* ***country reports*** *published by the Confederation of European Waste-to-Energy Plants* ***(CEWEP)****.*

New or revised employment and turnover ratios have been used in this year's edition, PV (adaptation of installation costs according to market development), heat pumps (EHPA and SULPU), small hydro power (Stream Map 2012), waste (CEWEP), biomass (AEBIOM) and in biogas. *These slight changes in methodology also reflect retroactive statistical data consolidations over the past years done by important national statistical institutions, as was the case for Germany and other countries which have changed the scope of certain indicators between 2011 and 2012. Data were thus partially retroactively revised and updated and are not directly comparable to last year's figures. Thus, data on turnover and employment published in the last year edition for 2011 can not directly be compared with those published in this issue for the same year.*

Croatia as new EU member State, since the 1st of July 2013, will be comprehensively included in next year's socio economic data collection and analysis.

WIND POWER

In contrast to other RES sectors, the wind energy proved to be a stable or even growing market, although with observable shifts to new EU markets. The newly installed and hooked up capacity over the year was 11 870 MW. The overall impact is assessed at around ***303 445*** persons employed. The turnover generated with on and off shore activities for the manufacturing of turbines and components, the installation and the operation and maintenance amounts to ***€ 34 billion for 2012*** and thus almost € 4 billion more than in 2011.

Europe has experienced a quite successful year. In particular the British and Eastern European market showed encouraging development trends, most notably in ***Poland and Romania***. In this latter country, the Fântânele-Cogealac wind farm (600 MW) was connected to the grid. For ***Romania*** this translates in into ***5 000 jobs and € 1.3 billion in turnover***. Also the German and Swedish markets showed good performances. And the ***Austrian*** wind industry has taken up momentum again, while some of the 'classic' wind states such as France, Spain (the largest market in terms of electricity generation) or Italy are underperforming or projected to contract.

With 2 439 MW of new installation, the German wind energy industry has seen a quite successful year in 2012. Beyond, the year is seen as the kick-off for larger offshore deployment. 21 plants were added to the Bard Offshore wind farm with a total capacity of 105 MW, of which not all were connected to the grid in 2012 in ***Germany***. Repowering (replacing obsolete wind turbines by modern units) with 431.6 MW is taking up momentum, too. The environmental ministry's working group on renewable energy statistics (AGEE-Stat) quantifies the socio-economic dynamics at ***118 000 persons*** employed (up from 101 000 in 2011) mainly due to the offshore activities and regained strength in the onshore business. The economic turnover is rated at ***€ 5.180 million***. The main challenges remain the grid connection of offshore wind farms and the grid extension of transmission lines to transport the power to where it is needed.

Also the ***United Kingdom*** wind industry has presented itself in a healthy condition. This is true in particular for the offshore section that connected more capacity (1 156.4 MW and bringing total UK offshore capacity to 2 995 MW) than it did onshore. It is that continued strive for expanding the lead in offshore that can explain the positive socioeconomic impacts. EurObserv'ER assumes that it has taken the lead in Europe with ***€ 5.6 billion***. The ***20 500*** strong workforce for the UK is thus a conservative estimate.

The situation was, however, more difficult in ***France***. With 701 MW of new additional capacity coming on grid during 2012 in France, it is the third year running that the French market has contracted. The main reason for this slowdown can be put down to the heaping of new obligations and administrative procedures. The wind farm fleet in service stood at ***7 594 MW*** at the end of 2012 on the mainland. The annual market assessment

compiled by Ademe points to a stagnation on the wind jobs front estimated at ***20 000***. The economic volume ranges somewhat below the ***€ 2 billion mark***. A reversal of this trend may be triggered by two calls for tender for offshore projects that could put France back on meeting its wind energy targets.

Spain reclaimed its top European wind power producer slot in 2012, with 48.5 TWh. At the end of the

EUROBSERV'ER – THE STATE OF RENEWABLE ENERGIES IN EUROPE – 2013 EDITION

1

Employment

	2011		2012	
	Installed capacity to date (MW)	Employment (direct and indirect jobs)	Installed capacity to date (MW)	Employment (direct and indirect jobs)
Germany	29 071.0	101 100	31 331.9	117 900
Denmark	3 952.1	42 500	4 163.0	40 500
Italy	6 918.0	30 000	8 102.0	40 000
Spain	21 547.0	30 000	22 579.0	30 000
United Kingdom	6 476.0	17 750	8 889.0	20 500
France	6 809.0	20 000	7 594.0	20 000
Sweden	2 769.0	8 000	3 607.0	5 100
Romania	988.0	4 000	1 941.0	5 000
Poland	1 800.0	1 600	2 564.0	2 815
Belgium	1 069.0	3 600	1 364.0	4 000
Austria	1 079.7	3 500	1 315.9	3 900
Netherlands	2 316.0	2 800	2 434.0	3 500
Portugal	4 378.0	3 000	4 531.0	2 700
Ireland	1 631.0	2 800	1 763.0	2 500
Greece	1 640.0	2 000	1 749.0	1 500
Bulgaria	541.0	1 000	657.0	830
Estonia	180.0	500	266.0	700
Finland	199.0	400	257.0	500
Czech Republic	213.0	300	258.0	500
Lithuania	202.0	250	225.0	400
Hungary	331.0	300	331.0	150
Cyprus	134.0	150	147.0	150
Luxembourg	45.0	350	58.0	100
Latvia	36.0	<50	68.0	100
Slovakia	3.1	<50	3.1	<50
Slovenia	0.0	0	2.3	<50
Malta	0.0	0	0.0	0
Total EU	94 327.9	276 000	106 200.2	303 445

Source: EurObserv'ER 2013

2

Turnover

	2011		2012	
	Annual installed capacity (MW)	Turnover (M€)	Annual installed capacity (MW)	Turnover (M€)
Denmark	180.9	7 200	220.6	7 380
United Kingdom	1 162.0	5 100	1 853.9	6 000
Germany	2 007.0	4 330	2 439.5	5 180
Spain	914.0	3 500	1 032.0	3 850
Italy	932.7	1 730	1 273.0	1 950
France	604.0	2 090	701.0	1 910
Romania	520.0	700	959.0	1 300
Sweden	906.0	1 250	846.3	1 230
Poland	431.0	700	884.0	1 260
Belgium	166.0	220	306.0	1 000
Netherlands	93.2	920	161.0	1 000
Austria	73.8	670	295.7	740
Portugal	426.0	725	224.0	500
Ireland	203.0	325	80.0	250
Bulgaria	237.0	315	131.0	200
Greece	311.2	400	117.0	200
Finland	9.0	100	89.7	120
Estonia	75.9	100	89.0	120
Czech Republic	2.0	15	45.0	70
Lithuania	25.0	40	46.0	55
Hungary	36.0	80	0.0	40
Latvia	0.0	<5	20.0	25
Cyprus	52.0	70	13.0	15
Luxembourg	0.0	<5	11.0	10
Malta	0.0	0	0.0	0
Slovakia	0.0	0	0.0	0
Slovenia	0.0	0	2.3	<5
Total EU	9 367.7	30 590	11 840.0	34 410

Source: EurObserv'ER 2013

year, the Spanish wind energy capacity stood at 22 579 MW, up ***1 332 MW*** in 2012. With this stable growth EurObserv'ER assesses the Spanish market at ***30 000 employees and an annual economic value of € 3.8 billion***. As an outlook: besides the economic turmoil in the country over recent years, a new law amending the wind energy sector incentive system and the temporary 35% reduction of the premium value over the last two years and a new 7% tax on electricity production will certainly not increase investor confidence.

More positive news from ***Poland*** that has set up turbines with a capacity of 884 MW during 2012 turning it into one of Europe's busiest wind energy markets. We assume that this trend lead to the creation of ***2 815 positions*** in the Polish job market and yielded turnover of certainly ***over € 1,2 billion***. With an official target to install 5 600 MW of onshore wind power and 500 MW of offshore wind power by 2020 Poland is a country to watch not only in socioeconomic terms.

Denmark remains the runner-up in the offshore segment (921.9 MW at the end of 2012), according to the Danish Energy Agency. Home of the world market leader Vestas, Denmark's wind industry should employ a stable ***40 000 persons*** and have a financial value of clearly over ***€ 7.3 billion***.

The ***Italian*** market grew by another a further 1 273 MW during 2012, taking its wind turbine fleet to 8 102 MW of capacity. A significant workforce is estimated at ***40 000 persons*** and an economic turnover of roughly ***€ 2 billion*** for the country. However, new regulations did not enhance investor security so some observers project a contraction of the national market.

Wind turbine prices have been tumbling according to Bloomberg New Energy Finance (BNEF) with

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an observed decline from € 1.21 million per MW in 2009 to € 0.91 million in 2011/12. The wind scene in socio-economic terms may thus witness a similar development than in the PV sector: dwindling installation costs and the onward march of aggressively pricing Chinese manufacturers that will also lower the turbine manufacturers' profitability and margins. There is another less gloomy perspective: The EU wind markets display a stable and continued growth and the EurObserv'ER Wind Barometer earlier this year has stressed the way ahead for the industries, which is reliability, logistics and a focus on O&M markets. Also the offshore business is still largely dominated by European players. These are good prerequisites for a continued expansion of both, exports of the European wind technology to new markets and the share of wind power in the EU electricity mix. □

PHOTOVOLTAIC

For the PV industry, 2012 marked a year of serious consolidation and restructuring, to put it mildly. Following the media coverage on the PV sector was a disastrous experience with numerous companies going out of business, declaring insolvency and factory closures nearly every other week. Also from an installation perspective the EU market was smaller than in the preceding year (16.5 GW as against 22 GW in 2011).

Indeed, these developments have left a trace in our socio economic account. Job losses reported from the major countries (23 000 in Germany, 23 750 in France, 30 000 in Italy to name but the largest) could by far not be offset by some growth and slight advancements in other EU markets. Taking these trends and figures into consideration, EurObserv'ER estimates that the European PV industry was declining from over 330 000 jobs in 2011 to around ***252 570 persons in 2012***. The PV sector has thus temporarily gone off track the EPIA 2012 scenario that foresaw a 1-million job industry by 2020 and also consequentially lost its top spot as major renewable job creator to wind and biomass. Also the cumulated turnover of ***€ 30.8 billion for 2012*** was clearly below the € 45 billion mark in 2011, although this drop is also due to significantly lower module and system prices.

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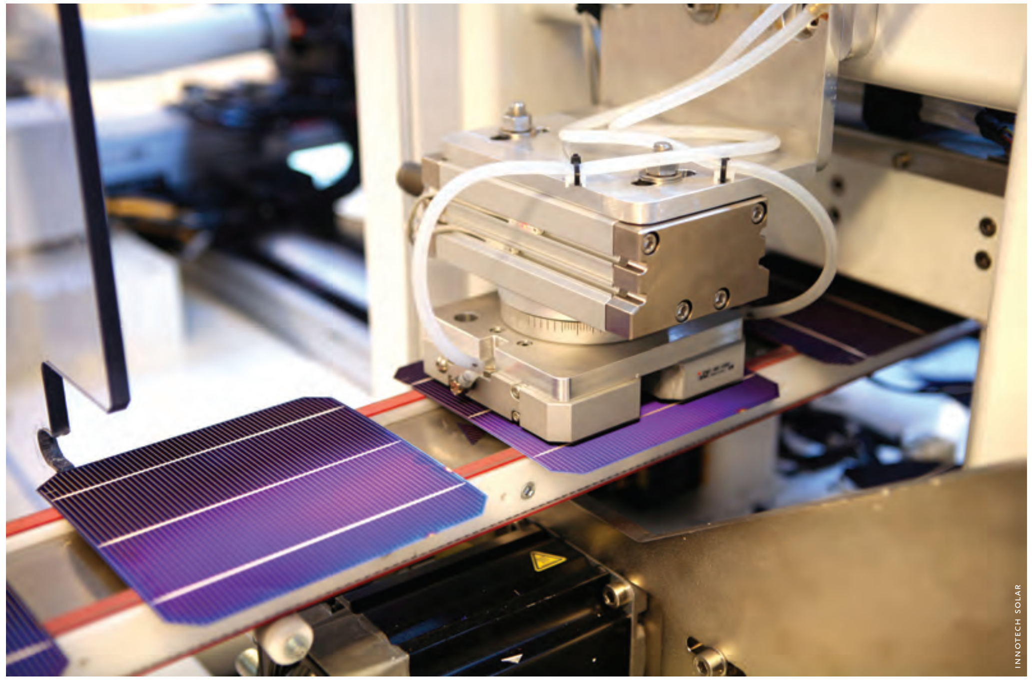
A major factor of the shrinking turnover in the EU has to be attributed to the German market. In ***Germany***, 17 companies or their subsidiaries along the PV value chain in 2012 went off the market. Nevertheless, the picture is not that bleak in Germany as it witnessed a new installation record of 7.6 GW representing investments of ***€ 11.2 billion***, a decline of 26% compared to 2011. And some of the companies were bought up by foreign investors so that filing of insolvency did not necessarily mean a closure of the affected locations and businesses and not all jobs were lost, despite hard job cuts in single



INNOTECH SOLAR

cases. AGEE-Stat quantifies the employment figure in the German PV industry resulting from these sales and taking into account operation and maintenance, to about ***87 800 people***. AGEE-Stat notes that lower employment due to the sales decline is not fully reflected in this figure so that further reductions might be expected for 2013 (with an estimated market of around 3.5-4 GW).

The ***Danish and Dutch*** markets took off and saw some exceptionally good performance. Denmark, whose domestic renewable energy industry has been largely reduced to the wind power sector meanwhile also, has a remarkable PV sector. The IEA PVPS national report assumes PV sector turnover of over ***€ 1.4 billion***, a very notable figure for the Northern country. At the same time the IEA –RETD pro-

1

Employment

	2011		2012	
	Installed capacity to date (MWp)	Employment (direct and indirect jobs)	Installed capacity to date (MWp)	Employment (direct and indirect jobs)
Germany	25 094.0	110 900	32 698.0	87 800
France	2 948.6	62 750	4 027.6	39 000
Greece	631.3	22 000	1 543.3	23 500
Belgium	2 050.6	20 500	2 581.1	20 500
Italy	12 783.0	55 000	16 431.0	16 000
United Kingdom	995.3	15 000	1 708.3	12 500
Spain	4 322.2	15 000	4 516.6	12 000
Bulgaria	212.2	3 600	933.2	10 000
Netherlands	146.0	5 000	365.0	7 500
Denmark	16.7	6 050	399.0	7 000
Austria	187.2	4 200	421.7	4 850
Portugal	172.0	3 500	242.0	3 500
Slovenia	100.4	1 150	217.4	2 400
Slovakia	487.3	3 000	517.3	2 000
Czech rep	1 913.4	500	2 022.4	1 500
Hungary	2.7	1 000	3.7	750
Sweden	15.7	450	23.8	600
Poland	2.2	400	3.4	420
Cyprus	10.1	230	17.2	250
Lithuania	0.1	<50	6.1	100
Luxembourg	41.0	<50	74.0	100
Estonia	0.2	<50	0.2	<50
Finland	11.2	<50	11.2	<50
Ireland	0.7	<50	0.7	<50
Latvia	1.5	<50	1.5	<50
Malta	6.6	<50	18.7	<50
Romania	3.5	<50	6.4	<50
Total EU	52 155.8	330 630	68 790.8	252 570

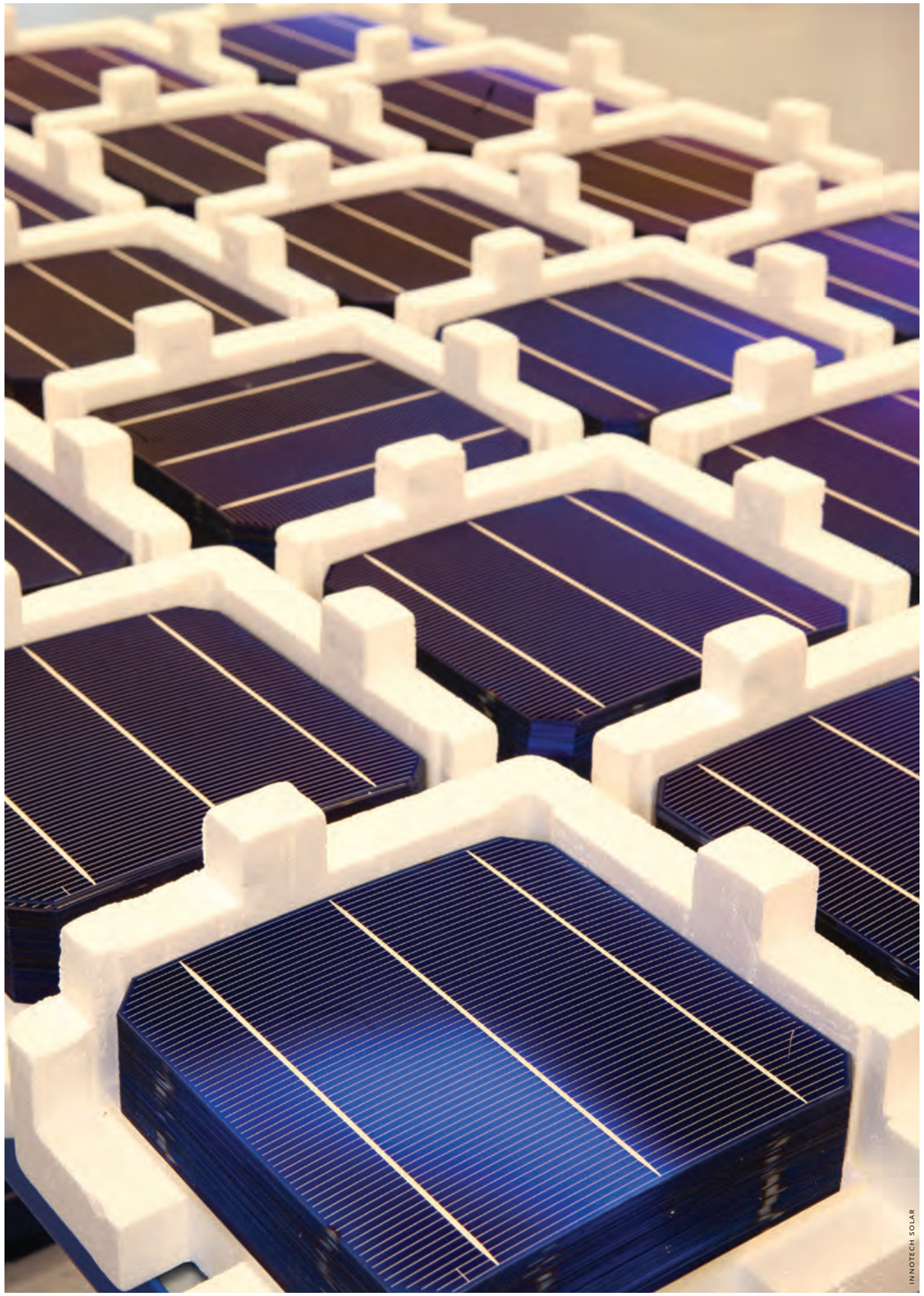
Source: EurObserv'ER 2013

2

Turnover

	2011		2012	
	Annual installed capacity (MWp)	Turnover (in M€)	Annual installed capacity (MWp)	Turnover (in M€)
Germany	7 490.0	16 010	7 604.0	12 420
Italy	9 303.0	15 060	3 578.0	4 600
France	1 755.9	3 880	1 079.0	2 430
Greece	425.9	1 100	912.0	1 800
Bulgaria	179.9	400	721.0	1 500
Netherlands	58.0	1 100	219	1 500
United Kingdom	899.3	2 000	713.0	1 500
Belgium	995.6	2 200	530.5	1 400
Denmark	9.6	670	375.0	1 400
Spain	378.9	1 500	194.4	800
Austria	91.7	272	234.5	390
Czech rep	0.0	100	109.0	300
Slovenia	54.9	150	116.9	250
Portugal	38.1	80	70.1	150
Slovakia	313.1	500	30.0	150
Sweden	4.3	175	8.1	60
Malta	2.8	20	12.1	40
Cyprus	3.8	10	7.1	15
Luxembourg	11.2	25	33.0	15
Poland	0.8	10	1.2	14
Lithuania	0.0	<1	6.0	10
Hungary	1.0	<5	0.9	5
Romania	1.6	<5	2.9	5
Estonia	0.1	<1	0.0	<1
Finland	1.5	<1	0.0	<1
Ireland	0.0	<1	0.0	<1
Latvia	1.5	<5	0.0	<1
Total EU	22 022.5	45 281	16 557.7	30 758

Source: EurObserv'ER 2013



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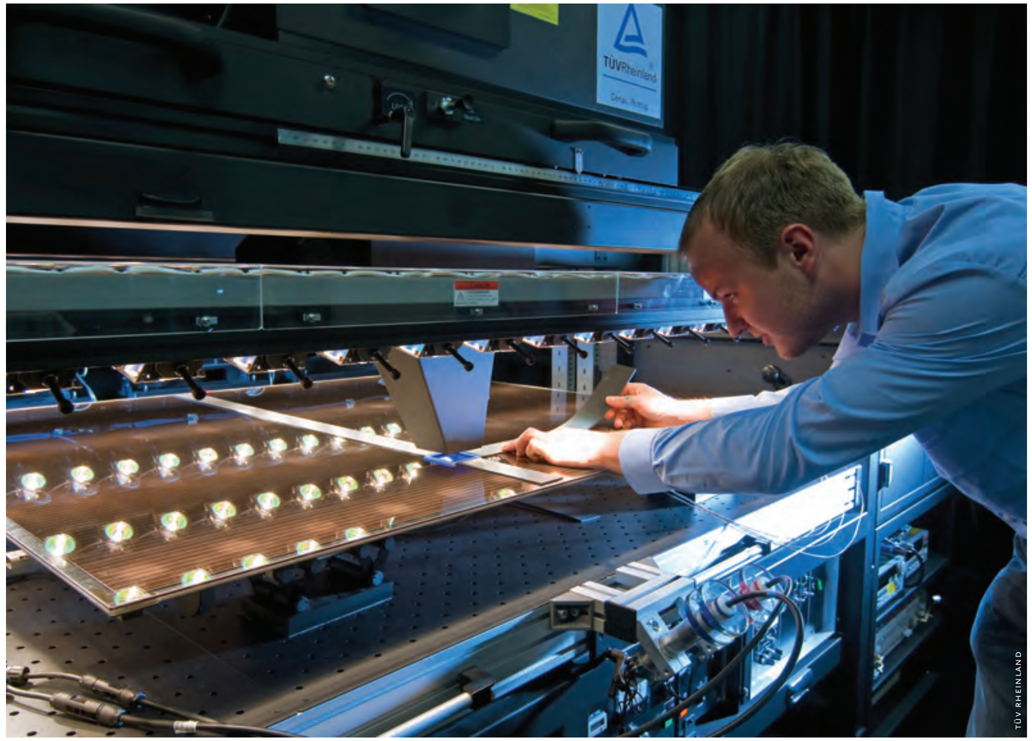

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ject has estimated 6 050 jobs for 2011 a number that should have gone up together with the market development in installation and O&M to ***7 000 positions***. Also in the ***Netherlands*** the expansion of PV may have paid off economically as EurObserv'ER rates the economic value at ***€ 1.5 billion*** for 2012.

Former class champion ***Italy*** had another 3.5 GW connected to the grid. This is well below the record year 2011 when 9.3 GW were installed but in socioeconomic terms, the country remains a top candidate. The annual IEA PVPS national status report estimates the country's turnover at ***€ 4.6 billion*** and a workforce of ***16 000 jobs*** in the sector. Due to the factual running out of the capped 6.7 billion funding in the Conto Energia, 2013 may result in a market collapse in 2013, although actual figures will have to be awaited.

France is the third EU member state in 2012 that surpassed the 1 GW mark in 2012. The annual socio economic report by Ademe / In Numeris thus estimates the PV sector at over ***€ 2.4 billion*** and a dramatically lower ***39 000 jobs*** (down from nearly 63 000 the year before). The sector has been hit hard and trends for 2013 are also oriented towards job destruction.

In the ***United Kingdom***'s PV sector is also going through difficult times. Initial expectations following the introduction of the FIT and the quite complicated support system has somewhat puzzled investors. The 900 MW installed in 2011 could not be replicated. Accordingly EurObserv'ER puts the socioeconomic impacts for the UK down to ***12 500 persons*** employed and a sector turnover of around ***€ 1.5 billion***.

Despite huge job destruction the major message is that the PV industry is not in such a bad condition as the news during 2012 had suggested. The observed global production overcapacity cannot last forever and we should not forget that employment in the PV sector is not only generated at the manufacturing side but to an increasing extent also in O&M and installation, R&D or system integration. □

SOLAR THERMAL

The European solar thermal market did not meet the cautious expectations that some analysts had set in it for 2012 and declined by 5.5% compared to 2011. Especially some Southern European countries (most notably Spain, Italy and Portugal) with the largest solar thermal potentials underperformed. Nearly stabilized conditions were observed in the large French and German markets. But the encouraging growth in other countries such as Poland, the Netherlands, Hungary, Belgium, Greece or Denmark could not offset the stagnation in other parts of Europe. The EurObserv'ER socio economic assessment arrives at a more or less equal ***sector turnover of nearly € 4 billion*** and an employment level of ***46 440 jobs*** for the European Union.

There are various reasons for this: the general economic recession, the delaying of investments and, linked to that, a clearly lower building activity in many EU member states. On the push side, higher oil and gas prices are potential drivers, although the replacement of heating and hot water equipment is in a strong competition with gas boilers on the one hand or even with other RES technologies such as heat pumps or biomass boilers.

For ***Germany***, the largest EU market, AGEE-Stat assumes that the installation figures for hot water provision and heating of 1,150,000 m² collector area translates into a solar thermal sector turnover of € 990 million (+ € 250 million for operation and maintenance), providing jobs for 11 100 employees in manufacturing, installation and O&M. The concentrated solar power (CSP) plant market saw some significant reorganization (with projects in Spain coming to a total halt) but still contributed 1 600 jobs, so for 2012 we arrive at a sector volume of ***€ 1 240 million*** and ***12 700 job positions*** for Germany.

Solar thermal was on the upswing and gaining market shares in ***Poland*** and became the third largest European Union market (following Italy and Germany) by passing the 300 000 m² mark with a double digit growth, mainly driven by the sharp hike in the price of gas from Russia and the success of the subsidy programme financed by the National Fund for Environmental Protection and Water Management (NFOŚiGW). EurObserv'ER confidently assumes socio economic impacts related to that upward trend of ***€ 241 million and over 2 500 positions*** in the industry and on the installation side.

The market was more in trouble in ***Italy***, declining by 5% in 2012 to 285 000 m² compared to 2011. As in other countries hit by recession, the building sector could not maintain previous levels. Correspondingly the job head count ranges around ***4 350 jobs*** and an annual sector turnover of ***€ 400 million***. A reason for a more positive market outlook is that the market stimulating effects of the enacted Heat Feed-in Tariff (Conto Termico) might become more apparent during 2014.

Denmark, in turn, not only countered the downward trend but more than doubled its annual market to 133 122 m² of solar thermal collector area, primarily based on a large number of collective solar thermal systems and on solar thermal collector fields that supply district heating networks. EurObserv'ER rates the market at over ***€ 100 million and 1 500 full time equivalents*** for 2012. The energy tax in the country also covering electricity is a major driver for this remarkable market growth that seems to be ongoing in 2014 and 2015.

The ***Austrian market*** continued to shrink, having installed 'only' 146 MWth in 2012 (against 165 MWth in 2011) despite increased support efforts on provincial level to overcome potential market saturation. Here the above-mentioned competition with biomass boilers/heat pump heating solutions came into play. The annual market statistic for the Ministry of Innovation and Technology (BMVIT) quantifies the sector turnover at ***€ 345 million*** and observes a shedding of 200 direct jobs in 2012, dropping from 3 600 to ***3 400***.

The market in ***France*** remained more or less stable and with a sector turnover of ***€ 430 million and 8 200 occupations***. It still belongs to the EU top league thanks to the subsidy programme implemented through the Heat Fund for collective applications.

The drop in sales and installations has negatively affected many manufacturers in the solar thermal industry that is undergoing a restructuring phase which not every company will survive. Much of the near future developments will depend on the continuation support programs for house owners and on the much harder to predict trend of increasing oil and gas prices as major investment factors. □

1

Employment

	2011		2012	
	Cumulated capacity to date (MWth)	Employment (direct and indirect jobs)	Cumulated capacity to date (MWth)	Employment (direct and indirect jobs)
Germany	10 663.8	14 100	11 416.3	12 700
France	1 543.0	8 100	1 677.0	8 200
Spain	1 915.0	5 000	2 075.4	4 500
Italy	2 149.0	4 500	2 380.0	4 350
Austria	3 303.3	3 600	3 449.4	3 400
Greece	2 862.0	2 500	2 885.0	3 000
Poland	636.6	2 000	848.0	2 540
Denmark	434.0	600	527.2	1 500
Portugal	614.0	1 500	676.7	1 100
Czech Republic	554.9	1 300	624.9	1 000
United Kindom	425.0	1 500	455.3	900
Belgium	292.0	450	334.0	600
Cyprus	490.0	500	505.2	500
Slovakia	102.0	250	108.0	500
Netherlands	590.1	350	608.3	350
Hungary	89.0	200	125.9	200
Ireland	170.0	250	183.8	200
Romania	86.0	150	100.1	200
Slovenia	132.0	100	141.8	150
Sweden	333.2	200	337.4	150
Bulgaria	56.0	100	58.1	100
Latvia	8.0	<50	9.4	<50
Lithuania	5.0	<50	6.4	<50
Luxembourg	22.0	<50	29.6	<50
Malta	33.0	<50	36.0	<50
Estonia	3.0	<50	4.3	<50
Finland	27.2	<50	31.3	<50
Total EU	**27 539.1**	**47 550**	**29 634.9**	**46 440**

Source: EurObserv'ER 2013

2

Turnover

	2011		2012	
	Annual installed capacity (MWth)	Turnover (in M€)	Annual installed capacity (MWth)	Turnover (in M€)
Germany	903.0	1 280	819.0	1 240
Spain	192.9	600	160.5	500
France	157.5	440	152.9	430
Italy	273.0	450	231.0	400
Austria	165.1	365	146.2	345
Poland	177.5	200	211.5	241
Greece	161.0	170	170.1	200
Denmark	43.7	50	93.2	110
Czech Republic	91.0	100	70.0	85
Portugal	89.7	100	63.6	75
Netherlands	40.4	50	47.9	60
Belgium	31.9	40	43.4	50
United Kindom	64.2	80	41.5	50
Hungary	17.4	15	36.2	35
Cyprus	20.0	25	16.9	20
Ireland	18.9	25	14.2	20
Romania	10.9	15	14.0	20
Sweden	14.6	20	8.5	10
Slovakia	16.2	20	5.6	10
Slovenia	7.4	10	9.4	10
Estonia	1.3	<5	1.3	<5
Finland	4.6	<5	4.2	<5
Latvia	1.3	<5	1.3	<5
Lithuania	1.3	<5	1.3	<5
Luxembourg	1.0	<5	4.8	<5
Malte	2.9	<5	2.8	<5
Bulgaria	5.6	<10	5.6	<10
Total EU	**2 514.2**	**4 095**	**2 376.9**	**3 951**

Source: EurObserv'ER 2013

SMALL HYDROPOWER

The hydropower sector and more precisely the small hydro sector with installed capacities of up to 10 MW that is monitored by EurObserv'ER is the most static one of all renewable technologies. The reason for this being that most suitable sites are already utilized and new constructions being hindered by numerous legislative or environmental obstacles and regulations. The market dynamics are thus not as clear cut as in other sectors and also the volume of new installations is not that large. In 2012 according to EurObserv'ER data ***182,1 MW*** of new small hydro capacities were installed. Small Hydro electricity generation in the EU-27 increased to 46.2 TWh, up from 43.4 TWh in 2011 but still well below the 51.3 TWh monitored in 2010.

In total, EurObserv'ER rates the European hydro market sector turnover at over ***€ 3.2 billion*** and with reference to the ESHA Streammap project data from 2011 and own projections, EurObserv'ER arrives at more or less constant European workforce close to ***26 000 permanent positions*** in the EU hydro sector. This includes manufacturing of equipment and components, installation and modernization and the operation and maintenance of existing small hydro plants.

Italy is the largest hydro market, both in terms of installed capacity and hydro electricity generated in the EU. For ***Italy*** we assume the largest economic value with around ***€ 600 million*** in the hydro sector. Numerous manufacturing firms are located in Italy so ***2 700 persons*** employed are a conservative assumption on the country's hydro related workforce.

No significant changes in job figures were observed in the ***German*** hydropower sector that witnessed a slight decrease from 7 300 in 2011 to ***7 200 in 2012***. This is due to an increase in the labor productivity over the previous year. The total sector turnover published in the BMU statistics amounted to ***€ 450 million*** but do not give a breakdown between small and large hydropower so that this figure is not directly comparable to other EU countries. Whereas the economic activity in new construction and the manufacturing of hydro power technology and components remained stable at € 60 million (down from 70 in 2011), the major change was analyzed in the area of operation and maintenance ranging at € 390 million in 2012.

For ***France*** Ademe has adjusted its socioeconomic account for the hydro sector, now standing at ***3 860 jobs and a sector revenue of € 300 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 rivers law on rivers and water courses.

Due to its geographic conditions ***Austria*** with its alpine environment is home to one of Europe's largest hydro resources. Also the Austrian economy benefits from the slow but continual small hydro expansion with 510 million turnover and an estimated ***1 050 persons employed*** according to Streammap data.

Potentially the EU member states and the industry body ESHA see room for further advancement of small hydropower sector and industry, however the ecological integrity of rivers, the need for technological innovations, and uncertainty over financial incentive mechanisms are limiting the immediate expansion of SHP in the EU. □

1

Employment

	2011		2012	
	Installed net capacity to date (MW)	Employment (direct and indirect jobs)	Installed net capacity to date (MW)	Employment (direct and indirect jobs)
Germany*	1 788.0	7 300*	1 780.0	7 200*
France	2 128.0	3 750	2 128.0	3 860
Italy	2 819.0	2 730	2 905.0	2 730
Portugal	377.0	1 750	380.0	1 750
Spain	1 931.0	1 500	1 931.0	1 500
Greece	206.0	1 240	218.0	1 250
Austria	1 163.0	1 050	1 184.0	1 050
United Kingdom	272.0	1 000	283.0	1 000
Poland*	268.0	950*	273.0	950*
Sweden	956.0	520	953.0	520
Romania	389.0	400	425.0	450
Bulgaria	451.0	420	451.0	420
Hungary	15.0	400	15.0	400
Belgium	64.0	400	62.0	400
Slovenia	159.0	380	160.0	385
Finland	315.0	375	315.0	375
Latvia	26.0	350	26.0	350
Czech Republic	297.0	300	311.0	300
Slovakia	99.0	300	102.0	300
Netherlands	0.0	200	0.0	200
Lithuania	26.0	150	26.0	150
Ireland	41.0	115	41.0	115
Denmark	9.0	<50	9.0	<50
Estonia	5.0	<50	8.0	<50
Luxembourg	34.0	<50	34.0	<50
Cyprus	0.0	0	0.0	0
Malta	0.0	0	0.0	0
Total EU	13 838.0	25 730	14 020.0	25 805

* Figures for large and small hydro large hydro. **Source: EurObserv'ER 2013**

2

Turnover

	2011		2012	
	Small hydro gross electricity production (GWh)	Turnover (M€)	Small hydro gross electricity production (GWh)	Turnover (M€)
Italy	10 047	600	9 409	600
Austria	4 739	500	5 745	510
Germany*	5 870	400	7 206	450
France	4 752	300	4 752	300
Sweden*	3 615	280	4 366	280
Spain	6 433	200	6 433	200
United Kingdom	1 053	150	883	170
Slovakia	334	140	375	140
Bulgaria	678	110	649	110
Portugal	938	90	627	95
Poland*	943	80	940	80
Romania	614	80	576	95
Czech Republic	895	60	917	70
Greece	581	50	669	55
Finland	1 147	45	1 733	45
Slovenia	292	15	297	15
Belgium	123	10	206	10
Denmark	17	<5	17	<5
Estonia	30	<5	42	<5
Hungary	52	<5	40	<5
Ireland	83	<5	108	<5
Latvia	64	<5	64	<5
Lithuania	90	<5	96	<5
Luxembourg	58	<5	97	<5
Cyprus	0	0	0	0
Malta	0	0	0	0
Netherlands	0	0	0	0
Total EU	43 449.1	3 460	46 247	3 260

* Figures for large and small hydro large hydro. **Source: EurObserv'ER 2013**

EUROBSERV'ER – THE STATE OF RENEWABLE ENERGIES IN EUROPE – 2013 EDITION

GEOTHERMAL ENERGY

Unlike in last years' edition of "The state of renewable energy in the EU", this year EurObserv'ER has split up the geothermal sector in 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, 20 of the 27 European Union are now using geothermal heat. Investment costs for deep geothermal projects are relatively high, due to comprehensive site assessment and drilling activities. Employment is also generated in equipment manufacturing and O&M activities in the EU. The deep geothermal industry in the European Union is one of the smaller and less volatile sectors amongst the renewable energy technologies. EurObserv'ER in its survey observed some slight upward trends, both in turnover ***(€ 1.16 billion)*** and in geothermal related employment (nearly ***11 000 positions*** in 2012). Italy is the forerunner in Europe for years by far, followed by Germany, Hungary and France and the Netherlands in terms of installed capacity and socioeconomic impacts.

Italy saw some capacity additions mainly in the direct use of heat which has grown to 778 MWth in 2012. A rough estimate arrives at ***€ 600 million*** in economic activity for the country and assumes around ***5 500 jobs*** in plant manufacturing and operation of installations for the Mediterranean country.

Hungary could also increase its geothermal heat generation to 714 MWth (up from 654 MWth in 2011) that should have also resulted in positive trends in employment we assess at ***850 persons*** and a sector volume of ***€ 60 million***.

France has a good potential underground for exploiting geothermal heat. This is the case in the Île de France region and in the east of the country. Those units account for most of the activity in this sector. Electricity generation is limited to the 15 MW Bouillante site in Guadeloupe. The sectors' turnover is about ***€ 60 million*** and ***1 200 people*** are working in this activity.

Also ***Germany*** witnessed some minor growth but the renewable energy statistics group AGEE-Stat states that the turnover in the sector remained stable at ***€ 160 million***, as was the employment level of ***1 400 persons*** for technology firms active in the deep geothermal sector. The investments and sales (and also employment) in the field of deep geothermal energy basically remained at the previous year's level in ***Germany***. The employment resulting from sales as well as operation and maintenance of existing plants, amounts to 1 400 persons of geothermal energy. The turnover ranges at around € 160 million according to the statistics of AGEE-Stat.

This branch of geothermal energy is less dynamic than the heat pump segment. However, there are some ambitions for heat, and to a lesser extent electricity operations, by 2020 in the national action plans of the country members. This sector, which is based on mature technologies, will enhance its energy weight and socioeconomic impact, by taking advantage of the rising cost of fossil fuels for years to come. □

EUROPEAN COMMUNITY

BRGM

1

Employment

	2011		2012	
	Cumulated capacity at the end of 2011	Employment (direct and indirect jobs)	Cumulated capacity at the end of 2012	Employment (direct and indirect jobs)
Italy	728.1 MWe 418 MWth	5 000	728.1 MWe 778.7 MWth	5 500
Germany	8 MWe 120.5 MWth	1 400	12 MWe 171 MWth	1 400
France	17.2 MWe 391 MWth	1 000	17.2 MWe 365 MWth	1 200
Hungary	654 MWth	750	714 MWth	850
Netherlands	16 MWth	500	39 MWth	400
Poland	60.6 MWth	150	115.4 MWth	200
Romania	153.2 MWth	200	176 MWth	200
Slovakia	130.6 MWth	150	163.9 MWth	170
Greece	91.2 MWth	150	104.9 MWth	150
Spain	22.8 MWth	< 100	22.8 MWth	<100
Denmark	21 MWth	< 100	21 MWth	<100
Portugal	25 MWe 27.8 MWth	< 100	25 MWe 27.8 MWth	<100
Slovenia	66.8 MWth	< 100	66.8 MWth	<100
Lithuania	48 MWth	< 100	48 MWth	<100
Sweden	48 MWth	< 100	48 MWth	<100
Austria	0.7 MWe 97 MWth	< 50	0.7 MWe 97 MWth	<50
Bulgaria	3.5 MWth	< 50	3.5 MWth	<50
Belgium	3.9 MWth	< 50	7 MWth	<50
United Kingdom	2 MWth	< 50	2 MWth	<50
Czech Republic	4.5 MWth	< 50	4.5 MWth	<50
Ireland	0	0	0	0
Latvia	0	0	0	0
Luxembourg	0	0	0	0
Cyprus	0	0	0	0
Estonia	0	0	0	0
Finland	0	0	0	0
Malta	0	0	0	0
Total EU	779 MWe 2 357.5 MWth	10 150	783 MWe 2 953.4 MWth	10 920

Source: EurObserv'ER 2013

2

Turnover

	2011		2012	
	Production (ktoe)	Turnover (M€)	Production (ktoe)	Turnover (M€)
Italy	625.5	600	684.5	600
Germany	28.0	160	64.8	160
Netherlands	7.5	75	11.8	80
France	93.8	40	98.4	60
Hungary	108.0	55	120.0	60
Belgium	3.9	30	1.5	40
Poland	13.0	15	16.0	30
Romania	32.1	25	31.1	25
Slovakia	76.0	25	83.6	25
Sweden	23.2	15	23.2	15
Austria	17.9	15	19.1	15
Portugal	28.3	10	22.8	10
Slovenia	18.5	10	15.8	10
Bulgaria	1.3	<5	1.3	<5
Denmark	7.9	<5	6.9	<5
United Kingdom	0.8	<5	0.8	<5
Czech Republic	2.1	<5	2.1	<5
Greece	15.9	<5	13.1	<5
Lithuania	1.6	<5	1.9	<5
Ireland	0.0	0	0.0	0
Spain	0.0	0	0.0	0
Latvia	0.0	0	0.0	0
Finland	0.0	0	0.0	0
Cyprus	0.0	0	0.0	0
Estonia	0.0	0	0.0	0
Luxembourg	0.0	0	0.0	0
Malta	0.0	0	0.0	0
Total EU	479.8	1 105	534.2	1 160

Source: EurObserv'ER 2013

HEAT PUMPS

This section is dedicated to the total European heat pump market, gathering both aerothermal and geothermal appliances. This is one of the new features of this new barometer edition. Aerothermal heat pumps are fully included in the calculation of the renewable share in the countries energy balance, so it was logical to translate this evolution in our socio-economic chapter. In total the heat pump sector in the EU can be estimated at more than ***89 000 jobs and a € 8 billion turnover for 2012***. The market suffered a decrease from 95 000 jobs level in 2011. For both years, aerothermal appliances represented the lion share of the total market with an average level of 86% of the sales.

France is one of the main geothermal markets in Europe, especially for the geothermal heat pump segmentation were most of the units sold are manufactured in the country. However, in the aerothermal part of the market the main share of the heat pumps are produced abroad, most notably in Asia. The country counted ***30 850 direct and indirect jobs*** in ***2012 and a € 1.87 billion turnover***.

In the field of geothermal heat, investments in 2012 were lower than in the previous year in ***Germany*** and add up to ***€ 1.69 billion*** (including Investments in renewable energy installations and turnover from operation in 2012 for both near surface and deep geothermal activities. Employment resulting from these sales and operations and maintenance, amounts to ***12 500 persons*** who are working in the heat pump segment. These downward trends are due to a reduction in prices, as well as to the steady shift in market share toward the much cheaper air-water heat pumps.

Sweden is another major European heat pump market in Europe, but the sector could not maintain its previous levels in 2012. The country's industry body SVEP reported a sharp drop in the sector's turnover from € 900 million (SK 8 billion) for 2011 to ***€ 600 million*** (SK 5.3 billion). The market contraction in heat pumps sales - mainly due to the slump in the new build sector (minus 10.9% in GSHP segment) is specifically worrying as heat pumps are the population's preferred heating method, both in the new build sector and for replacing existing heating systems. Around ***8 500 jobs*** represents a fourth place in the employment league.

As has been pointed out in the thematic EurObserv'ER heat pumps barometer (November 2013), the situation in ***Italy*** is hard to compare with other EU member states. The Italian heat pump activity is hugely oriented towards aerothermal technologies (for 99%) but EurObserv'ER assumes that the largest share of domestic market is composed by reversible air/air heat pumps which are mainly used for cooling and not for heating purposes. In this table we tried to express jobs and turnover just related to reversible air/air heat pumps mainly used for heating which represent around 12% of the total market. The consortium assess the Italian sector activity at around ***€ 1.8 billion and 10 500 position*** in the industry and commerce.

The European Heat Pumps Association (EHPA) foresees a more positive perspective for coming years than the figures mentioned above might suggest. The heat pump sector can be seen as being in a waiting position, with potentially large and relatively easy to tap potentials. A broader recovery of the housing market throughout Europe or the continued rise in oil and gas prices might positively impact socioeconomic data within a relatively short period of time. □

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1

Employment

	2011			2012		
	Total heat pumps sales	Employment (direct and indirect jobs)	Share of aerothermal heat pump in total employment	Total heat pumps sales	Employment (direct and indirect jobs)	Share of aerothermal heat pump in total employment
France	162 565	30 800	94%	142 380	30 850	94%
Germany	47 700	12 800	58%	54 100	12 500	62%
Italy	136 850	12 300*	99%	116 850	10 500*	99%
Sweden	106 775	9 600	71%	95 107	8 500	74%
Netherlands	38 261	5 000	85%	36 635	5 000	84%
Finland	72 267	6 500	81%	60 900	5 000	79%
Spain	75 135	6 500	99%	50 136	4 500	99%
Denmark	24 634	2 200	83%	30 382	2 700	89%
Bulgaria	48 647	4 300	98%	27 453	2 400	98%
United Kingdom	18 500	1 700	88%	17 799	1 600	87%
Estonia	11 806	1 000	91%	13 495	1 200	91%
Austria	12 259	1 050	45%	13 620	1 130	53%
Czech Republic	6 992	600	66%	7 657	700	67%
Portugal	14 096	1 200	100%	8 074	700	100%
Poland	6 270	500	24%	7 116	560	28%
Belgium	5 931	500	78%	6 553	600	78%
Slovenia	2 346	200	90%	5 425	480	91%
Ireland	1 226	100	55%	1 384	100	65%
Hungary	844	100	72%	695	50	58%
Lithuania	597	50	32%	645	50	30%
Slovakia	537	50	66%	756	50	68%
Cyprus	0	0	0%	0	0	0%
Greece	0	0	0%	0	0	0%
Latvia	0	0	0%	0	0	0%
Luxembourg	0	0	0%	0	0	0%
Malta	0	0	0%	0	0	0%
Romania	0	0		0	0	0%
Total EU	**794 238**	**97 050**	**86%**	**697 162**	**89 170**	**86%**

** Employment related to the aerothermal heat pumps mainly used for cooling is not included in this figure. Source: EurObserv'ER 2013*

2

Turnover

	2011		2012	
	Heat pump market evolution (%)	Global Heat pump market Turnover (in M€)	Heat pump market evolution (%)	Global Heat pump market Turnover (in M€)
France	-15%	1 850	-12%	1 870
Italy	25%	1 935*	-2%	1 825*
Germany	-21%	1 500	13%	1 520
Sweden	-2%	900	-11%	600
Netherlands	25%	500	-4%	500
Finland	42%	370	-16%	400
Austria	3%	201	11%	212
Denmark	n.a.	125	23%	208
Bulgaria	n.a.	140	-44%	175
United Kingdom	-44%	160	-4%	160
Poland	16%	50	13%	65
Spain	n.a.	140	-33%	100
Estonia	4%	38	14%	94
Czech Republic	6%	75	10%	80
Belgium	4%	58	10%	64
Slovenia	148%	20	131%	45
Portugal	n.a.	25	-43%	17
Ireland	145%	14	13%	15
Latvia	n.a.	8	0%	10
Lithuania	13%	8	8%	9
Hungary	-76%	6	-18%	7
Slovakia	16%	5	41%	7
Romania	0%	0	0%	5
Cyprus	0%	0	0%	0
Greece	0%	0	0%	0
Luxembourg	0%	0	0%	0
Malta	0%	0	0%	0
Total EU	**-1%**	**7 978**	**-12%**	**7 828**

** Turnover related to the aerothermal heat pumps mainly used for cooling is not included in this figure. n.a. : non available. Source: EurObserv'ER 2013*

BIOGAS

The European biogas sector is dominated by the three main countries Germany, United Kingdom and Italy, accounting for three quarters of the installed capacity and the largest part of primary energy production, now standing at 12 049 ktoe (against 10 414 ktoe in 2011). France, the Czech Republic, the Netherlands and Spain are following with some distance. The other member states are partially picking up momentum although at a somewhat slower pace. Socioeconomic data analyzing the biogas sector is not as clear cut and easily available as in other RES sectors. EurObserv'ER estimates an economic volume of investment in new plants, manufacturing of components and its operation and agricultural fuel supply at approximately ***€ 5.7 billion for 2012***. The number of jobs should ranges around ***69 000*** in 2012.

Germany remains the largest biogas market, but following changes in the primary support instrument EEG, Germany witnessed a dramatic decline in new biogas capacity installations in 2012. Despite this stagnation, a part of the domestic market contraction could be compensated by German biogas companies through their activities abroad but the sector turnover decreased to around ***€ 2 billion***. Two thirds of the ***51 000 job places*** (down from 52 900 the year before and including 1 500 jobs for operation and maintenance of stationary liquid biomass facilities) are attributable to plant manufacturing and operation, the remaining third, or 16 200 jobs result from the supply of biomass. The cultivated land area for biogas covers now 913 000 ha according to the FNR Agency.

The ***United Kingdom*** in recent years has developed its biogas sector as well and that has become a fundamental industry branch in the country as well. Our data suggest a workforce of ***3 500 persons*** and an estimated sector turnover of around ***€ 600 million***.

The ***Czech Republic*** could not keep up the growth rates of previous years but still is one of the EU top players according to EBA. The economic benefit for the country should rank clearly above ***€ 120 million***.

Italy is also a major biogas hub and home to hundreds of biogas related firms such as plant manufacturers and operators. The sector covers ***around 5 000 persons*** employed and a country turnover of nearly ***€ 1.9 billion***.

For ***France***, Ademe counts ***3 200 jobs*** in biogas related activities and the sector turnover ranges at ***€ 300 million***. Efforts during recent years to develop agricultural plants have not yet allowed a take off of the sector.

The ***Austrian*** biogas association appreciates the added local value creation and has given an estimate of 1 500 persons employed in the sector, a figure that can be confidently increased to ***1 900*** for 2012, considering the continual growth of biogas use in the alpine country. Using our averaged calculation ratio, Austria's biogas sector displays a financial value of ***€ 75 million***.

The market dynamics in biogas are somewhat incoherent throughout the EU. Germany has witnessed a contraction in large agricultural plants for the first time whereas other markets still see potential in that segment. The trend also seems to be going into the direction of smaller plants using organic inputs, not the least because of growing public concerns in the fuel vs. food debate. Landfill biogas remains the main application in markets such as the UK, France or Spain. With more and more emerging systems able to inject biomethane into the natural gas grids, the biogas sector has a pretty good growth prospective, although overall at a slower pace as witnessed or anticipated in previous years. □

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1
Employment

	2011		2012	
	Primary production of biogas (ktoe)	Employment (direct and indirect jobs)	Primary production of biogas (ktoe)	Employment (direct and indirect jobs)
Germany	5 180.5	52 900	6 416.2	51 000
Italy	1 103.9	4 000	1 178.8	5 000
United Kingdom	1 800.7	3 200	1 811.2	3 500
France	396.9	2 350	446.0	3 200
Austria	169.1	1 500	207.5	1 900
Czech Republic	249.8	520	374.9	1 000
Netherlands	292.9	580	297.5	600
Spain	287.0	490	260.5	520
Poland	136.9	250	168.0	320
Belgium	128.3	300	157.7	300
Sweden	119.3	200	126.8	250
Denmark	100.7	190	104.7	200
Slovenia	36.0	110	38.1	130
Hungary	60.7	120	79.8	130
Portugal	45.0	90	56.4	120
Greece	72.8	115	88.6	115
Ireland	57.6	110	55.9	110
Finland	53.0	75	57.9	80
Slovakia	45.8	65	43.5	60
Latvia	22.0	60	22.0	60
Luxembourg	13.5	< 50	15.7	< 50
Lithuania	11.1	< 50	11.6	< 50
Romania	13.2	< 50	13.4	< 50
Estonia	3.3	< 50	2.9	< 50
Cyprus	11.0	< 50	11.0	< 50
Bulgaria	3.0	< 50	3.0	< 50
Malta	0.0	0	0.0	0
Total EU	10 413.8	67 525	12 049.7	68 895

Source: EurObserv'ER 2013

2
Turnover

	2011		2012	
	Primary energy production trend (%)	Turnover (M€)	Primary energy production trend (%)	Turnover (M€)
Germany	-24	2 280	24	2 075
Italy	1	1 500	7	1 900
United Kingdom	116	575	1	600
France	5	190	12	290
Czech Republic	-1	90	23	140
Spain	-7	115	50	105
Netherlands	24	100	2	100
Austria	41	60	-9	75
Belgium	0	60	23	70
Poland	19	40	23	50
Sweden	18	45	6	50
Denmark	0	35	4	40
Greece	-4	25	6	30
Hungary	7	20	31	30
Ireland	65	20	25	25
Portugal	-1	20	22	25
Finland	46	15	-3	20
Slovakia	8	15	9	20
Slovenia	-15	13	-5	18
Latvia	277	10	0	10
Luxembourg	32	<5	16	10
Estonia	-40	<5	5	<5
Lithuania	-1	<5	2	<5
Romania	11	<5	-11	<5
Bulgaria	0	0	0	0
Cyprus	0	0	0	0
Malta	0	0	0	0
Total EU	-7	5 248	16	5 698

Source: EurObserv'ER 2013

EUROBSERV'ER – THE STATE OF RENEWABLE ENERGIES IN EUROPE – 2013 EDITION

BIOFUELS

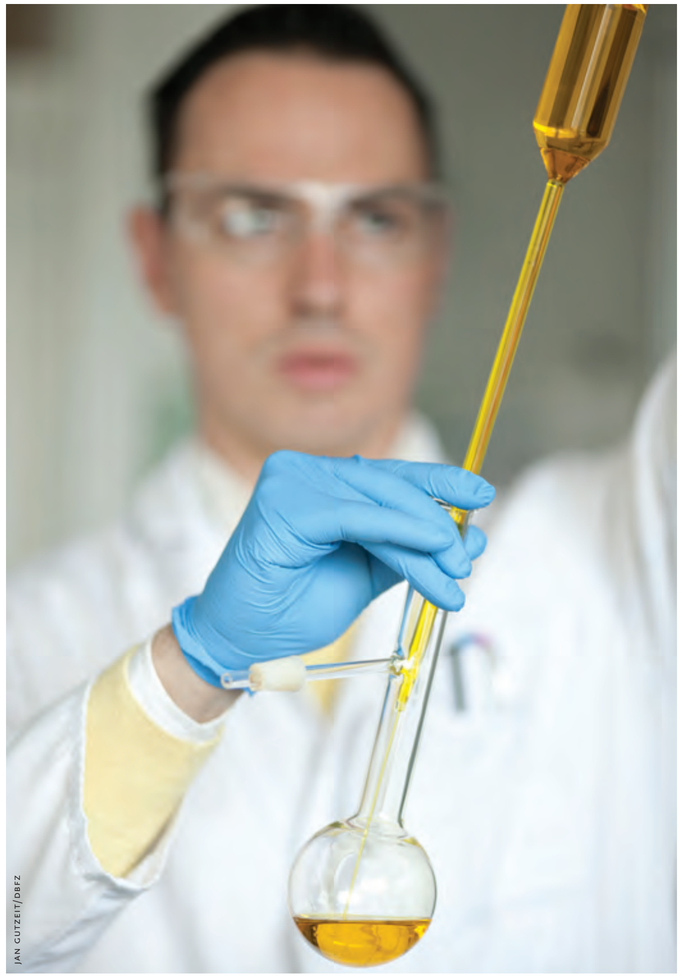
The biofuels market witnessed a small growth over the two preceding years that EurObserv'ER puts at 2.9% up to 14.4 Mtoe in 2012. Growth and decline were unevenly distributed throughout EU member states. However, all EU markets and the EU biofuels industry are confronted with challenges from various sides: stricter environmental criteria and a suggested and discussed 5% cap for the incorporation rate on the one hand and growing import shares from importing countries in South America and East Asia that provide biofuels produced under questionable sustainability conditions on the other hand. This has caused the market exit of some EU producers and lower EU production figures. EurObserv'ER assumes that 30% of biodiesel and 15% of bioethanol consumption are imported and this has been taken that into consideration when estimating the socioeconomic impacts. Overall, EurObserv'ER, using conservative assumptions, arrives at a more or less stable sector turnover of ***around € 14.5 billion and 115 000 jobs in the EU biofuels industry*** including the supply side in the agricultural sector.

MAGNUS WECKSTRÖM/NESTE OIL

Europe's leading biodiesel consumer ***France*** (2.3 million toe in 2012) with 6.8% also features one of the highest incorporation rates of biofuels in the transport sector. Socioeconomic data for the industry provided by Ademe suggest a sector turnover of ***nearly € 2.5 billion and a workforce of 30 000*** in the country.

Spain holds a top position concerning its incorporation rate standing at 7.3%. Also biofuel consumption by energy content showed an upward trend of 13%. EurObserv'ER assumes a sector value of ***€ 1.8 billion for 2012***, relating to an employment level of clearly over ***9 400 jobs*** and thus following Spain's top renewable employment sector PV.

The overall sales of biofuels of in ***Germany*** in 2012 were slightly higher against 2011. Sales of biodiesel declined whereas an increase in sales of bioethanol and vegetable oil could be observed. Also the existing production capacity was not fully utilised. AGEE-Stat, that analyses the socioeconomic impacts of the biofuels sector for Germany, still attributes a turnover of nearly ***€ 3.7 billion*** and employment for ***22 700*** persons (slightly down from 23 200 in 2011).



JAN GUTZEIT/DBFZ

According to EurObserv'ER estimates, ***Sweden*** has the highest EU incorporation rate for biofuels in the transport sector (7.8%). We can confidently assume that the ambitious plans to go for 100% clean vehicles by 2030 will further stimulate the domestic market that already today accounts for a turnover of around ***€ 500 million and 4 140*** jobs in the Scandinavian country. Other notable EU member states are Italy ***(€ 1.3 billion and over 8 000 positions)*** and Poland, that despite a temporary drawback, might have attained a sector turnover of ***€ 580 million and 5 500 direct and indirect jobs*** in the biofuels sector.

The ongoing restructuring process in the industry will have some effects on future economic accounts, with possibly ongoing shifts towards second generation biofuels. Beyond, the outcome surrounding a possible EU fuel substitution strategy will certainly affect the sector and the socioeconomic headcount but the latter one cannot be seriously predicted at this point in time. □

1

Employment

	2011		2012	
	Biofuel consumption for transport (ktoe)	Employment (direct and indirect jobs)	Biofuel consumption for transport (ktoe)	Employment (direct and indirect jobs)
France	2 426 700	29 900	2 717 400	30 000
Germany	2 956 746	23 200	3 018 321	22 700
Belgium	321 429	8 920	329 393	9 920
Spain	1 701 369	10 680	1 927 325	9 435
Poland	1 013 280	4 750	899 641	5 480
Italy	1 401 026	3 860	1 362 401	5 270
Austria	492 015	4 320	519 289	4 580
United Kingdom	1 056 105	6 150	888 435	4 420
Hungary	164 126	3 520	81 500	4 230
Sweden	505 466	3 700	586 887	4 140
Czech Republic	299 847	2 600	281 134	2 925
Slovakia	123 024	2 590	100 856	2 590
Portugal	314 864	1 775	287 042	1 830
Finland	199 269	1 540	254 729	1 540
Romania	196 188	1 600	196 188	925
Lithuania	44 867	760	60 517	840
Bulgaria	16 791	310	9 809	790
Denmark	132 300	770	229 534	770
Netherlands	321 296	700	326 192	700
Latvia	22 293	420	19 217	570
Greece	103 396	480	124 606	490
Ireland	97 452	310	83 436	310
Luxembourg	45 679	200	46 987	200
Slovenia	35 194	150	51 627	200
Cyprus	15 899	<50	16 136	<50
Estonia	0	<50	0	<50
Malta	0	0	0	0
Total EU	14 006 623	113 305	14 418 603	114 955

Source: EurObserv'ER 2013

2

Turnover

	2011		2012	
	Consumption trend (%)	Turnover (in M€)	Consumption trend (%)	Turnover (in M€)
Germany	-3	3 670	2	3 680
France	0	2 450	12	2 470
Spain	18	1 600	13	1 830
Italy	-1	1 330	-3	1 300
United Kingdom	-8	1 000	-16	850
Netherlands	36	600	2	660
Poland	4	950	-11	580
Sweden	20	480	16	560
Austria	-12	470	6	500
Belgium	-2	300	2	310
Czech Republic	28	280	-6	270
Portugal	-6	300	-9	270
Finland	38	190	28	250
Denmark	514	120	73	220
Romania	0	180	0	180
Greece	-17	100	21	120
Slovakia	2	120	-18	100
Ireland	-14	90	-14	80
Hungary	-6	150	-50	75
Lithuania	-1	40	35	60
Slovenia	-21	35	47	50
Luxembourg	7	45	3	45
Latvia	54	20	-14	20
Cyprus	0	15	1	15
Bulgaria	0	15	-42	10
Estonia	0	5	0	5
Malta	0	0	0	0
Total EU	6.3	14 615	0.8	14 510

Source: EurObserv'ER 2013

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. Each individual European Union country sets the amount of energy recovered by its incineration plants that it considers as renewable, depending on the biomass content of the incinerated waste. Most of the time the used ratio is 50% to express the share of renewable energy produced from the whole municipal wastes operated. Total primary energy production in the EU (electricity and heat from incineration plants) increased in 2012 to 8 516 ktoe (up from 8229 ktoe in 2011). The preferred waste-to-energy mode is electricity production and is steadily rising. It was put at 18.9 TWh in 2012, which is a 3.3% year-on-year increase. Heat sales from incineration plants are naturally more common in countries where district heating networks are widespread (Germany, Sweden, Denmark, Netherlands) and are rising faster than electricity production prompted by higher heating requirements due to the winter temperatures which reverted to normal after 2011.

There are hardly any solid data on socioeconomic impacts of these activities. The only information on employment effects is provided in bi-annual country reports provided by the industry body CEWEP (Confederation of European Waste-to Energy Plants) that gives some estimation for some countries. Overall, EurObserv'ER- taking into account 2012 country reports and the market developments estimates a slightly growing workforce of around ***23 935 persons employed in the EU*** member states.

In ***Germany***, the transposition of the Waste Framework Directive in Germany in February 2012 by the Waste Management and Product Recycling Act (Kreislaufwirtschaftsgesetz–KrWG) did not result in a reduction in waste-to-energy recovery in favour of recycling – proof that the two handling

MVV ENERGIE

systems are complementary. The country stays the first in Europe for the energy generation from wastes. According to CEWEP publications, the sector activity represent ***5 200 jobs*** which put the country ahead the others EU members (BMU/AGEE stat, however,do not include RMW in their statistical scope. The figure here is given indicatively).

The Netherlands are also active players. During last years, the country engaged itself in policy on favor of converting household waste to energy by incineration. A lot of modern plants were created and they need huge bulks of wastes to operate. Waste deliveries to plant operators are lower than expected as a result of the new national waste management plan (NWMP) priority to develop the recycling sectors leading the country to become a net importer of renewable waste.

The growth potential for waste-to-energy recovery is still high but the problem is that this potential is now left to those very countries that have yet to make the necessary investments to recover energy from waste. Investment decisions are being put off because of the recession that has most of the European Union reeling. Sector development is also being tripped up by the prospects for heat sales, for the new plants must be constructed in places where heat sales are possible. This therefore implies the need to provide the right conditions to attract factories on site to use this heat and at the same time promote the building of district heating networks.

1

Employment

	2011		2012	
	Primary energy production (ktoe)	Employment (direct and indirect jobs)	Primary energy production (ktoe)	Employment (direct and indirect jobs)
Germany	2 404.5	5 200	2 595.6	5 200
Netherlands	876.3	4 500	849.7	4 500
France	1 010.0	3 700	1 028.0	3 700
Sweden	713.5	2 900	769.5	2 900
Denmark	506.4	2 500	492.6	2 500
United Kingdom	640.7	1 720	805.6	2 000
Spain	174.0	855	158.8	855
Italy	843.0	950	806.8	950
Belgium	482.4	180	333.1	180
Portugal	98.5	300	86.0	300
Finland	139.6	250	193.0	250
Austria	138.4	150	143.7	150
Czech Republic	79.9	100	83.7	100
Hungary	42.0	50	55.6	50
Poland	32	50	32	50
Slovakia	17.8	<50	17.9	<50
Luxembourg	11.1	<50	10.7	<50
Ireland	10.6	<50	44.4	<50
Slovenia	6.2	<50	7.5	<50
Latvia	2	<50	2	<50
Bulgaria	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.
Lithuania	n.a.	n.a.	n.a.	n.a.
Malta	n.a.	n.a.	n.a.	n.a.
Romania	n.a.	n.a.	n.a.	n.a.
Total EU	**8 228.9**	**23 655**	**8 516.2**	**23 935**

n.a. : not available. ***Source: EurObserv'ER 2013***

SOLID BIOMASS

Solid biomass creates opportunities for income and "green jobs" in the European economy in forestry, machinery production, wood processing and last but not least in the energy industry. Beyond, occupations are created in fuel trading, in research and development, training or consulting, although the latter ones are not counted in our methodology.

Biomass has turned and strengthened its position as top sectors for the socioeconomic aspects. Between 2011 and 2012 all EU member states have increased their biomass based primary energy production (82.3 Mtoe were produced against 78.1 Mtoe in 2011). Market development in 2012 was thus positive and accordingly EurObserv'ER has adjusted its socioeconomic impact assessment at ***€ 27.7 billion and a remarkable 282 000 jobs***.

The Scandinavian and Baltic countries by their very resource availability are natural forerunners in biomass uses. For ***Sweden*** a biomass energy related workforce of over ***28 000*** persons can be confidently assumed. The sector turnover is around ***€ 2.7 billion*** according to EurObserv'ER estimations and the well-established biomass industry in the country. Meanwhile the national association SVEBIO claims that bioenergy accounts for almost a third of Sweden's energy use. Also ***Finland*** is continually increasing its biomass based energy production and consumption now standing at 7.8 Mtoe. For 2012 EurObserv'ER estimates the sector at ***€ 2.28 billion*** and ***over 23 000*** job positions in the industry that also accounts the forestry sector.

In terms of primary energy consumed, solid biomass remains the most developed renewable sector in ***France***, especially for heating purposes. Since 2010, the sector benefits from a very ambitious national program titled "Heat Fund". This action is dedicated to support investments in large wood boilers in industry or buildings but also to promote district heating fueled by solid biomass inputs. According to the Ademe, the total activity is assumed to employ around ***48 000 people*** in 2012 and generate a ***€ 1.6 billion*** turnover.

For ***Germany***, the economic turnover resulting the construction and operation of facilities biomass and of heat and electricity generation (excluding biogas) ranges at over ***€ 7.5 billion for 2012*** and is clearly above the € 7.1 billion recorded for 2011. AGEE-Stat also assessed a 6% growth in biomass related employment that is now standing at ***50 000 jobs***. These include jobs created by investment in small biomass heating systems and their operation and maintenance and in large biomass Heating plants. Beyond the job effect of fuel supply in the forestry sector are taken into account (21 400 jobs). O&M alone has marked a 22% increase in turnover to € 830 million according to AGEE-Stat.

In ***Austria*** the annual market statistics published by the BMVIT counts socioeconomic effects in solid biomass sector by adding up revenues and primary jobs. The data collection refers to biomass fuel supply, the manufacturing of biomass boilers and stoves in the country and also includes the national pellet industry. The head count arrived at ***18 600 full time equivalents*** for 2012 and is thus slightly below the 2011 level. The same procedure is applied to the sector turnover that ranges at ***€ 2.55 billion***, representing a minor growth compared to 2011.

Other regions to look out for in biomass energy use are the Baltic States and ***Poland*** where increasing shares of biomass are used in the country' dominating coal fired electricity plants. With over ***20 000 jobs*** attributable to biomass it is the country's most important renewable energy source and employer. EurObserv'ER estimates an industry sector turnover of nearly ***€ 2 billion***.

Much of the future developments will depend on the forthcoming EU directive and the controversially discussed sustainability criteria. The observed trend of substituting coal in centralized power plants is certainly continuing for near term future, and so are the positive socioeconomic impacts for EU member states. □

1

Employment

	2011		2012	
	Primary energy production (ktoe)	Employment (direct and indirect jobs)	Primary energy production (ktoe)	Employment (direct and indirect jobs)
Germany	11.054	43 100	11.811	50 000
France*	9.089	47 970	10.457	48 000
Sweden	8.934	26 800	9.449	28 350
Finland	7.593	22 780	7.919	23 500
Poland	6.350	19 050	6.988	20 500
Austria	4.537	18 850	4.820	18 600
Spain	4.812	14 450	4.833	14 500
Italy	3.914	11 750	4.212	12 200
Romania	3.476	10 400	3.470	10 410
United Kingdom	1.623	7 000	1.810	7 050
Portugal	2.617	7 850	2.342	7 025
Czech Republic	2.079	6 200	2.153	6 460
Latvia	1.741	5 200	1.741	5 200
Hungary	1.429	4 300	1.429	4 300
Belgium	1.105	3 300	1.404	3 300
Netherlands	1.000	3 000	1.099	3 300
Denmark	1.499	3 250	1.489	3 250
Estonia	0.939	2 800	1.012	3 040
Greece	0.940	2 800	1.000	3 000
Lithuania	0.983	2 950	0.992	2 975
Bulgaria	0.834	2 500	0.974	2 925
Slovakia	0.784	2 350	0.717	2 150
Slovenia	0.566	1 700	0.560	1 680
Luxembourg	0.046	150	0.048	150
Ireland	0.190	100	0.195	100
Cyprus	0.005	<50	0.005	<50
Malta	0.001	0	0.001	0
Total EU	**78.139**	**270 730**	**82.930**	**282 095**

** Overseas departments included. **Source: EurObserv'ER 2013***

2

Turnover

	2011		2012	
	Primary energy production trend (%)	Turnover (M€)	Primary energy production trend (%)	Turnover (M€)
Germany	-4	7 100	7	7 525
Sweden	-18	2 600	15	2 745
Austria	-5	2 430	6	2 550
Finland	-3	2 210	3	2 280
Poland	15	1 850	8	1 990
France*	-13	1 730	6	1 560
Spain	6	1 400	0	1 405
Italy	6	1 140	4	1 180
Romania	0	1 010	0	1 010
Portugal	1	760	11	680
Czech Republic	-2	600	-11	625
United Kingdom	33	470	4	525
Latvia	1	505	0	505
Denmark	-12	440	0	435
Hungary	0	415	0	415
Belgium	5	320	10	320
Netherlands	-3	290	-1	320
Estonia	-10	275	8	295
Greece	22	275	6	290
Lithuania	-2	285	1	290
Bulgaria	8	240	17	285
Slovakia	6	230	-9	210
Slovenia	-6	164	-1	163
Ireland	-2	55	3	60
Luxembourg	-12	15	3	15
Cyprus	0	<1	0	<1
Malta	0	0	0	0
Total EU	**-3**	**26 810**	**5**	**27 679**

** Overseas departments included. **Source: EurObserv'ER 2013***

2011 was the first year where the European economic crisis translated into a halt in the increase of turnover and employment figures of the RES sectors. This stagnation of the activity appeared after six years of uninterrupted growth of renewable energy. In 2012, the trend has not been reversed and there is now a decline in employment and turnover even if some sectors resist better than others.

EMPLOYMENT

Overall, renewable energy induced employment in the European Union stands around ***1.2 million direct and indirect jobs*** in 2012, down 50 000 compared revised and consolidated EurObserv'ER figures for 2011. These contractions can be explained by investor insecurities related to the generally critical macroeconomic conditions in many EU member states following the financial crisis on the one hand, and on the other hand by the partially drastic drops in major markets and renewable sectors. Most notably, the PV sector witnessed a large decrease (- 80 000 jobs) that could not be compensated by encouraging but small growth rates in other RE sectors. Also Germany, for years the power train in renewable energy related job creation showed signs of weakness and for the first time also monitored a decline in employment.

A general trend worth noting is, that the larger country players (Germany, Italy, Spain, UK, Sweden) suffered job losses, whereas virtually all other EU states and most obviously some Eastern and Southern European states could harvest the positive benefits of RE use for their labour markets. Examples for that include Poland, Bulgaria, the Czech Republic, Lithuania, or Slovenia and even crisis hit Greece should have benefitted according to EurObserv'ER estimations. So despite this observed overall decline, the dynamic towards more equally distributed job counts triggered by renewable energy use is a positive sign, possibly even a start of a longer term market trend. □

W.E.B WINDENERGIE AG/A.ZECHMEISTER

TURNOVER

The economic value of renewable energy deployment in the EU is assessed at nearly ***€ 130 billion***. Also here a contraction of several billions from € 141 billion in 2011 is monitored. The reasons for this are similar than for the job losses mentioned above. But in this case also other factors need to be taken into account. The ongoing and continuing decline in PV module prices is a case in point. Also efficiency gains in the production of RES technologies and increased labour productivity might be named.

With over € 34 billion, Germany, by a long way still heads the league in terms of renewable energy induced turnover, accounting alone for over 26% of total EU turnover. Italy (€ 14.3 billion) and France (€11.3 billion) managed to pass the € 10 billion threshold, followed by the UK (€ 9.8 billion), Denmark and Spain.
Some market analysts predict a further recovery in the European and International economy. Whether that is also the case for the European renewable energy sectors remains to be seen, but even in harsh conditions, and growing political (feed in cuts), public (acceptance) and economical resistance (established market players losing market shares) and technological competition (revival of coal, shale gas), the renewable energy industries could demonstrate that they are here to stay and maybe even pick up a more impressive growth momentum again as was observed during the last years. □

W.E.B WINDENERGIE AG/A.ZECHMEISTER

EMPLOYMENT

2012 distribution of employment by sector

	Country total	Wind power	Solide biomass	Photovoltaïc	Biofuels	Heat pumps	Biogas	Solar thermal	Small hydro power	Wastes	Geothermal energy
Germany	368 400	117 000	50 200	87 800	22 700	12 500	51 000	12 700	7 200*	5 200	1 400
France	188 010	20 000	48 000	39 000	30 000	30 850	3 200	8 200	3 860	3 700	1 200
Italy	102 500	40 000	12 200	16 000	5 270	10 500	5 000	4 350	2 730	950	5 500
Spain	77 910	30 000	14 500	12 000	9 435	4 500	520	4 500	1 500	855	<100
Denmark	58 570	40 500	3 250	7 000	770	2 700	200	1 500	<50	2 500	<100
United Kingdom	53 520	20 500	7 050	12 500	4 420	1 600	3 500	900	1 000	2 000	<50
Sweden	50 610	5 100	28 350	600	4 140	8 500	250	150	520	2 900	<100
Belgium	39 850	4 000	3 300	20 500	9 920	600	300	600	400	180	<50
Austria	39 610	3 900	18 600	4 850	4 580	1 130	1 900	3 400	1 050	150	<50
Poland	33 835	2 815	20 500	420	5 480	560	320	2 540	950*	50	200
Greece	33 005	1 500	3 000	23 500	490	0	115	3 000	1 250	n.a	150
Finland	31 345	500	23 500	<50	1 540	5 000	80	<50	375	250	0
Netherlands	26 050	3 500	3 300	7 500	700	5 000	600	350	200	4 500	400
Portugal	19 125	2 700	7 025	3 500	1 830	700	120	1 100	1 750	300	<100
Bulgaria	17 565	830	2 925	10 000	790	2 400	<50	100	420	n.a	<50
Romania	17 285	5 000	10 410	<50	925	0	<50	200	450	n.a	200
Czech Republic	14 535	500	6 460	1 500	2 925	700	1 000	1 000	300	100	<50
Hungary	11 110	150	4 300	750	4 230	<50	130	200	400	50	850
Slovakia	7 920	<50	2 150	2 000	2 590	<50	60	500	300	<50	170
Latvia	6 430	100	5 200	<50	570	0	60	<50	350	<50	0
Slovenia	5 705	<50	1 760	2 400	200	480	130	150	385	<50	<100
Estonia	5 190	700	3 040	<50	<50	1 200	<50	<50	<50	n.a	0
Lithuania	4 715	400	2 975	100	840	<50	<50	<50	150	n.a	<100
Ireland	3 535	2 500	100	<50	310	100	110	200	115	<50	0
Cyprus	1 050	150	<50	250	<50	0	<50	500	0	n.a	0
Luxembourg	750	100	150	100	200	0	<50	<50	<50	<50	0
Malta	100	0	0	<50	0	0	0	<50	0	n.a	0
Total EU	1 218 230	303 445	282 095	252 570	114 955	89 170	68 895	46 440	25 805	23 935	10 920

** Small and large hydro. n.a.: non available.* ***Source: EurObserv'ER 2013***

TURNOVER

2012 turnover by sector in millions of euros (€M)

	Country total	Wind power	Photovoltaïc	Solide biomass	Biofuels	Heat pumps	Biogas	Solar thermal	Small hydro power	Geothermal energy
Germany	34 260	5 180	12 420	7 525	3 680	1 530	2 075	1 240	450	160
Italy	14 355	1 950	4 600	1 180	1 300	1 825	1 900	400	600	600
France	11 320	1 910	2 430	1 560	2 470	1 870	290	430	300	60
United Kingdom	9 860	6 000	1 500	525	850	160	600	50	170	<5
Denmark	9 803	7 380	1 400	435	220	208	40	110	<5	<5
Spain	8 790	3 850	800	1 405	1 830	100	105	500	200	0
Sweden	5 550	1 230	60	2 745	560	600	50	10	280	15
Austria	5 337	740	390	2 550	500	212	75	345	510	15
Poland	4 310	1 260	14	1 990	580	65	50	241	80	30
Netherlands	4 220	1 000	1 500	320	660	500	100	60	0	80
Belgium	3 264	1 000	1 400	320	310	64	70	50	10	40
Finland	3 121	120	<1	2 280	250	400	20	<5	45	0
Greece	2 700	200	1 800	290	120	0	30	200	55	<5
Romania	2 645	1 300	5	1 010	180	5	<5	20	95	25
Bulgaria	2 295	200	1 500	285	10	175	0	<10	110	<5
Portugal	1 822	500	150	680	270	17	25	75	95	10
Czech Republic	1 645	70	300	625	270	80	140	85	70	<5
Hungary	672	40	5	415	75	7	30	35	<5	60
Slovakia	662	0	150	210	100	7	20	10	140	25
Latvia	581	25	<1	505	20	10	10	<5	<5	0
Slovenia	566	<5	250	163	50	45	18	10	15	10
Estonia	530	120	<1	295	5	94	<5	<5	<5	0
Ireland	456	250	<1	60	80	15	25	20	<5	0
Lithuania	444	55	10	290	60	9	<5	<5	<5	5
Luxembourg	105	10	15	15	45	0	10	<5	<5	0
Cyprus	66	15	15	<1	15	0	0	20	0	0
Malta	45	0	40	0	0	0	0	<5	0	0
Total EU	129 424	34 410	30 758	27 679	14 510	7 998	5 698	3 951	3 260	1 160

Source: EurObserv'ER 2013

EUROBSERV'ER – THE STATE OF RENEWABLE ENERGIES IN EUROPE – 2013 EDITION

INVESTMENT INDICATORS

For the first 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).

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 2011 and 2012 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

From 2011 to 2012, a sharp decrease in asset finance in utility-scale wind capacity can be observed. While asset finance totalled € 16.5 billion in 2011, the investments in 2012 only amounted to € 11.8 billion, a decrease of 28%. In line with this observation, the number of projects also decreased in the EU by 17% from 319 to 264 projects. Since the latter is smaller than the decline in the investment sum, the average project/investment size was smaller in 2012 compared to 2011. The average investment into a wind power plant decreased from € 52 million per project in 2011 to an average asset finance sum of € 45 million in 2012.

OFFSHORE CAPACITY 3 TIMES MORE EXPENSIVE THAN ONSHORE

The asset finance deals that were closed in 2011 and 2012 translate into an estimated total capacity added in the EU of 10.11 GW and 7.27 GW, respectively. Hence, the investment cost per MW of capacity asset stayed almost constant with € 1.629 million per MW in 2011 and € 1.626 million per MW in 2012. When comparing onshore and offshore, the data shows that investments in offshore are more expensive. In 2011, for one MW of onshore wind capacity € 1.21 million were invested compared to € 2.46 million for one MW of offshore wind capacity. In 2012, this difference even increased: for one MW offshore wind € 4 million were invested compared to € 1.26 million for one MW onshore wind.

Taking a more disaggregated look at the data, the very heteroge-

1

Overview of asset finance in the wind power sector (onshore + offshore) in the EU member states in 2011 and 2012

	2011			2012		
	Asset Finance - New Built (in mln. €)	Number of Projects	Capacity (in MW)	Asset Finance - New Built (in mln. €)	Number of Projects	Capacity (in MW)
United Kingdom	1 809.76	41	853.3	2 847.60	66	1 431.36
Germany	6 036.33	76	2 567.6	2 247.52	39	1017.1
Romania	589.34	13	501.0	994.12	10	722.4
Belgium	25.24	2	25.1	909.51	7	288.8
Poland	729.84	28	598.0	893.24	23	663.9
Sweden	1 405.27	38	961.7	866.38	19	722.9
Italy	589.01	17	513.7	768.17	22	647.3
France	690.70	35	588.3	446.45	21	389,0
Ireland	255.70	11	228.4	404.45	10	328.9
Spain	965.73	19	838.1	375.20	8	277.4
Denmark	1 496.19	5	1 145.0	292.18	17	147.1
Austria	401.01	2	343.6	276.18	6	244.5
Bulgaria	56.72	5	56.4	135.66	1	124.5
Finland	29.77	3	29.6	121.61	5	111.6
Netherlands	615.60	4	149.7	106.24	3	97.5
Portugal	473.92	8	448,0	104.02	1	27,0
Czech Republic	1.81	1	1.8	19.18	4	17.6
Luxembourg	0	0	0	15.04	2	13.8
Cyprus	31.68	1	31.50	0	0	0
Estonia	113.91	3	91,0	0	0	0
Greece	93.58	5	93.05	0	0	0
Lithuania	70.55	2	52.90	0	0	0
Total EU	16 481.67	319	10 117.7	11 822.77	264	7 272.6

Source: EurObserv'ER 2013

2

Share of different types of asset finance in the photovoltaic in the EU in 2011 and 2012 member states in 2011 and 2012

	2011		2012	
	Asset Finance - New Built (in mln. €)	Number of Projects	Asset Finance - New Built (in mln. €)	Number of Projects
Balance Sheet	48.47%	83.07%	65.38%	84.35%
Project Finance	51.53%	16.93%	34.41%	15.27%
Bond/Other	0.00%	0.00%	0.20%	0.38%
Total EU	100.00%	100.00%	100.00%	100.00%

Source: EurObserv'ER 2013

neous situation across the EU member states is revealed. Major observations are that the highest differences between investment sums in 2011 and 2012 are mainly driven through decreases or increases in offshore investments. This becomes obvious when comparing the average project size that was in 2012 (2011) € 32 million (€ 27 million) for onshore wind and € 480 million (€ 693 million) for offshore projects.

Comparing the types of asset finance for wind in the EU in 2011, the situation is quite balanced between project finance and balance sheet financing; both have a share of almost 50% of total investments. The situation in 2012 changes in favour of balance sheet financing that covers 65% of total investments whereas 34% are covered by project finance. Looking at the number of projects, it becomes obvious that project finance is generally used for larger projects. In both years, project finance only covers around 15% of all the projects and hence these projects are on average larger that the balanced sheet financed investments. Finally, the very minor role of bonds and other asset finance types is very obvious in the wind sector. No projects in 2011 used this type of asset finance and in 2011 it only accounted for 0.2% of overall asset finance in that year.

THE UK TAKES THE LEAD

Looking at the breakdown by major countries, Germany has lost its pole position in asset financing into wind to the United Kingdom. This is mainly due to the massive reduction in closed asset finance deals in Germany that declined to almost a third of the 2011 value. This large change in Germany is mainly driven through four very large offshore wind farm deals in 2011 (all between around € 900 million and more than € 2 billion). While the onshore sector remained almost constant, the decrease in asset finance in wind was mainly driven by the offshore sector. In contrast, the United Kingdom experienced a significant increase in asset finance by slightly more than € 1 billion. Interestingly, this increase in investments is mainly driven by onshore wind farms. Asset financing for onshore wind grew by around € 715 million, whereas asset finance for offshore was only responsible for € 320 million of the increase.

FALL OF INVESTMENT IN DENMARK AND SWEDEN

Denmark and Sweden saw asset finance investments of € 1.5 billion and € 1.4 billion in 2011, respectively, but experienced major declines in asset finance in 2012. In Denmark this decline is mainly driven by offshore: in 2012 no investments in offshore were recorded in Denmark, whereas asset finance in 2011 almost solely consisted of offshore investments. The opposite development can be observed in Belgium. Asset finance in onshore wind more than tripled to € 85 million. However, the high amount of asset financing in 2012 is mainly due to a very large deal in offshore wind that amounted to

3

Overview of asset finance in the wind power sector (offshore) in the EU member states in 2011 and 2012

	2011			2012		
	Asset Finance - New Built (in mln. €)	Number of Projects	Capacity (in MW)	Asset Finance - New Built (in mln. €)	Number of Projects	Capacity (in MW)
Germany	5264.44	5	1948	2388.54	4	612,0
United Kingdom	1024.64	2	281.1	1348.19	3	306.8
Belgium	0	0	0	825.03	1	216,0
Portugal	18.68	1	2	104.02	1	27,0
Denmark	1321.62	1	400,0	0	0	0
Netherlands	443.25	1	n.a.	0	0	0
Sweden	117.10	1	48,0	0	0	0
Total EU	8189.73	11	2679.1	4665.79	9	1161.8

n.a.: non available. ***Source: EurObserv'ER 2013***

€ 825 million. A similar explanation is also true for the high difference between asset financing sums in the Netherlands. The high amount of asset finance of more than € 616 million in 2011 compared to € 106 million in 2012 is mainly due to an asset finance deal in offshore that amounted to € 425 million in 2011.

Other success stories of 2012 are Romania and Poland that both saw increases in asset financing to € 994 million and € 893 million, respectively. Compared to previous investment, the increase is particularly significant in Romania, where asset finance totalled € 589 million in 2011. In both countries the increased total investment in wind is accompanied by a larger project size.

Two major European countries with solid asset finance amounts in 2011, France and Spain, faced drastic decreases in asset finance. Comparing the 2012 numbers to the previous year, asset financing decreased by around € 250 million in France. In Spain the decrease is even more dramatic when comparing the 2012 investments of € 375 million to the 2011 investment sum of almost € 1 billion. In contrast to these countries, there has been an increase in investment in wind in Italy. In 2012, asset financing in wind totalled € 768 million compared to € 589 million in 2011.

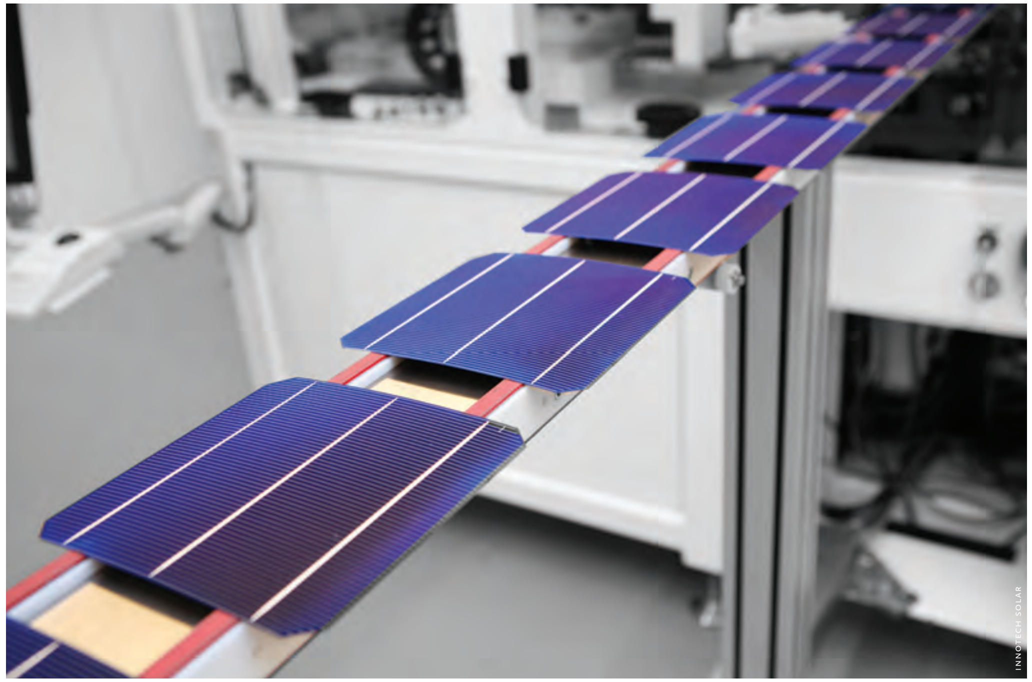
Countries with smaller investments, but positive trends, include Ireland, Bulgaria, and Finland. In all three countries the investment sum in wind capacity significantly increased to € 404 million, € 136 million, and € 122 million. Finally, in Cyprus, Estonia, Greece, and Lithuania, there have been no recorded asset finance deals in 2012, while there was asset financing in 2011. □

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. Asset financing for utility-scale photovoltaic capacity significantly decreased from 2011 to 2012. EU-wide investment in new utility-scale PV capacity totalled € 9.8 billion in 2011; the investments in 2012 only amounted to € 6.4 billion. This corresponds to a decrease of 35%. The amount of projects also decreased by 25% from 392 projects in 2011 to 294 projects in 2012. The average investment into solar PV power plant dropped slightly from € 25 million per project in 2011 to an average investment sum of € 22 million in 2012. Furthermore, the sharp decrease in prices for PV from 2011 to 2012 can be seen clearly in the data. Despite the sharp decrease in investments, the associated capacity added almost stayed constant with 3.17 GW for the 2011 investments and 3.14 GW for 2012. Relating investments to capacity, the fall in PV prices becomes particularly obvious. While the average investment per one MW was € 3.09 million in 2011, the 2012 average investment for one MW was only € 2.05 million. This corresponds to a drop of around one third within only one year.

DIVERSITY OF SITUATIONS IN EUROPE

With respect to asset financing for utility-scale investment, the EU shows a very heterogeneous picture. Although total new investments drastically decreased in the EU in total, there are numerous countries that show modest or significant increases in new investments. Next to other countries



that experienced declines in new investments, by far the most dominant country is Italy where in 2011 almost 50% of asset financing for PV power plants happened, but where the investment decreased by around 90%. In most of the countries where investments in utility scale PV decreased, this development could be explained by partly drastic cuts in PV support schemes, particularly for utility-scale installations.

When it comes to the types of asset finance, balance sheet financing is the most important type. In 2011 67% and in 2012 even 73% of total investments in PV were financed from balance sheets. Consequently, the role of project finance declined from 32% to 26%. Looking at the number of projects instead of the investment sums, project finance covers 22% of projects in 2011 and 15% in 2012. Hence, the on average larger investments are financed using project finance. Bonds and other asset finance types played a very minor role that even slightly decreased from 1.4% in 2011 to only 0.9% in 2012.

The top 3 countries with respect to total asset finance for utility-scale PV projects in 2012 are Germany, France, and the United Kingdom with asset financing of € 2.12 billion, € 1.15 billion, and € 1.01 billion, respectively. These countries share one common attribute: in all three countries asset finance increased compared to the previous year. While the increases were quite modest in the UK (8.4%) and France (11%), asset finance in Germany increased by almost 22%. Interestingly, there are also systematic differences among these countries. First of all, the average project size is significantly smaller in the UK compared to France and Germany. Comparing the respective data from 2011 and 2012, it can be observed that, while the project size in terms of investment stayed almost constant in Germany, the average investment in France increased from € 32.3 million to € 52.5 million and decreased from €19.8 million to € 12.8 million in the UK.

A FALL IN INVESTMENTS IN ITALY

A drastic cutback in new investment can be observed in Italy.

1

Overview of asset finance in the PV sector in the EU member states in 2011 and 2012

	2011			2012		
	Asset Finance - New Built (in mln. €)	Number of Projects	Capacity (in MW)	Asset Finance - New Built (in mln. €)	Number of Projects	Capacity (in MW)
Germany	1 746.91	48	637	2 124.75	67	977.5
France	1 065.17	33	325.0	1 154.34	22	436.6
United Kingdom	913.86	46	282.6	1 014.89	80	438.6
Bulgaria	522.19	38	174.6	959.67	46	391.5
Italy	4 593.72	179	1 469.7	441.56	32	177.8
Romania	0	0	0	382.40	21	165.2
Greece	65.19	5	22.8	193.52	17	82.9
Spain	366.98	19	99.9	84.65	8	438.1
Portugal	89.45	2	29.4	41.10	1	17.6
Belgium	52.51	5	17.0	10.86	2	4.6
Czech Republic	142.96	2	40.0	5.30	1	2.3
Netherlands	0	0	0	3.50	1	1.5
Slovakia	199.76	13	65.07	2.33	1	1,0
Slovenia	6.80	2	2.2	0	0	0
Total EU	9 765.50	392	3 165.4	6 418.88	299	3 135.1

Source: EurObserv'ER 2013

In 2011, Italy has seen by far the largest investment in new utility-scale PV capacity of € 4.6 billion. Almost 50% of EU-wide asset financing in PV happened Italy. In 2012 asset financing dropped to around 10% of the previous year's level. The number of projects dropped to "only" 18% of the 2011 level indicating that also the average project size decreased. A reason for this drop was the recent cuts in incentives that were introduced in 2012 with "Conto Energia V".

The success stories of 2012 are Bulgaria and Romania. In Bulgaria asset financing increased from € 522 million in 2011 to € 960 million in 2012 making Bulgaria the country with the fourth highest investments in the EU almost reaching the investment levels in the two major economies of France and the UK. Romania has not experienced any investments in PV power plants in 2011. Only one year later, investments amounted to € 384 million. Also in Greece a significant increase in PV capacity could be observed in 2012. Investments more than tripled to € 194 million in 2012.

2

Share of different types of asset finance in the photovoltaic sector in the EU in 2011 and 2012 member states in 2011 and 2012

	2011		2012	
	Asset Finance - New Built (in mln. €)	Number of Projects	Asset Finance - New Built (in mln. €)	Number of Projects
Balance Sheet	66.74%	76.98%	73.31%	84.28%
Project Finance	31.84%	21.74%	25.82%	14.38%
Bond/Other	1.42%	1.28%	0.87%	1.34%
Total EU	100.00%	100.00%	100.00%	100.00%

Source: EurObserv'ER 2013

Major decreases in new investment in solar PV plants could be observed in Spain, the Czech Republic and Slovakia. In Spain investments fell from € 377 million in 2011 to € 85 million in 2012. Even more dramatic are the drops in investments in the other two countries. Asset financing in the Czech Republic and Slovakia fell from € 143 million to € 5 million and € 200 million to € 2 million, respectively. In all three countries these massive reductions are based on drastic reductions in solar PV incentives for plant size installations that were even retroactive on the case of Spain. □

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, (i) 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. Taking a look at recent new investments in geothermal power plants, it is striking that in only 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.

A DECREASE IN INVESTMENTS BUT NOT IN CAPACITY

Comparing total new investments in geothermal energy, a decrease in both total asset financing and the number of projects can be observed. Investments decreased by almost 34% from € 186.6 million in 2011 to € 123.6 million in 2012. Relating the total investments to the number of projects in the respective year, a modest cutback in the average project size from € 46.6 million to € 41.2 million becomes apparent. Interestingly, the opposite can be observed concerning the added capacity. The total new investments in 2011 are estimated to lead to an added capacity of 34 MW, whereas the significantly smaller investments in 2012 are associated with a slightly higher total capacity of 36 MW. Relating investments and capacity, it is obvious that the costs per MW is higher in 2011 (€ 5.6 million per MW) than in 2012 (€ 3.4 million per MW). But due to the very limited project number, this should not be interpreted as a decline in technology costs, since differences in costs could be (largely) project-specific.

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. The situation was different in the previous year, when project finance and balance sheet finance both covered around 50% each of the new investments. Bonds and other types of asset finance were not used at all to finance geothermal investments.

ONLY 3 COUNTRIES INVOLVED

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.

In contrast to 2012, by far the highest level of investments in 2011 happened in Germany. Overall, three geothermal project secured financing in that year. Total asset financing for all three geothermal plants in Germany amounted to € 159 million which translates into an average project size of € 53 million. A relatively smaller investment happened in Italy. € 27.5 million were invested into a geothermal plant in 2011.

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 be even smaller. □

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 2011 and 2012

	2011			2012		
	Asset Finance - New Built (in mln. €)	Number of Projects	Capacity (in MW)	Asset Finance - New Built (in mln. €)	Number of Projects	Capacity (in MW)
Hungary	0	0	0	80.68	1	11.8
Italy	27.48	1	17	35.02	1	20.0
Germany	159.12	3	16.5	7.88	1	4.5
Total EU	186.60	4	33.5	123.59	3	36.3

Source: EurObserv'ER 2013

2

Share of different types of asset finance in the geothermal sector in the EU in 2011 and 2012 member states in 2011 and 2012

	2011		2012	
	Asset Finance - New Built (in mln. €)	Number of Projects	Asset Finance - New Built (in mln. €)	Number of Projects
Balance Sheet	48.22%	50.00%	100.00%	100.00%
Project Finance	51.78%	50.00%	0.00%	0.00%
Bond/Other	0.00%	0.00%	0.00%	0.00%
Total EU	100.00%	100.00%	100.00%	100.00%

Source: EurObserv'ER 2013

BIOGAS

In the BNEF database, 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 practice, there are only projects in the categories (i) electricity generation (new), and (iv) CHP for the years 2011 and 2012. 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 2011 and 2012 data, e.g., there is only one project of that kind was recorded in the whole EU.

-50% IN FORESEEN ADDITIONALE CAPACITY IN 2012

Asset financing for utility-scale biogas capacity slightly decreased from 2011 to 2012. EU-wide investment in new biogas capacity totalled € 58 million in 2011, whereas investments in 2012 amounted to around € 42 million. This corresponds to a decrease in new investments of 28%. The amount of projects also almost halved from 7 projects in 2011 to 4 projects in 2012. The increased drop in the number of projects compared to total asset financing translates into an increase of the average biogas investment that grew slightly from € 8.25 million per project in 2011 to an average investment of € 10.4 million in 2012. The capacity added associated to these investments also decreased significantly. While the 2011 asset finance is estimated to translate into 28 MW, the 2012 investments are supposed to generate new capacity of only 13 MW. Comparing all these numbers to, e.g., asset finance for solid biomass, it is obvious how small these biogas plants are compared to other technologies.

A striking point is revealed when disaggregating the types of asset finance. In 2011, 55.5% of the whole investment in biogas plants came from another source than balance sheets or project finance. In this case, it was a guarantee for the biogas investment in Italy. So the by far largest investment in 2011 uses this rather unusual financing source. Balance sheet financing was used for 40% of investment in 2011 and project finance played only a minor role with 4.5%. Comparing 2011 and 2012, one similarity can be highlighted. In both years the share of balance sheet financing on total investment is smaller than the share of projects that are financed from this source. Hence, it is the smaller biogas investments that are financed from balance sheets. Since there is no project using bonds or other asset finance types, the share of project finance in new investments increases to 48% in 2012.

SPORADIC INVESTMENT THROUGHOUT THE EU

A more detailed look at the data reveals two striking points concer-

1

Overview of asset finance in the biogas sector in the EU member states in 2011 and 2012

	2011			2012		
	Asset Finance - New Built (in mln. €)	Number of Projects	Capacity (in MW)	Asset Finance - New Built (in mln. €)	Number of Projects	Capacity (in MW)
United Kingdom	6.54	1	2,5	19.93	1	5.1
Poland	0	0	0	9.34	1	2.4
Romania	0	0	0	6.30	1	3
France	0	0	0	6.10	1	2
Belgium	6.01	1	3.0	0	0	0
Germany	9.22	2	4,6	0	0	0
Hungary	2.61	1	1	0	0	0
Italy	32.07	1	16	0	0	0
Latvia	1.31	1	0,5	0	0	0
Total EU	57.76	7	27.6	41.66	4	12.5

Source: EurObserv'ER 2013

ning 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. The only exception is the UK. And except Germany in 2011, there is no country that saw more than one investment in biogas plants in the same year.

The largest recorded investment in biogas in 2012 happened in the United Kingdom. This investment of almost € 20 million largely supersedes the average investment in the biogas sector. The average investment size in 2012 was, if the UK investment is not taken into account, only € 7.25 million. This project is also three times higher than the UK project that was financed in 2011.

The country with the second largest investment was Poland where asset financing of € 9.35 million was recorded for a new biogas plant. The final two countries with almost the same investment sums are Romania and France, where € 6.3 million and € 6.1 million were invested respectively. It should be mentioned at this point that this project in France is the only recorded investment which is not a plant that produces electricity and/or heat, but a bio methane plant that produces and exports biogas into the natural gas grid.

Looking at the 2011 data there are five countries, in addition to the UK discussed above, that experienced asset financing in biogas plants in 2011. The highest investment across the EU in both years was recorded in Italy in 2011, where € 32 million were invested in a biogas CHP power plant. Even more than the relatively large investment in the UK in 2012, this investment largely exceeds the average investment size of the remaining six projects in 2011 that is only € 4.3 million. The second highest investment of € 9.22 million was delivered in Germany. The remaining countries with asset financing for biogas plants are Belgium, Hungary, and Latvia, where particularly in the latter the investments of € 2.6 million and € 1.3 million are significantly under the average investment size. □

2

Share of different types of asset finance in the biogas sector in the EU in 2011 and 2012

	2011		2012	
	Asset Finance - New Built (in mln. €)	Number of Projects	Asset Finance - New Built (in mln. €)	Number of Projects
Balance Sheet	39.95%	71.43%	52.18%	75.00%
Project Finance	4.53%	14.29%	47.82%	25.00%
Bond/Other	55.52%	14.29%	0,00%	0.00%
Total EU	100.00%	100.00%	100.00%	100.00%

Source: EurObserv'ER 2013

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 BNEF database, the following two types of biofuel utility-scale investments are tracked: (i) Diesel substitutes and (ii) gasoline/petrol substitutes.

INVESTMENTS TRIPLED IN THE EU

In comparison to many of the other renewable energy technologies, asset financing for biofuel production more than tripled from 2011 to 2012. In 2011, it totalled € 148 million, whereas investments in 2012 amounted to € 491 million. The amount of projects doubled between both years. Comparing the capacities added in both years, an almost tenfold increase from 2011 to 2012 is observable. While capacity added due to 2011 investments was only 92 mLpa, the new investments in 2012 are associated with new capacity in the magnitude of 913.2 mLpa.

Looking at the types of asset finance, one type dominated investments in 2011, where all investments were financed from balance sheets. In 2012, the situation is almost balanced between two types of asset finance. 40% of all investments are financed from balance sheets, whereas 60% of total investments are covered by project finance. With respect to the number of projects, the breakdown is perfectly balanced: both sources financed half of all projects. Hence, project finance was used for projects with a relatively larger investment sum in 2012. In both years, bonds or other asset finance types were not used at all for investments in biofuels.

1

Overview of asset finance in the biofuels sector in the EU member states in 2011 and 2012

	2011			2012		
	Asset Finance - New Built (in mln. €)	Number of Projects	Capacity (in mLpa)	Asset Finance - New Built (in mln. €)	Number of Projects	Capacity (in mLpa)
United Kingdom	4.02	1	16.0	258.54	1	200.0
Netherlands	0	0	0	182.91	1	500.0
France	0	0	0	49.77	2	213.2
Italy	143.68	1	76.0	0	0	0
Total EU	147.70	2	92.0	491.22	4	913.2

Source: EurObserv'ER 2013

2

Share of different types of asset finance in the biofuels sector in the EU in 2011 and 2012

	2011		2012	
	Asset Finance - New Built (in mln. €)	Number of Projects	Asset Finance - New Built (in mln. €)	Number of Projects
Balance Sheet	100.00%	100.00%	40.44%	50.00%
Project Finance	0.00%	0.00%	59.56%	50.00%
Bond/Other	0.00%	0.00%	0.00%	0.00%
Total EU	100.00%	100.00%	100.00%	100.00%

Source: EurObserv'ER 2013

90% OF INVESTMENTS GO TO BIOETHANOL

Distinguishing between the type of biofuel – biodiesel and bioethanol/-methanol – a significant difference between the investment sizes becomes obvious, although for both categories three projects were recorded, respectively. For biodiesel plants, € 4 million of asset finance were recorded in 2011 (the UK project) and almost € 50 million in 2012 (both projects in France). Hence, the remaining investments can be attributed to bioethanol/-methanol plants - € 144 million in 2011 and € 441.5 million in 2012.

The asset finance data reveals two interesting points concerning the situation of new investments in biofuels plants. As in the case of biogas, new investments are highly irregular across the EU – only in the UK asset finance for biofuel plants could be observed in both years. Furthermore, there is only country that saw more than one investment in biofuel plants within one year, namely France in 2012.

The largest recorded investment in biofuels in 2012 could be observed in the United Kingdom. This investment of almost € 259 million largely surpasses the average biofuel investment in the EU in both years. The average investment size in 2012 was, if this UK investment is not taken into account, € 78 million. The magnitude of this investment is even more remarkable when comparing to the UK investment in 2011 that only amounted to € 4 million. Furthermore, the UK is one of only two countries with tracked investments in 2011 and 2012.

A very similar situation is found in the Netherlands. The 2012 investment of € 183 million is significantly higher than the average investments in biofuels. Hence, the two investments in the Netherlands and the UK are the key drivers of the total asset financing for biofuel plants in the EU in 2012. Particularly the project in the Netherlands is characterised by a very high estimated capacity added of around 500 mLpa. Particularly when comparing this investment to the capacity added in the UK, which is smaller with 200 mLpa, although the investment costs are estimated to be higher.

The third country with new investments in biofuels is France. It is the only country that experienced two projects in one year. Furthermore, compared to the UK and the Netherlands, the project size is significantly smaller. Given the total asset financing of € 50 million in 2012, the average project size is only € 25 million.

Finally, one 2011 investment in biofuels was recorded in Italy which amounted to € 144 million and an associated capacity added of 76 mLpa. Hence, this investment dominated asset finance for biofuels in 2011. □

RENEWABLE URBAN WASTE

The data on asset financing for waste-to-energy includes three 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 proportion of renewable waste they burn.

-33% IN VOLUMES IN 2012

Asset financing for utility-scale waste-to-energy capacity strongly decreased from 2011 to 2012. EU-wide investment in new waste-to-energy capacity totalled € 705 million in 2012 compared to total new investments of € 1.05 billion in 2011. This corresponds to a decrease in asset financing of almost 33%. The number of projects exactly halved from

12 projects in 2011 to 6 projects in 2012. Since the number of investments decreased more than the total investments the average investment into waste-to-energy power plants increased by more than a third. An average investment amounted to € 95 million in 2011 and to almost € 118 million in 2012. In line with this decrease of financing, the associated capacity added also dropped.

Disaggregating the investments in asset finance types reveals further information. In 2011, balance sheet financing and project finance almost perfectly shared the market. Around 50% of total investments and exactly 50% of the number of projects were covered by each asset finance type. Neither investments in 2011, nor in 2012, used bonds or other types of asset finance. In 2012, the situation significantly changes. With respect to total investments, the role of project finance drastically increases to 72% of total asset finance. With respect to the number projects, only 33% of all projects used project finance compared to 66% financed from balance sheets. Hence, as in the other sectors, the larger investments were financed through project, whereas smaller investments were balance sheet financed.

EUROBSERV'ER – THE STATE OF RENEWABLE ENERGIES IN EUROPE – 2013 EDITION

1

Overview of asset finance in the waste sector in the EU member states in 2011 and 2012

	2011			2012		
	Asset Finance - New Built (in mln. €)	Number of Projects	Capacity (in MW)	Asset Finance - New Built (in mln. €)	Number of Projects	Capacity (in MW)
United Kingdom	336.52	5	87.6	704.89	6	133.41
Denmark	171.05	1	n.a.	0	0	0
Estonia	94.18	1	17	0	0	0
Germany	224.07	2	44.4	0	0	0
Spain	40.09	1	20	0	0	0
Sweden	178.88	2	20	0	0	0
Total EU	**1044.78**	**12**	**189**	**704.89**	**6**	**133.41**

n.a.: non available. ***Source: EurObserv'ER 2013***

The 2011 investments are estimated to lead to an added capacity of 189 MW, whereas asset financing in 2012 is associated with increased capacity of 133 MW. It is essential to mention here that the capacity added by the project in Denmark and one project in Sweden is unknown. Hence, the capacity added in 2011 is certainly underestimated. 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 € 5.53 million in 2011 compared to € 5.28 million in 2012. But one should be careful with interpreting these values. Since there are relatively few waste-to-energy projects and that the UK dominates the market in 2011 and 2012, it is very difficult to say whether the change in investment cost is technology, country, or project specific.

NO INVESTMENT OUTSIDE UK IN 2012

The most striking observation concerning waste-to-energy is that, while there are numerous countries with investments in 2011, the UK is the only EU-country where waste-to-energy asset financing was recorded in 2012. Taking a closer look at the UK, the significance of waste-to-energy plants becomes obvious. Already in 2011, when asset financing for new plants was also tracked in five other countries, the UK had seen the highest investments in the EU amounting to almost € 337 million. Despite of these relatively high investments in 2011, the investments in 2012 more than doubled in the UK. Furthermore, the average project size significantly increased from € 67 million in 2011 – which is lower than the EU average that year – to € 151 million in 2012. This has to be put in relation with the closing of more than 300 waste deposits starting by 2015, which makes it necessary to put other processes in place.

The three countries with the highest asset finance for waste-to-energy in 2011 after the UK are Germany, Sweden, and Denmark, where investments totalled € 224 million, € 179 million, and € 171 million, respectively. Whereas in both Germany and Sweden two projects were recorded, in Denmark only one investment could be observed. But with € 171 million, the Danish project is of particular magnitude. It exceeds the EU average investment size and even the UK's in both 2011 and 2012.

Finally, new investments in waste-to-energy plants could be also observed in Estonia and Spain in 2011. □

2

Share of different types of asset finance in waste sector in the EU in 2011 and 2012

	2011		2012	
	Asset Finance - New Built (in mln. €)	Number of Projects	Asset Finance - New Built (in mln. €)	Number of Projects
Balance Sheet	53.46%	50.00%	27.82%	66.67%
Project Finance	46.54%	50.00%	72.18%	33.33%
Bond/Other	0.00%	0.00%	0.00%	0.00%
Total EU	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Source: EurObserv'ER 2013

SOLID BIOMASS

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.

NOT A GOOD YEAR FOR BIOMASS INVESTMENTS

Asset financing for utility-scale biomass capacity significantly decreased from 2011 to 2012. EU-wide investment in new solid biomass capacity totalled € 3.05 billion in 2011; the investments in 2012 only amounted to € 1.08 billion. This corresponds to a decrease in new investments of 65%. The number of projects also almost halved from 24 projects in 2011 to 13 projects in 2012. The average investment into a biomass power plant dropped slightly from € 127 million per project in 2011 to an average investment sum of € 83 million in 2012. In line with the decrease in asset finance, also the associated capacity added decreased from 1.9 GW in 2011 to 0.8 GW in 2012. Relating the capacity and asset finance, a drop in the investment per MW installed is revealed. On average, the investment for one MW of biomass was € 1.6 million in 2011 and only € 1.3 million in 2012.

1

Overview of asset finance in the solid biomass sector in the EU member states in 2011 and 2012

	2011			2012		
	Asset Finance - New Built (in mln. €)	Number of Projects	Capacity (in MW)	Asset Finance - New Built (in mln. €)	Number of Projects	Capacity (in MW)
Sweden	0	0	0	628,12	2	282.0
Spain	154.02	2	71.4	141.23	2	35.0
Hungary	0	0	0	99.16	1	35.0
Denmark	0	0	0	74.64	1	300.0
Finland	235.92	3	112.5	41.14	1	140.0
United Kingdom	1 831.72	9	1 334.0	36.04	2	3.9
Germany	77.95	2	16.8	23.02	2	9.9
Poland	414.17	5	288.2	21.25	1	7.5
Romania	0	0	0	13.25	1	6.1
Estonia	43.97	1	12.8	0	0	0
Lithuania	136.21	1	20.0	0	0	0
Netherlands	151.26	1	50.0	0	0	0
Total EU	3 045.22	24	1 905.7	1 077.85	13	819

Source: EurObserv'ER 2013

When it comes to the type of financing for solid biomass investments, a major difference between 2011 and 2012 is obvious. In 2011, 65% of all investments and 62.5% of all projects were financed from balance sheets. The remaining investments used project finance. In 2012, the situation reversed. Around 80% of total new investment came from project finance compared to only 20% financed from balance sheets. Looking at the shares of projects financed through the two sources, only 62% of all projects were financed by project finance and 38% from balance sheets. As in other sectors, the larger projects used project finance. No projects used bonds or other types of asset finance.

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 high increases and with decreases in investments – but also within countries – there are almost no countries with similar investment amounts in 2011 and 2012. Furthermore, in most of the countries, where new investments in solid biomass were recorded, there were one or two projects only. The only exceptions are the UK, Poland, and Finland where nine, five, and three projects were conducted respectively in 2011.

LARGER PROJECTS IN SWEDEN AND DENMARK

The highest investments in 2012 happened in Sweden, with investments amounting to € 628 million into two new biomass power plants. The average project size of € 314 million in Sweden is unusually high compared to the average project size in all the remaining countries which is only € 41 million. In the country with the second highest asset financing in 2012, Spain, also two projects were financed, while the investment sum of € 141 million is significantly smaller. Spain is also one counterexample to the heterogeneity described above. Compared to 2011, where investments were € 154, total new investment stayed almost constant in 2012.

Two countries without any asset financing for solid biomass in 2011, but rather high investments in 2012, are Hungary and Denmark. In both countries one project was financed. With an investment of € 99.16 million, the investment in Hungary is above the average investment size in 2012 of € 83 million. If the two large investments in Sweden are not considered, then also the Danish project (€ 74.64 million) supersedes that average value of the remaining projects of € 41 million.

In the United Kingdom, asset finance for biomass has declined significantly. The UK was the key player in asset finance in this sector in 2011 with investments of € 1.83 billion. In the whole year, 60% of all investments in biomass power plants in the EU occurred in the UK. Similar to Sweden in 2012, the UK investments in 2011 were larger on average than in the rest of the EU. While the average project size in the remaining countries amounted to € 81 million, a new investment in the UK was on average € 204 million. Compared to these large new investments in 2011, 2012 asset financing of two projects amounting to € 36 million was only minor. This can be probably linked to the setback in the conversion of coal plants to biomass or co-fired plants due to low coal prices and uncertainty of support schemes (cf Solid biomass barometer from December 2013).

2

Share of different types of asset finance in the solid biomass sector in the EU in 2011 and 2012

	2011		2012	
	Asset Finance - New Built (in mln. €)	Number of Projects	Asset Finance - New Built (in mln. €)	Number of Projects
Balance Sheet	65.14%	62.50%	20.15%	38.46%
Project Finance	34.86%	37.50%	79.85%	61.54%
Bond/Other	0.00%	0.00%	0.00%	0.00%
Total EU	100.00%	100.00%	100.00%	100.00%

Source: EurObserv'ER 2013

In Finland and Poland, a similar development could be observed, though in a smaller magnitude. In 2011, asset financing was € 414 million in Poland and € 236 million in Finland. Hence, these countries experienced the second and third highest investments in new build biomass plants all over the EU. In 2012, asset financing significantly decreased in both countries to € 21 million in Poland and € 41 million in Finland. A decline of smaller magnitude could be observed in Germany, where investments decreased from € 78 million to € 23 million, whereas the number of projects stayed constant.

Finally, in three countries that experienced one new investment in biomass each in 2011, Estonia, Lithuania, and the Netherlands, no asset financing could be observed in 2012. Amounting to € 151 million and € 136 million, the projects in the Netherlands and Lithuania, respectively, have been quite large. □

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 economic 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.

SPAIN PUTS THE BREAK ON CSP INVESTMENTS

This fact can be also seen in the asset financing data. Both in 2011 and 2012, asset financing for CSP power plants was only recorded in Spain. Comparing both years with each other, two main points can be seen. First of all, investments in new CSP capacity dramatically decreased from € 4.27 billion in 2011 to only € 916 million in 2012 which corresponds to a drop by 79%. Secondly, also the number of projects decreased, but with a smaller magnitude than total asset finance. Hence, also the average project size decreased from € 356 million in 2011 to € 229 million in the following year. Consequently, the capacity added associated with these investments dropped. While asset financing in 2011 is estimated to lead to an installed capacity of 730 MW, the 2012 investments only translate into 174 MW of capacity.

Comparing the types of asset finance for CSP in 2011 and in 2012, the situation is situation is almost perfectly reversed. In 2011, project finance dominates by covering almost 85% of all investments. In 2012, however, 82% of total asset finance came from balance sheet finance. In both years bonds and other types of finance did not play any role in the CSP sector.

1

Overview of asset finance in the CSP sector in the EU member states in 2011 and 2012

	2011			2012		
	Asset Finance - New Built (in mln. €)	Number of Projects	Capacity (in MW)	Asset Finance - New Built (in mln. €)	Number of Projects	Capacity (in MW)
Spain	4 272.56	12	729.8	915.78	4	173.5
Total EU	4 272.56	12	729.8	915.78	4	173.5

Source: EurObserv'ER 2013

2

Share of different types of asset finance in the CSP sector in the EU in 2011 and 2012

	2011		2012	
	Asset Finance - New Built (in mln. €)	Number of Projects	Asset Finance - New Built (in mln. €)	Number of Projects
Balance Sheet	15.13%	25.00%	81.59%	75.00%
Project Finance	84.87%	75.00%	18.41%	25.00%
Bond/Other	0.00%	0.00%	0.00%	0.00%
Total EU	100.00%	100.00%	100.00%	100.00%

Source: EurObserv'ER 2013

Comparing the types of asset finance used for CSP projects, there is a fundamental change visible between both years. Focussing on the number of projects, then 75% of all projects in 2011 were financed from balance-sheets compared to 25%, where project finance was used. In 2012, the situation is exactly reversed. Comparing these shares to the amount of total investment financed by the respective asset finance types in 2011 – 15% of all investments came from balance sheets compared to 85% from project finance – the CSP sector shows the typical picture. Project finance is rather used for larger projects whereas smaller projects are financed from balance-sheets. But in 2012, also this situation flips around: almost 82% of all investments are financed by money from balance-sheets compared to 18% project finance. In both years, bonds and other types of asset finance don't play any role for CSP investments.

Independent of the year, 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. Except of one investment in 2011 that used the Fresnel technology, in all new investments parabolic troughs were used. Relating asset finance to capacity installed, a slight drop in the investment costs of CSP is observable. While the costs per MW were almost € 5.9 million in 2011, they amounted to € 5.3 million in 2012. But since there are only a few CSP projects in the data, such a change in costs per MW should be interpreted with care. It does not necessarily mean that the technology became cheaper, but could rather be project specific. □

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 as the Nordic Investment Bank, KfW, Caisse des Dépôts, Cassa Depositie Prestiti, Instituto de Crédito Oficial, etc.

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 € 3.2 billion and € 1.8 billion in 2011 and 2012, respectively. In the case of the EBRD, a multilateral bank focussing on Eastern Europe, it was € 171 million and € 256 million for 2011 and 2012.

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 € in each of 2011 and 2012. 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 € 7.1 billion in 2012 compared to € 6.8 billion in 2011[1].

As a general trend the activities by public finance institutions are increasing – likely not least because of the economic crisis. At the same time the criteria for involvement of public finance institutions move towards a stronger focus on using the scarce public funds in order to maximize private investment mobilized. □

1. *ZSW (2013), Evaluierung der inländischen KfW-Programme zur Förderung Erneuerbarer Energien im Jahr 2012, available online: https://www.kfw.de/PDF/Download-Center/Konzernthemen/Research/PDF-Dokumente-alle-Evaluationen/Evaluierung_EE_2012.pdf*

The analysis of asset finance for renewable energy generation projects in the EU has shown a significant decrease of total new investments from € 36 billion in 2011 to almost € 22 billion in 2012. However, data on the associated capacity added revealed that some of the investment decrease might have been driven by falling technology prices. E.g., in the solar PV sector, where asset finance in the EU decreased from € 9.8 billion in 2011 to € 6.4 billion in 2012, the associated capacity added stayed almost constant (3,165 MW in 2011 and 3,135 MW in 2012). Furthermore, the analysis showed that the majority of renewable energy generation projects are financed from balance-sheets, typically by large utilities. While project finance is used for a smaller number of projects, these projects tend to be larger. It remains to be seen, to what extent potential upcoming regulation in the financial markets, e.g. the implementation of the Basel III requirements, might induce some structural change in the composition of how asset finance is taking place, and whether there will be an increased role of the so-called EU project bonds in the renewables sector. □

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 2011, the firms are weighted by their 2010 revenues whereas in 2012, the 2011 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 by 31% in the EU between 2011 and 2012. This fall in VC/PE investment is not only renewable energy specific. Despite this dramatic drop in the total investment sum, the number of projects stayed almost constant. Data of the European Private Equity and Venture Capital Association (EVCA) show a similar picture for VC/PE investment over all sectors that decreased by almost 22% from 2011 to 2012. Hence, a large share of the decrease is driven by the weak economic situation in the European Union in the last years and the uncertainty of venture capital and private equity funds.

Another trend in 2012 can be identified when taking a closer look at the amount of investments and the investment size. Compared to the significant drop in total VC/PE investments mentioned above, the number of deals only decreased rather modestly, namely by 6%. This indicates that the investments have been on average smaller in 2012: while in 2011 a VC/PE investment was on average € 64 million, it has only been € 47 million in 2012.

TECHNOLOGY TRENDS

Taking a more detailed look at the respective renewable energy technologies, the picture becomes quite heterogeneous. While some sectors have experienced very drastic drops in investment, others experienced partly significant increases. Furthermore, it is essential to analyse the investment sums in more detail. The reason is that VC investments are typically smaller than PE investments, in particular PE buy-outs. The latter are purchases of companies or a controlling interest of a company's shares and happen later in the life-cycle of a firm and hence are typically higher investments. Hence, if total VC/PE buyout data is dominated by one specific deal, this will be addressed in the analysis of the respective sectors.

The renewable energy technology with the highest VC/PE investments 2011, wind, has experienced a decisive drop in investments from 2011 to 2012 by € 500 million. But despite this decrease by 50%, wind kept its VC/PE pole position in 2012. These very large investments in wind compared to the other sectors are due to the fact that the sector experienced in both years some PE buy-outs that amount to € 1.36 billion in 2011 and € 843 million in 2012. Hence, the decrease in total VC/PE investments can be almost solely explained by a reduction of PE buy-out deal size (the amount of deals is six in both years). The amount of venture capital and private equity expansion capital has even increased from € 50 million in 2011 to € 136 million in 2012.

Before analysing the renewable energy technologies in detail, 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.

Biomass & Waste experienced the second largest total VC/PE investments in 2012. Particularly striking is the large increase from € 58 million in 2011 to € 818 million in 2012. The reason for this quite is simple: in 2012 there were four large PE-buyouts amounting to € 809 million. When blending out these large deals PE-buyouts, there has been a significant drop in the remaining VC/PE investments in 2012.

When looking at the remaining sectors that experienced recorded VC/PE investments in 2012 – solar PV, small hydro, biogas, and CSP – and the respective investments sums, it is plausible that there haven't been any PE buy-outs in that year in the magnitude as in the wind and biomass sector.

The sector with the third largest VC/PE investments in 2012 is biogas. While there is a significant drop in total VC/PE investments from € 334 million in 2011 to € 186 million in 2012, the number of projects has significantly increased. The high investment in 2011 is driven by one large deal. In general, this sector seems quite dynamic given the relatively high number of projects that are financed by venture capital or private equity.

Comparing the VC/PE investments in solar PV in both years, the magnitude of the drop in investments is obvious; the sector experienced the highest decline in investments among all renewable energy technologies amounting to almost € 1 billion. This massive change is, as in the case of biomass and wind, due to PE buy-outs. While only one small PE buy-out deal of € 20 million was recorded in 2012, there were four major PE buy-out deals in the solar PV sector in the previous year that are almost solely responsible for

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Venture capital and private equity investments in renewable energy per technology in the EU in 2011 and 2012

	2011		2012	
	Venture Capital / Private Equity (in mln. €)	Number of Projects	Venture Capital / Private Equity (in mln. €)	Number of Projects
Wind power	1514.76	14	978.65	15
Biomass & Waste	58.12	7	817.95	7
Biogas	333.64	2	186.11	9
Solar photovoltaic	1044.09	19	56.73	9
Small hydropower	3.16	1	25.84	3
CSP	16.20	1	4.41	1
Geothermal	13.67	2	0	0
Biofuels	8.48	1	0	0
Total EU	**2992.11**	**47**	**2069.69**	**44**

Source: EurObserv'ER 2013

this huge difference. But also when comparing the data on the other VC/PE investments, a decrease can be observed. While these investments totalled € 97.5 million in 2011, the 2012 investments were only € 38 million.

An increase in VC/PE deals could be observed in the small hydro sector. Not only the number of deals tripled but also the investment sum increased from modest € 3 million in 2011 to € 26 million in 2012. Hence, the average project size almost tripled to € 8.6 million. When comparing the number of projects, there is no change in the CSP sector. In both years one project was recorded, while there is a decrease in the deal size from € 16.2 million in 2011 to € 4.4 million in 2012.

GERMANY, ITALY, AND THE UK DOMINATE THE MARKET

The top three countries with respect to VC/PE investments are in both years Germany, the United Kingdom, and Italy. While Germany experienced the largest overall investments in both years, Italy and the United Kingdom switched their positions. The UK was placed two in 2011 whereas in 2012 the second largest investments were recorded in Italy. In 2011, around € 2.5 billion of VC/PE investments took place in Germany, the UK, and Italy and € 1.74 billion in in 2012. But this concentration of VC/PE investments declined between both years. In 2011 88% of investments happened in these three economies, whereas the share was 78% in 2012.
Reasons for that decreasing dominance are twofold. Firstly, VC/PE investments decreased in the UK and Germany by around € 400 million. Secondly, other countries experienced significant increases in investments that narrow the gap to the three dominant VC/PE countries. This is in particular France, where investments went up significantly from € 123 million in 2011 to € 222 million in 2012 and hence almost reaching the investments in the UK, where € 251 million were recorded in 2012.

EXPECTATIONS ON FURTHER DEVELOPMENT

The expectations for VC/PE investments in 2013 are rather modest. VC/PE investments in general are largely affected by the economic situation and since many European countries have still not completely overcome recession, growth in VC/PE investments is rather not to be expected. Another indication for this development can be found in the EVCA Quarterly Activity Indicator. At the time of preparing this report, the EVCA has provided indicators for overall VC/PE investments in the EU that show that in the first two quarters of 2013 VC/PE investments are slightly lower than in the respective quarters in 2012. Although this data includes VC/PE investments for all sectors, it can give an indication of the development. □

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. 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 16 companies out of which six are biogas companies next to five biofuels and five biomass companies. Since there are only few companies 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 not satisfies the chosen criteria for the RES indices as their revenues are not mainly driven by their activities in the area of renewables.

An overview of all included companies can be found in the note page 183. With respect to the regional distribution of bio-technology firms, German and French companies are dominating. The biogas and biofuels indices mainly consist of companies listed in Germany, whereas three biomass companies are listed in France. The situation is similar in the solar PV index, where the five largest companies are German. Finally, the wind index is significantly more heterogeneous with respect to the regional distribution of the companies with the Danish turbine manufacturer Vestas being the by far 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 relative 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, all included RES indices have underperformed against the whole market. While the STOXX's close value at the end of 2012 was almost the same as at the base date – all the RES indices experienced a negative trend in 2011 and 2012.

PHOTOVOLTAIC AND WIND POWER COMPANIES ALONG THE SAME TRENDS

Comparing the three RES indices with each other also reveals interesting differences. The composite bio-technology index shows an almost constant decline over 2011 and 2012. The PV and wind indices show positive trends until the second quarter of 2011. Afterwards, both indices start to

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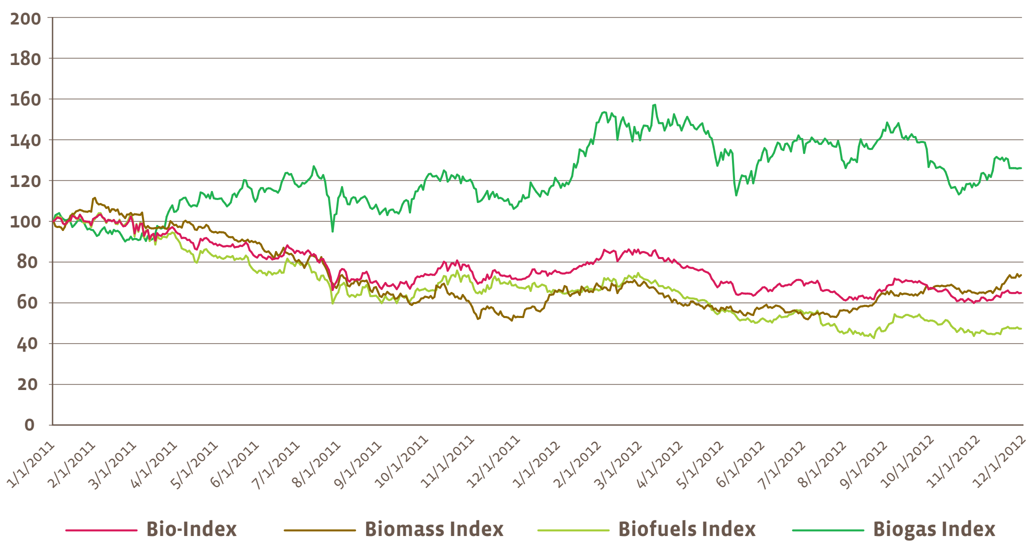
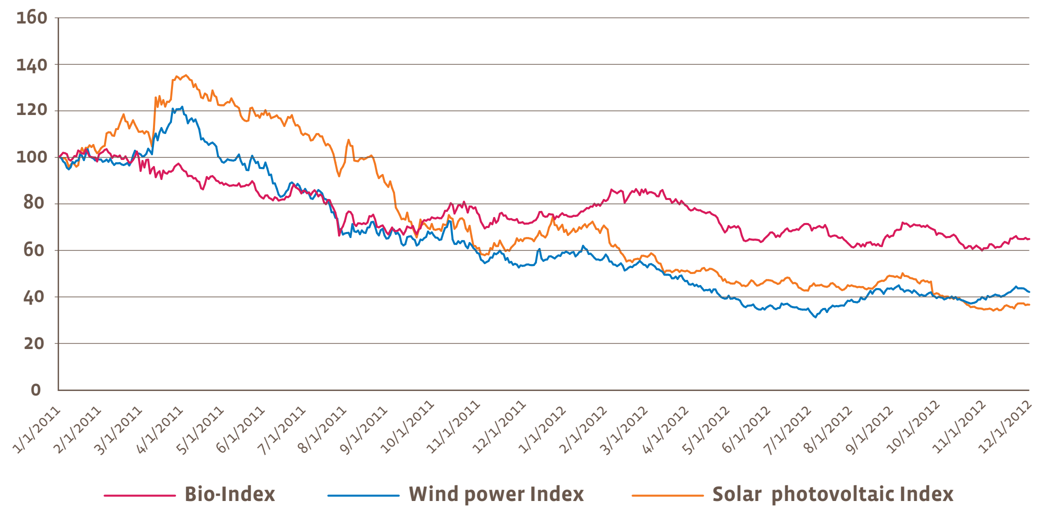
Evolution of the biotechnologies indices during 2011 and 2012



2

Evolution of the RES indices during 2011 and 2012



decline at a higher rate than the bio index such that they both intersect it at some point and close at lower values as the bio index. Over the whole period, the bio index fell 35% compared to the wind and solar PV indices that fell by 58% and 63%, respectively.

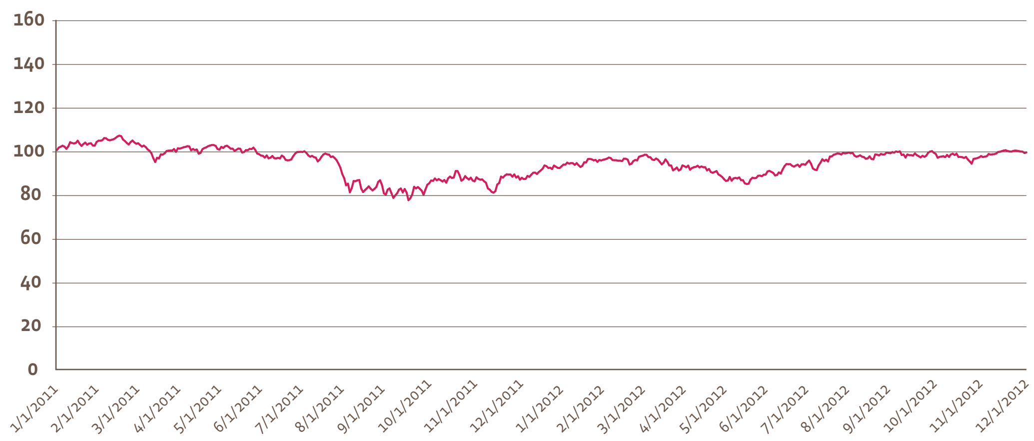
BETTER PERFORMANCE FOR BIOGAS COMPANIES

In order to analyse the composition of the bio-technology index, figure [enter the name or number of the graph with the bio indices here] displays the bio-technology index and the respective sub-indices. As the wind and the solar PV indices, the biofuels, biogas, and biomass indices were weighted by revenues. The most remarkable point is the heterogeneous developments of the sub-indices. While the biofuels and the biomass indices are decreasing over 2011 and 2012 – the biomass index closes at 73.6 points and compared to 47.3 points for the biofuels index – the biogas index shows an overall positive trend. It closes at 126 points after reaching a maximum of 156 points in the beginning of April 2012. The composite bio index has a negative trend due to the large weight of the biofuels index. Around 70% 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 2011 and 2012 were not really prosperous for the large listed RES-only companies in the EU. But in spite of the large decrease of the index, there is a slight positive trend in the end of 2012, at least in the wind and the bio-technology index. Part of the trend can also be seen in the benchmark index for the whole European market, the STOXX Europe 50, but since this index only dropped by 1% between the base data and the end of 2012, probably almost the whole decline of the RES indices is RES specific. One reason for this 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. □

3

Evolution of the STOXX Europe 50 reference indice during 2011 and 2012



1. *Wind Index: Vestas (DK), Suzlon (UK), Gamesa (ES), Enel Green Power (IT), EDP Renovaveis (PT), Nordex (DE), Falck Renewables (IT), Vergnet (FR), PNE Wind AG (DE), Alerion Clean Power SpA (IT)*

Photovoltaic Index: SMA Solar Technology AG, Solarworld AG, Aleo Solar AG, SAG Solarstrom AG, Roth & Rau AG (DE), Solaria Energia (ES), Solar-Fabrik AG (DE), Ternienergia (IT), PV Crystalox Solar plc (UK), Etrion (SE)

Biomass Index: Albioma (FR), Cogra (FR), Kedco (UK), Weya (FR), Helius Energy (UK)

Biofuels Index: Verbio Bioenergie, Cropenergies AG, Biopetrol Industries AG, Petrotec AG (DE), Global Bioenergies (FR)

Biogas Index: Envitec Biogas, 2G Energy AG, Biogas Nord AG, DTB-Deutsche Biogas AG (DE), Méthanor (FR), Thenergo (BE)

ON THE WHOLE

Between 2011 and 2012, investments in utility-scale projects declined substantially. In comparison to investment, the associated capacity that will be added through these investments decreased only slightly in most RES sectors. This illustrates a cost reduction in most technologies. The underperformance of RES companies on stock exchanges is probably related to this drop in technology prices. On the contrary, the decline of VC/PE investment appears mostly driven by the economic situation as overall VC/PE investment in Europe fell by almost the same amount as that in the RES sectors.

-39% FOR ASSET FINANCING

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 € 21.6 million in 2012. In comparison, total investment in 2011 amounted to € 35 million. The magnitude of the drop in asset finance differed among the RES sectors. The most dramatic decreases in investments could be observed in the solid biomass and CSP sector with 65% and 79%, respectively. The drops in investments in the remaining RES sectors are more moderate and lie between 28% and 35%. The only sector that experienced increases in investments between 2011 and 2012 is the biofuels sector where investments more than doubled.

... BUT ONLY -28% FOR ADDITIONAL CAPACITIES

But when looking at the associated capacity added of these investments, the picture changes. The renewable energy megawatts installed due to these investments declined by only 23% between 2011 and 2012 compared to asset finance that dropped by 38% in this period. Since the analysed data captures the moment of the asset finance deal and not the time of e.g. the beginning or the end of construction, a prediction when the capacity is added is not straightforward. But comparing the associated capacity added with the investments in 2011 and 2012 reveals another interesting point, namely a decrease in the costs of most RES technologies. This trend was most significant in the solar PV sector, where asset finance dropped by 34% whereas the associated capacity is only 1% smaller in 2012 compared to 2011.

VENTURE CAPITAL AND PRIVATE EQUITY ALSO FACE THE ECONOMIC CRISIS

VC/PE investment in renewable energy fell by 31% in the EU between 2011 and 2012. This fall in VC/PE investment is not renewable energy specific. Despite this dramatic drop in the total investment sum, the number of projects stayed almost constant. In the same period VC/PE investment over all sectors in the EU decreased by almost 22%. Hence, a large share of the decrease seems driven by the weak economic situation in the European Union in the last years and the uncertainty of venture capital and private equity funds.

Another trend in 2012 can be identified when taking a closer look at the amount of investments and the investment size. Compared to the significant drop in total VC/PE investments mentioned above, the number of deals only decreased rather modestly, namely by 6%. This indicates that the investments have been on average smaller in 2012. The VC/PE market is dominated by the UK and Germany, while the highest investment could be observed in the wind sector.

VC/PE investments in general are largely affected by the economic situation and since many European countries are still affected by the economic crisis, slow growth in VC/PE investments is plausible. Another indication for this are also the EVCA indicators for overall VC/PE investments in the EU showing that in the first two quarters of 2013 VC/PE investments are slightly lower than in the respective quarters in 2012.

A DIFFICULT CONTEXT FOR RES VALUES LISTED IN STOCK MARKETS

In order to shed some light on the situation of RES technology firms, Eurobserv'ER constructed several RES indices. These sectoral 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 have underperformed. All the RES indices experienced a negative trend in 2011 and 2012 whereas the STOXX's close value at the end of 2012 was almost the same as at the base date. Over the whole period, the index comprising biofuel, biogas and biomass fell by 35% compared to the wind and solar PV indices that fell by 58% and 63%, respectively. Looking at the composite bio-index in more detail, the heterogeneous performance of the bio-technology firms in the sub-indices becomes obvious. While the biofuels and the biomass indices are decreasing over 2011 and 2012 the biogas index shows an overall positive trend.

Overall, the RES indices show that the years 2011 and 2012 were not really prosperous for large listed RES-only companies in the EU. But in spite of the large decrease of the index, there is a slight positive trend in the end of 2012, at least in the wind and the bio-technology index. One reason for this difficult business environment for the RES firms might stem from the increasing competition from other providers of the respective renewable energy technology 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. □

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)*
- CEDEFOP – European Centre for the Development of Vocational Training *(www.cedefop.europa.eu)*
- 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)*
- EIB – European Investment Bank *(www.eib.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)*
- EREF – European Renewable Energies Federation *(www.eref-europe.org)*
- ESHA – European Small Hydropower Association *(www.esha.be)*
- ESHA Stream Map *(www.streammap.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)*
- Eubia – European Biomass Industry Association *(www.eubia.org)*
- 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/renewables/transparency_platform/transparency_platform_en.htm)*
- NIB – Nordic Investment Bank *(www.nib.int)*
- OEC – Ocean Energy Council *(www.oceanenergycouncil.com)*
- Photon International – Solar Power Magazine *(www.photon-magazine.com)*
- Pro Heat Pump *(www.proheatpump.eu)*
- 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.de)*
- 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)*

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- ARGE Kompost & Biogas – Austrian Biogas Association *(www.kompost-biogas.info)*
- Arsenal Research *(www.arsenal.ac.at)*
- 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)*
- Eurosolar Austria *(www.eurosolar.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/)*
- 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)*
- WKO – Wirtschaftskammer Österreichs *(http://portal.wko.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)*
- Walloon Energie Portal *(www.energie.wallonie.be)*
- SPF Economy – Energy Department – Energy Observatory *(http://economie.fgov.be/fr/spf/structure/Observatoires/Observatoire_Energie)*
- Valbiom – Biomass Valuation asbl *(www.valbiom.be)*
- VEA – Flemish Energy Agency *(www.energiesparen.be)*
- VWEA – Flemish Wind Energy Association *(www.vwea.be)*
- ODE – Sustainable Energie Organisation Vlaanderen *(www.ode.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)*
- Ministry of Economy, Energy and Tourism *(www.mee.government.bg/en)*
- 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)*

DENMARK

- DANBIO – Danish Biomass Association *(www.biogasbranchen.dk)*
- Ea Energianalyse – EA Energy Analyses *(www.eaea.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
- 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 – 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)*
- AGQM Arbeitsgemeinschaft Qualitätsmanagment Biodiesel *(www.agqm.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 *(www.biogas.org)*
- BEE – German Renewable Energy Federation *(www.bee-ev.de)*
- Biogasregister – Biogas Register and Documentation *(www.biogasregister.de)*
- Biomasseatlas *(www.biomasseatlas.de)*
- BMU – Federal Ministry for the Environment, Nature Conservation and Nuclear Safety *(www.bmu.de)*
- BMWi – Federal Ministry of Economics and Technology *(www.renewables-made-in-germany.com)*
- BWE – German WindEnergy Association *(www.wind-energie.de)*
- BSW-Solar – Bundesverband Solarwirtschaft *(www.solarwirtschaft.de)*
- BWP – Bundesverband Wärmepumpe *(www.waermepumpe.de)*
- Bundesnetzagentur – Federal Network Agency *(www.bundesnetzagentur.de)*
- Bundesverband Wasserkraft – German Small Hydro Federation *(www.wasserkraft-deutschland.de)*
- C.A.R.M.E.N. – Centrales Agrar Rohstoff Marketing und Entwicklungs Netzwerk *(www.carmen-ev.de)*
- Dena – German Energy Agency *(www.dena.de)*
- DGS – EnergyMap Deutsche Gesellschaft für Solarenergie *(www.energymap.info)*
- DBV – Deutscher Bauernverband *(www.bauernverband.de)*
- DCTI – German Clean Tech Institute *(www.dcti.de)*
- DBFZ – German Biomass Research Centre *(www.dbfz.de)*
- DEWI – Deutsches Windenergie Institut *(www.dewi.de)*
- Ecoprog *(www.ecoprog.com)*
- 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)*
- FNR – Agency for Renewable Resources *(www.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)*
- HWWI – Hamburg Institute of International Economics *(www.hwwi.org)*
- 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)*

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- 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)*
- 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)*

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)*
- University of Miskolc *(www.uni-miskolc.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)*
- Ministry of Economic Development – Department of Energy *(www.sviluppoeconomico.gov.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)*
- 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)*
- 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
- Agentschap NL – Ministerie van Economische Zaken, Landbouw en Innovatie *(www.agentschapnl.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)*
- Polder PV *(www.polderpv.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)*
- Wind Energie Nieuws *(www.windenergie-nieuws.nl)*

POLAND
- CPV – Centre for Photovoltaicsat Warsaw University of Technology *(www.pv.pl)*
- Energy Regulatory Office *(www.ure.gov.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)*
- Polish Geothermal Society
- 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)*

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

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)*

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)*
- ISTAS – Instituto Sindical de Trabajo, Ambiente y Salud *(www.istas.net)*
- 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)*
- AEA Energy & Environment *(www.aeat.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)*

SLOVENIA

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

SWEDEN

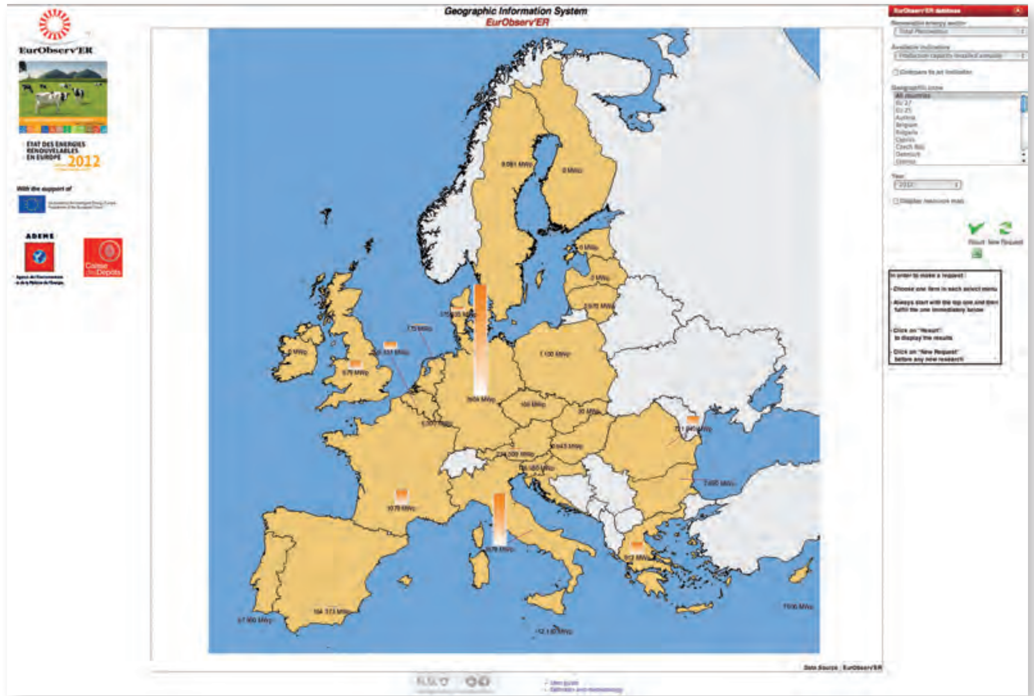
- Avfall Sverige – Swedish Waste Management *(www.avfallsverige.se)*
- ÅSC – Angstrom Solar Center *(www.asc.angstrom.uu.se)*
- Energimyndigheten – Swedish Energy Agency *(www.energimyndigheten.se)*
- SCB – Statistics Sweden *(www.scb.se)*
- SERO – Sveriges Energiföreningars Riks Organisation *(www.sero.se)*
- 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 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
www.ecn.nl
www.fs-unep-centre.org/projects
www.renac.de

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 (economical, 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

For more extensive information pertaining to the EurObserv'ER barometers, please contact:

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Schedule for the next EurObserv'ER barometers

Wind power	>> **February 2014**
Photovoltaic	>> **April 2014**
Solar thermal and concentrated solar power	>> **May 2014**
Biofuels	>> **July 2014**
Biogas	>> **Octobre 2014**
Renewable municipal waste	>> **October 2014**
Solid biomass	>> **Novembre 2014**
The State of Renewable Energies in Europe 14th EurObserv'ER Report	>> **December 2014**

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).

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

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

Editorial director: Alain Liébard
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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: Alice Guillier
Pictograms: bigre! et Lucie Baratte/kaleidoscopeye.com
Cover photo credit: Siemens AG
Printed by Imprimerie New Goff, December 2013
ISSN 2101-9622
39 euros