Study of the Macroeconomic Impact of Renewable Energies in Spain

2014

APPA
Asociación de Empresas de Energías Renovables

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Executive summary

The Renewable Energies sector is strategic for Spain and the vast majority of the developed countries; their contribution to the economy is clearly positive. It has been a long time since the main developed countries have announced ambitious plans regarding these energies, with the aim of gradually abandoning traditional power generation technologies mainly based on fossil fuels, which pollute and are finite.

The unlimited renewable resources, environmentally friendly and increasingly competitive with traditional energy sources, provide great benefits not only to society but particularly to the economy.

This report compiles the main macroeconomic indicators from the several renewable technologies. In 2014, the Renewable Energy Sector as a whole contributed 7,387 m EUR to Gross Domestic Product (GDP); represented a net tax contribution of 970 m EUR; contributed positively to the Spanish balance of trade with exports for an aggregate value of 2,316 m EUR; invested 216 m EUR in R&D&I; generated 5,871 m EUR in savings for the electricity market; avoided imports amounting to 8,469 m EUR.

GDP, taxation, trade balance and innovation

In 2014 the Renewable Energies Sector decreased its total contribution to GDP to 7387 m EUR (representing 0.7% % of GDP), for the second time registering a decrease in the annual series (22% compared to 2013). In two years the sector has lost 3.15 bn EUR of contribution to GDP, as a result of government reform. Direct contribution to GDP, the lowest in six years, fell by 14.5% to reach 6.123 bn EUR. Additionally, the Sector's induced contribution to GDP also fell down to 1.265 bn EUR which has resulted in a significant reduction, by 45.5% compared to 2013. By Technologies, the largest contribution to GDP was solar photovoltaic (35.33%), fo-

Chart 3.1

Renewable Energies direct, induced and aggregate contribution to GDP

Source: APPA

Current m EUR

llowed by wind (20.66%), thermal solar power (17.72%), biomass (13.93%), biofuels (5.65%) and small-scale hydropower (3.64%).

In 2014, the Renewable Energy Sector was once again a net fiscal contributor to the Spanish economy. The difference between taxes paid and subsidies received was 970 m EUR, which is lower than the previous year mainly due to the decrease in income tax.

In relation to the sector's trade balance, it registered once again a surplus, amounting to 2,316 m EUR. Renewable Energy companies' exports totaled 2.639 m EUR whereas imports amounted to 323 m EUR. It is the second highest total of the series analysed and makes the positive contribution of the renewable energy technologies in improving the Spanish trade balance clear. On the other hand, the decline in imports has been more pronounced since the paralysis of the sector in 2012, due to the significant decrease in imported goods and services.

The industry spent in 2014 a total of 216 million euros to research, development and innovation, representing 3.52% of its direct contribution to GDP. It is noteworthy that the average investment of the Spanish economy

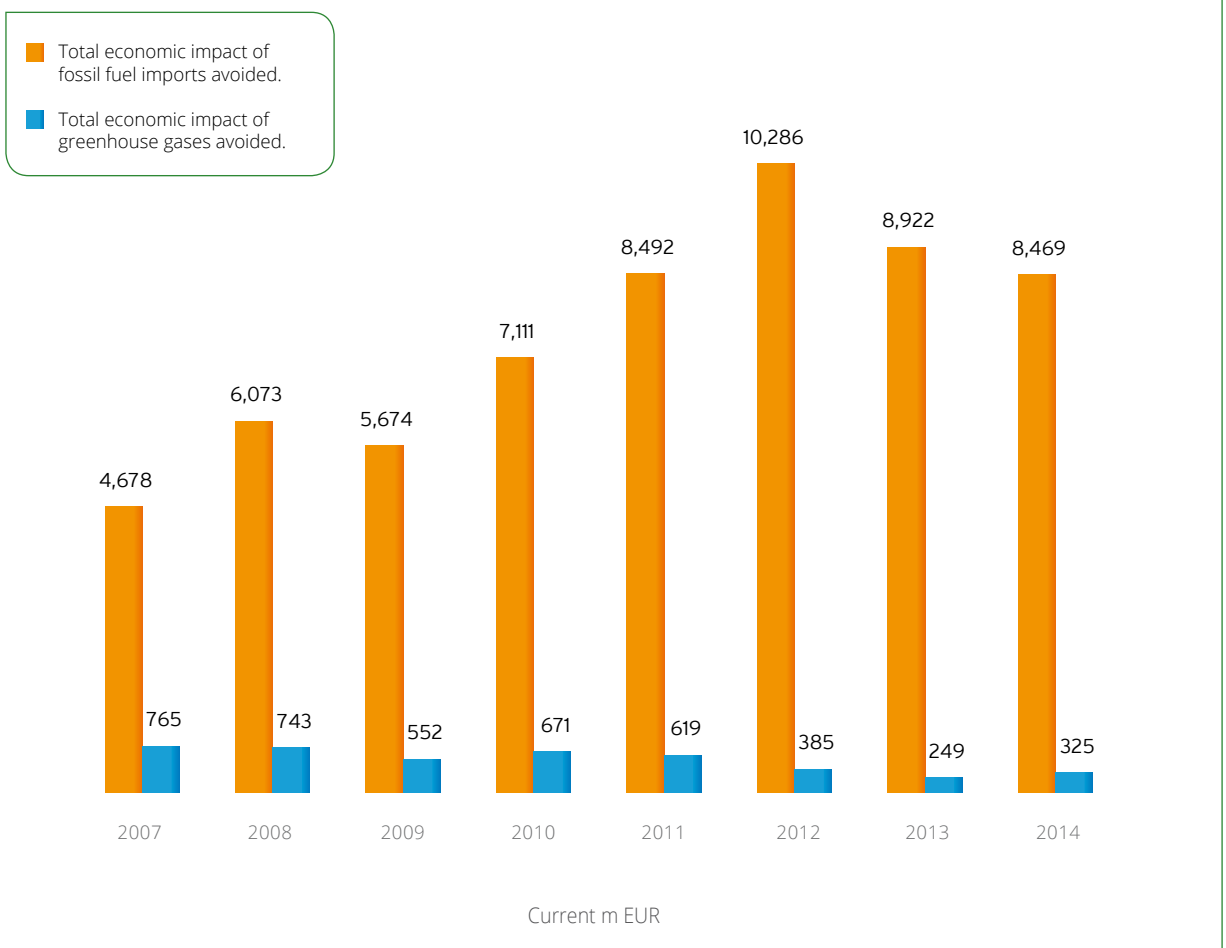
in R&D in 2013 was 1.24% of European GDP and 2.2%. Thus, renewable companies nearly tripled in percentage terms the Spanish average and approached twice the average for the European Union.

One year more the Renewable Energy Sector maintains its commitment to innovation. In 2014, renewable energy companies invested 216 m EUR in research, development and innovation (R&D&I), representing 3.52% of its direct contribution to GDP. It is noteworthy that in 2013 the average investment of the Spanish economy in R&D&I was 1.24% of GDP whereas the European average investment represented 2.2%. Thus, it can be concluded that the sector's average investments was way above both the Spanish and the European average.

Chart 5.1

Savings produced by the use of renewable energies

Source: APPA



Benefits and employment generated by renewable energies

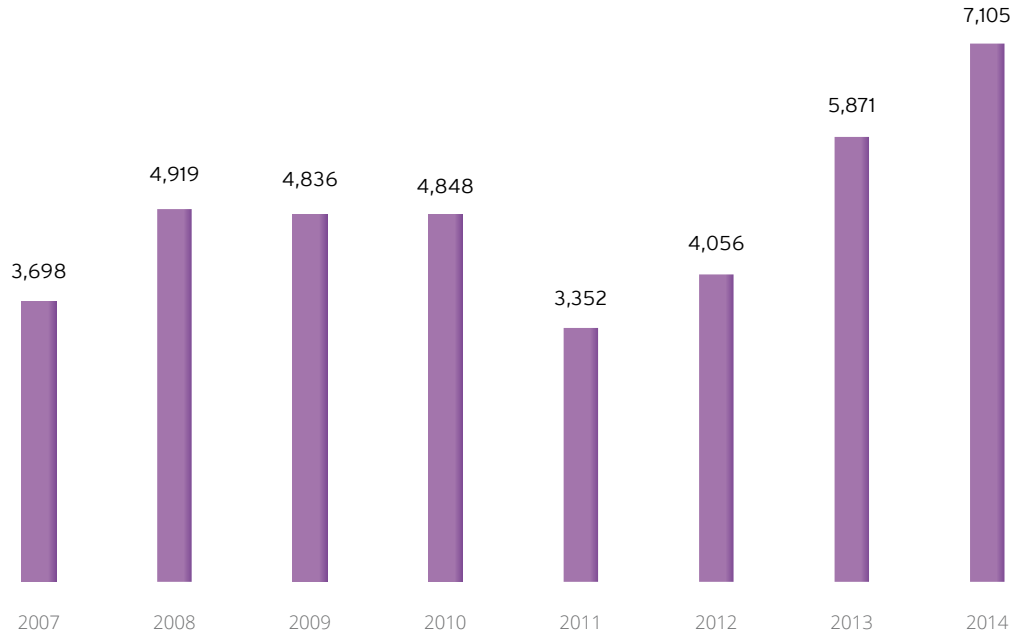
Renewable energies generate a number of different benefits for the Spanish economy, for the energy sector and for the electricity system. The economic contribution of the biomass, biogas, geothermal and solar technologies has been measured in terms of savings in energy imports and savings in the purchase of CO_2 emission rights. Considering its contribution in electricity and thermal power, the Renewable Energy Sector avoided in 2014 imports of 20,577,904 tonnes of oil equivalent (toe) in fossil fuels, resulting in economic savings amounting to 8,469 m EUR. Likewise, the Sector contributed to avoid 54,433,800 tonnes of CO_2 emissions being released into the atmosphere, amounting to circa 325 m EUR.

In 2014, the penetration of renewable energies in the electricity system caused a reduction in the cost of acquiring energy in OMIE's Daily Market totaling 7,105m EUR resulting from a 29.2 m EUR reduction in MWh prices. Such

Chart 6.3

Reduction in the cost of acquiring energy in OMIE's Daily Market due to penetration of renewable energies

Source: APPA



Current m EUR

saving was 1,867 million EUR higher than the Feed-in Tariff (FIT) received by renewable energies. In addition to these savings in the pool, in 2014 renewable energies generated savings in imports and reductions in CO_2 emissions amounting to 3,105 m EUR; accordingly, the aggregated savings amounted to 10,210 m EUR, i.e. 4,972 m EUR more than FIT received during the same period. The total amount of FITs —5,238 m EUR— decreased in 2014 22% when compared to 2013.

Considering the price savings in the market, the savings on imports of fossil fuels and the savings on CO_2 emissions, the aggregated savings provided by the renewable energies to the Spanish energy mix amounted to 70,898 m EUR.

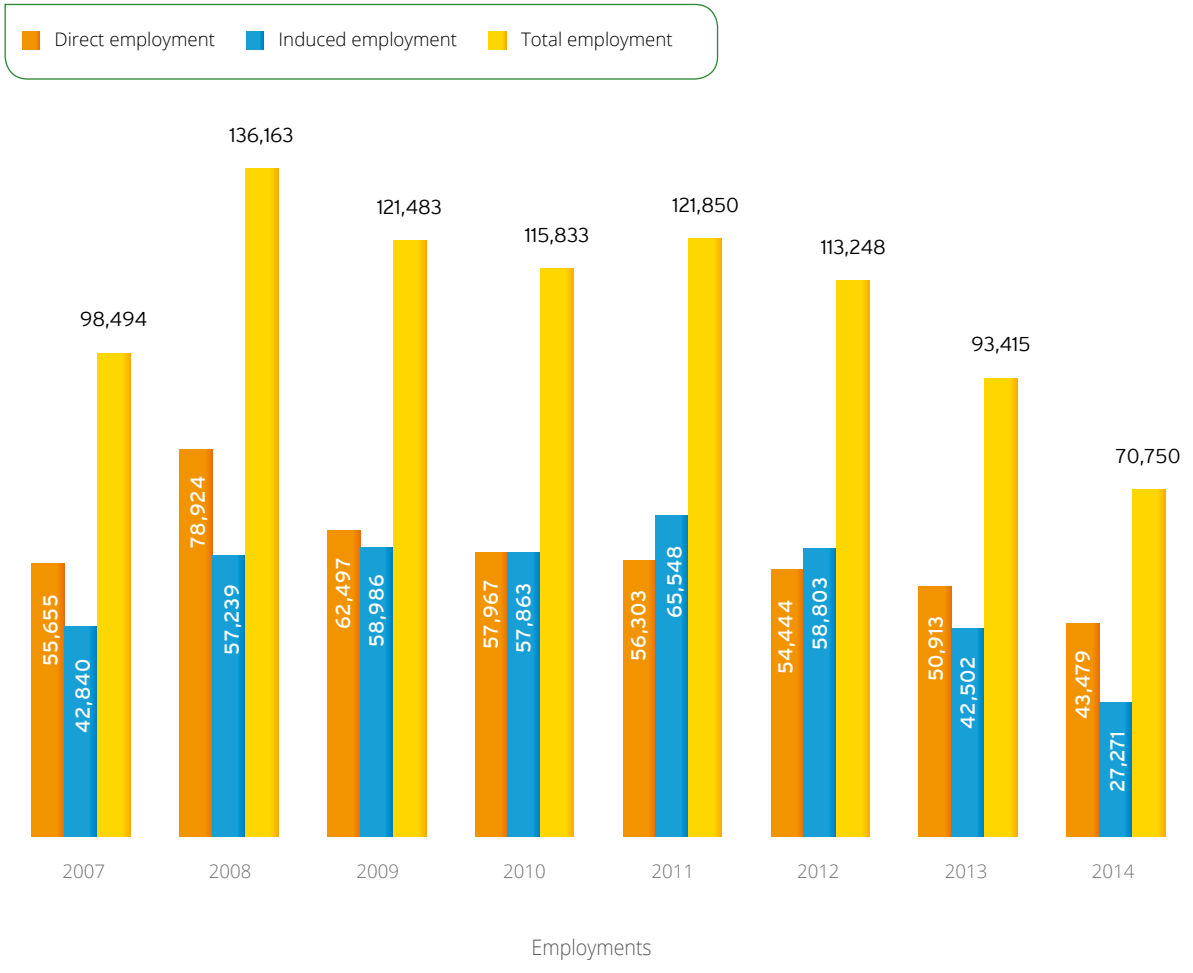
The increasingly reduced activity in the Renewable Energy Sector led to the loss of 19,832 employments in 2014, representing a 24.3% reduction compared to 2013. In aggregate, the sector registered a lump sum of 70,750 employments (the lowest level since 2005). Direct employments amounted to 43,479, 14.6% less than the previous year.

The most significant reduction took place in indirect employments, where the decrease exceeded 58%, registering a total of 27,271 employments. The technology that created the greatest number of employments in 2014 was biofuel (895), whereas biomass was the sub-sector that lost the greatest number of employments (-13 135).

Chart 3.7

Direct and induced employment in the Renewable Energy Sector

Source: APPA



1

Overview 2014

2014 data reflect the "success" of the energy policy implemented by the current government since it came to power. This policy, which began with the moratorium against renewable energies implemented in January 2012 was materialized during the last year, when only 43 MW of new renewable power were installed. The figure reflects the total paralysis suffered by the Spanish renewable sector caused by the continuous regulatory changes. Operations cannot take place without a predictable and certain framework, where there is a broad consensus desirable for the Sector. Changing the energy policy is an urgent priority if Spain wants to meet its European commitments on the environmental field.

As in previous years, in 2014 the Renewable Energy Sector focused on what (negative) surprises the new legislation would bring, rather than on the normal course of its business. During that year, the Ministry of Industry completed the legislation for the energy reform, which for the sector was only an additional step in the Governmental crusade against clean energy: Royal Decree 413/2014, adopted on 6th June and Order IET / 1045/2014, issued ten days later.

These two regulations, like the other actions of the Government when it comes to energy matters, are a clear example of the legislative improvisation that the industry has suffered and undergone in recent years. The Government has placed the focus of its misnamed electricity reform on liquidating the controversial tariff deficit. In doing so, the Government has mistakenly identified the renewable energies as the main culprit for the tariff deficit and has not hesitated blaming renewable energies for being expensive and even responsible for the increase in electricity prices, a position proved wrong in this report.

The electricity reform has radically changed the conditions in which investments were made and put the sector under the most absolute legal uncertainty, with retrospective measures (i.e. revision every six years) that have left promotors of renewable energy facilities without the capability to predict what the economic situation in the future will be and what the cost of the State bonds will be, both necessary to calculate the profitability of their facilities.

The result has been an unfair and discriminatory reform. Whilst there are certain electrical costs inherent to the system that have barely been cut, the disappeared Special Regime technologies, and in particular the renewable energy industries have been those suffering the biggest cuts from the reform. The Minister stated in the Parliament that the cut would be equitable between companies, Government and consumers but the reality is that the renewables have been the major companies affected by the reform. The Minister of Industry announced a cut of 1.1 bn EUR to affect such industries. However, in 2014 the cuts to these technologies were around 2.3 bn EUR. Moreover, the same reform has left 7,500 MW of renewable energy without any regulated compensation. Those MW only count with the market price, which on its turn has to compete with non clean technologies that barely pay for their negative externalities.

The reform has come together with the cuts, adding more taxes for renewables. Some absurdly justified as environmental taxes, ignoring the fact that most of the renewable technologies help reducing emissions of greenhouse as well as our high dependence on imported energy. Last but not least, no consideration is made to the fact that renewable energies are the main Spanish available asset to achieve the European environmental objectives.

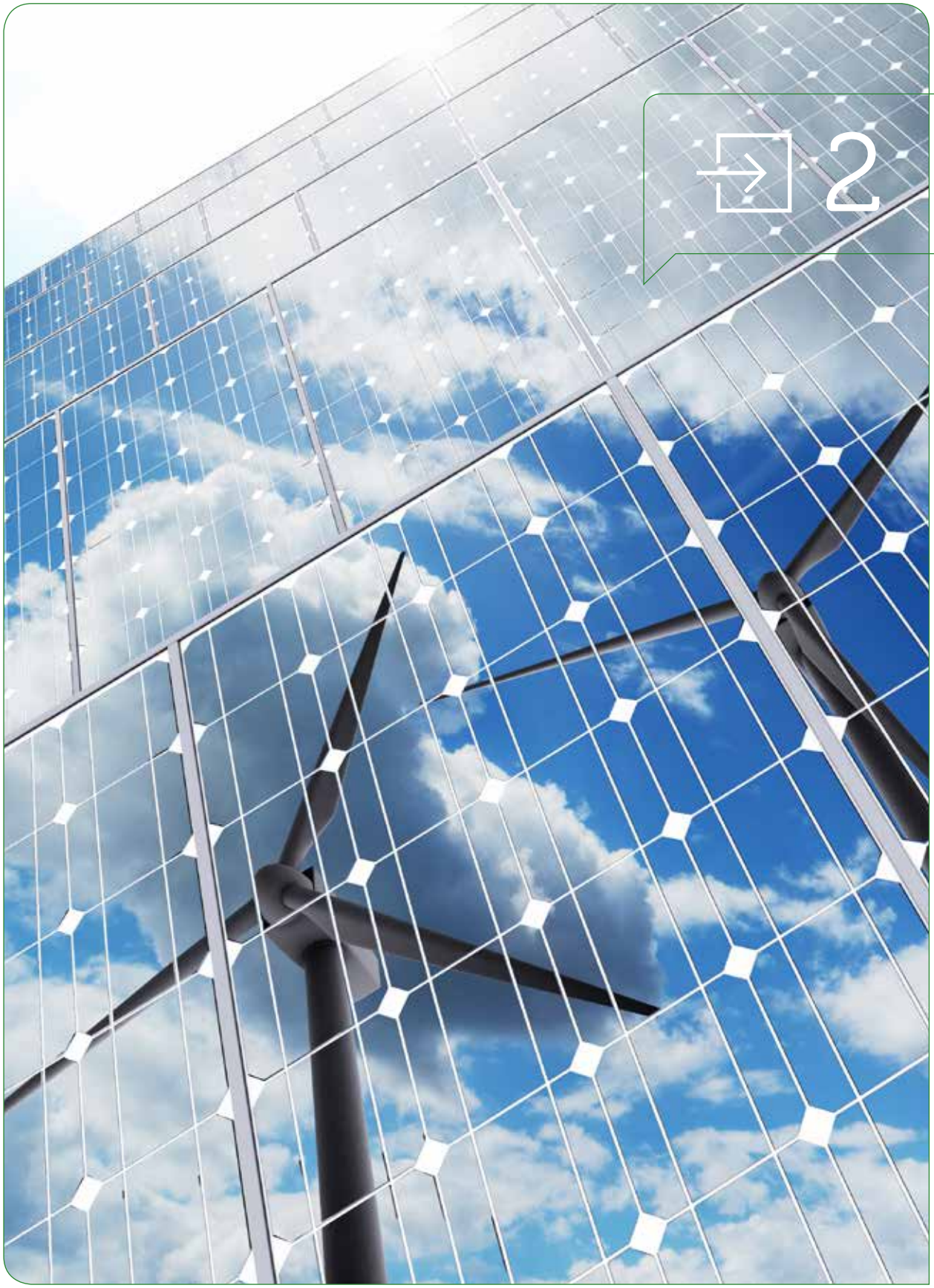
On the other hand, the so called energy reform leaves many problems unresolved, two of them worth to mention. Firstly, the actions of the Ministry have been limited exclusively to the electricity sector, but the main problem of our country regarding energy, remains

unresolved: Spain's extremely high energy dependence on external sources. Secondly, the reform keeps many costs that have nothing to do with power generation in the electricity bill, such as the costs associated with capacity received by combined gas cycle; the non interruption, only understandable within an industrial policy; and those associated with policies structuring the territory.

When legislating a reform without any consensus, without hearing or having considered minimally the allegations from the affected Parties, the only defense such Parties may have to protect their interests is found at the courts. In fact, every legislative step the Government has made has been followed by a flurry of lawsuits at both Spanish and international courts. The aforesaid Royal Decree and the Order were challenged by numerous associations, companies, institutions and individuals. As a result, the renewable sector devotes much of its efforts to lawsuits when those should be devoted to fostering their development. As a result, apart from the current and obvious implications, the definitive results of the reform will be clarified at the court, probably long after the Government members have finished their governance responsibilities.

Order IET / 1045/2014 on compensation parameters, which has been appealed at the Supreme Court by numerous industry associations, deserves special mention. In particular, APPA repeatedly requested the Supreme Court to instruct the Ministry of Industry to facilitate the reports of the consulting companies in which the Ministry had relied on when fixing the remuneration of various renewable technologies in order to develop the appeal with sufficient judicial guarantees. An enormous amount of documentation was provided but not the reports issued by the consultants. Before the insistence of APPA, the Ministry of Industry clarified that the calculations had been based on a report issued by IDAE and not on the consultants' ones. This was contradicted by the Minister himself when, after the Council of Ministers on September the 20th, 2013, he clarified that "the compensation would be fixed once the consultants' reports had been finished". The reality is that one report was never finalized and the other was delivered after the publication of the Order. On its turn, the IDEA's report to which the Minister of Industry had made reference, was made public in September 2015 and is was dated as of June the 15th 2015, that is, twelve months after publication of the IET / 1045/2014 on compensation parameters.

The aforementioned is another example of the lack of transparency that has characterized the entire reform. With such reform the Government has repeatedly violated the Law 24/2013 on the Electricity Sector approved by it which specifically states: "the remuneration of activities shall be established in regulations subject to the principles of objectivity, transparency and non-discrimination ... ".



2

Penetration of renewable energies in Spain

In 2014 renewable energies reached their highest historical participation in the consumption of primary energy, representing 14.4% of Spain's total consumption of primary energy. They remained in the third place behind petroleum, which with 42.9% remains as the most used primary energy source in Spain, and natural gas, which in the second position reached 20% of Spain's total consumption of primary energy. Nuclear energy, with 12.6%, and coal, with 10.1%, ranked fourth and fifth, respectively.

According to the aforementioned rates, the order of sources of primary energy consumption in Spain remains the same as in 2013, except in the case of the renewable energies which have successfully moved up from fourth to third place, beating nuclear power.

Since 2007, when representing 7% of the consumed primary energy, renewable energies have not stopped growing to reach, in 2014, the aforementioned 14.4% of primary energy consumption. Different behaviors are observed from other technologies. Petroleum has ranked the first position for years and has seen its contribution reduced by only 5.2 percentage points. Natural gas has slightly reduced its contribution year after year, reaching in 2014 a lower level when compared to the start of the series analysed. Nuclear power has alternated between increases and decreases in share throughout the years, reaching in 2014 its greatest participation. Finally, in the case of coal, its contribution to primary energy depends almost exclusively on the policies implemented by the Government, without following a defined path. (Charts 2.1 and 2.2).

Chart 2.1

Primary energy 2014

Source: MINETUR

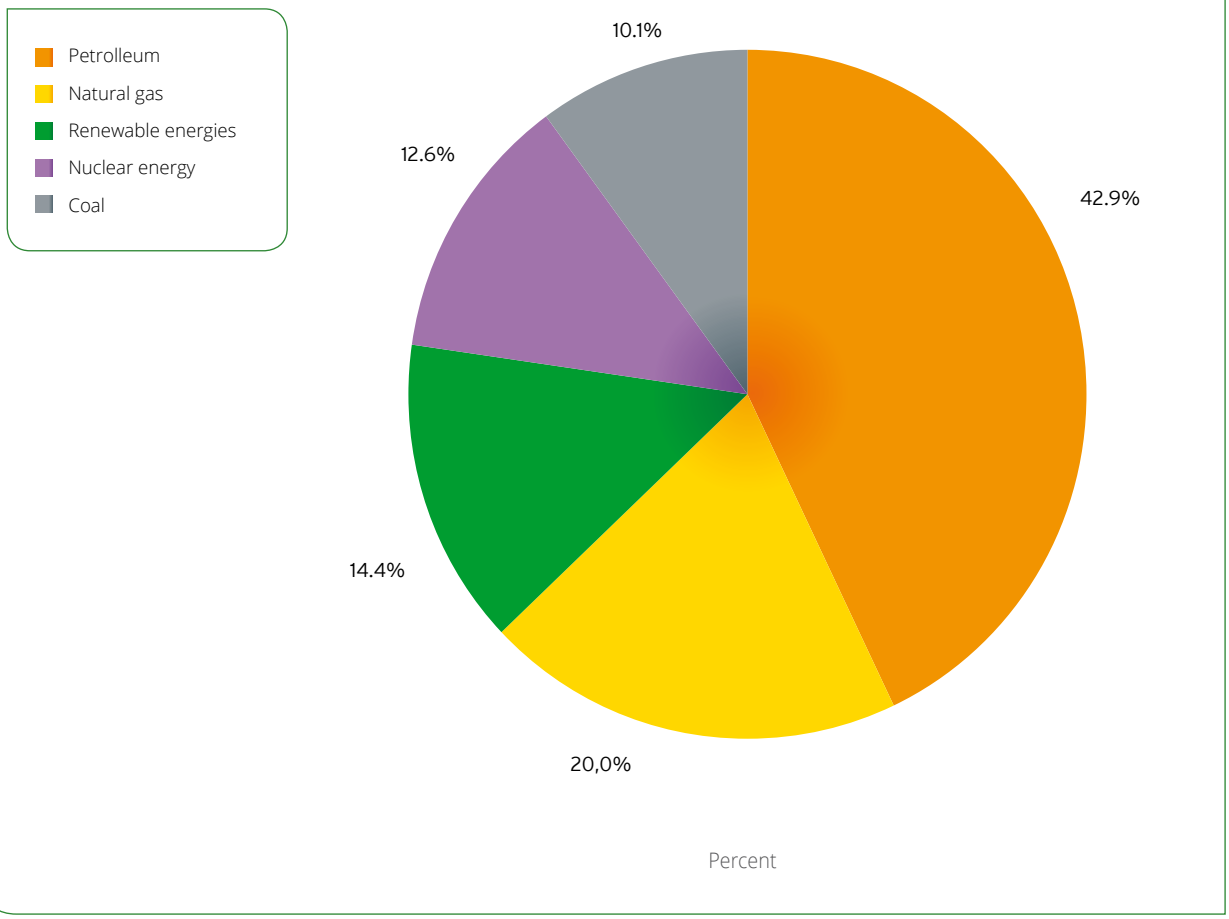
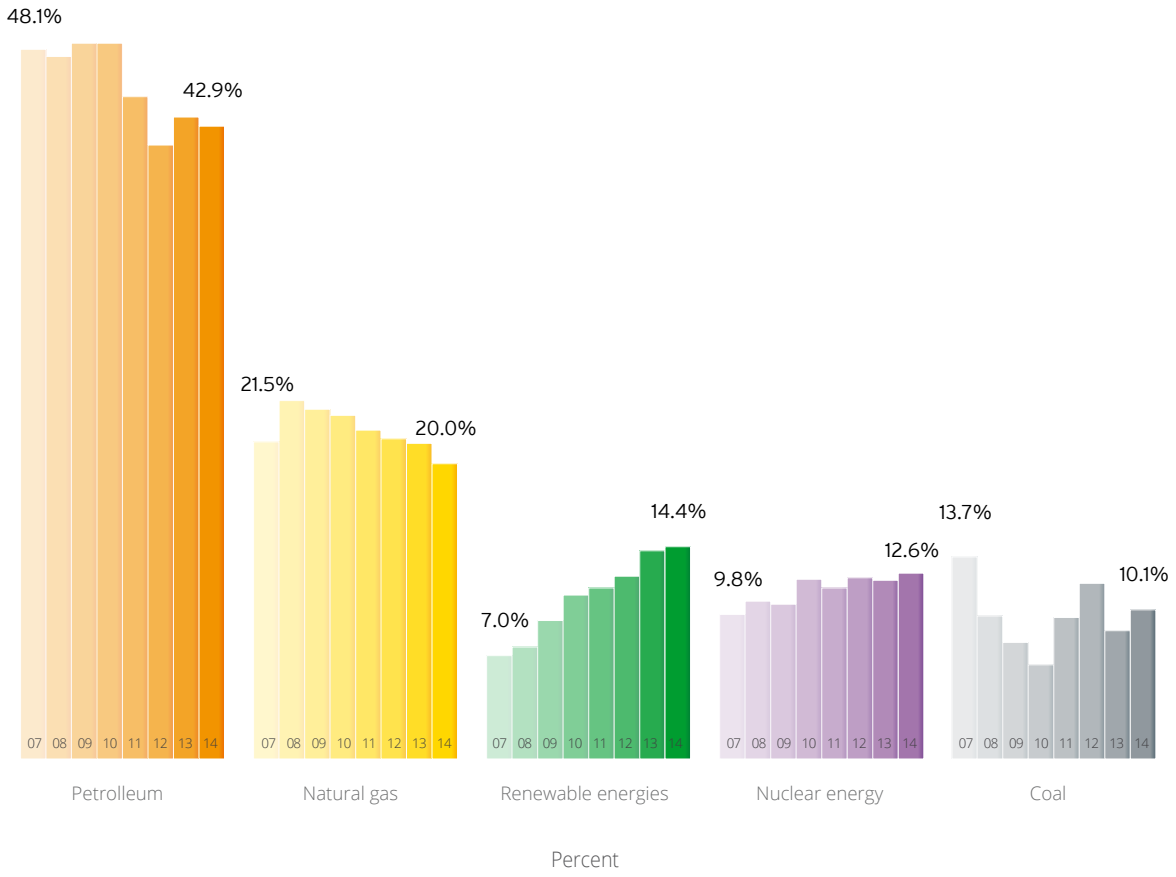


Chart 2.2

Primary energy 2007-2014

Source: MINETUR



In 2014, renewable energies represented 15.6% of the total final energy consumption in Spain. This share has decreased slightly compared to 2013, when it reached 15.9% of the total final energy consumption due to the decline in participation of renewable electricity generation, falling from the 9.7% obtained in 2013 to 9.3%. The renewable thermal technologies increased their contribution slightly from 6.2% to 6.3% during 2014. (Chart 2.3). As for gross final energy —which is the benchmark for meeting the 20% target by 2020—, in 2014 the achieved rate was 17.1%, with half a percentage point over the previous year. The gross final consumption of energy increased again after the drop experienced in 2013 and reached its highest value in the analysed series. (Chart 2.4).

Chart 2.3

Final energy 2014

Source: MINETUR

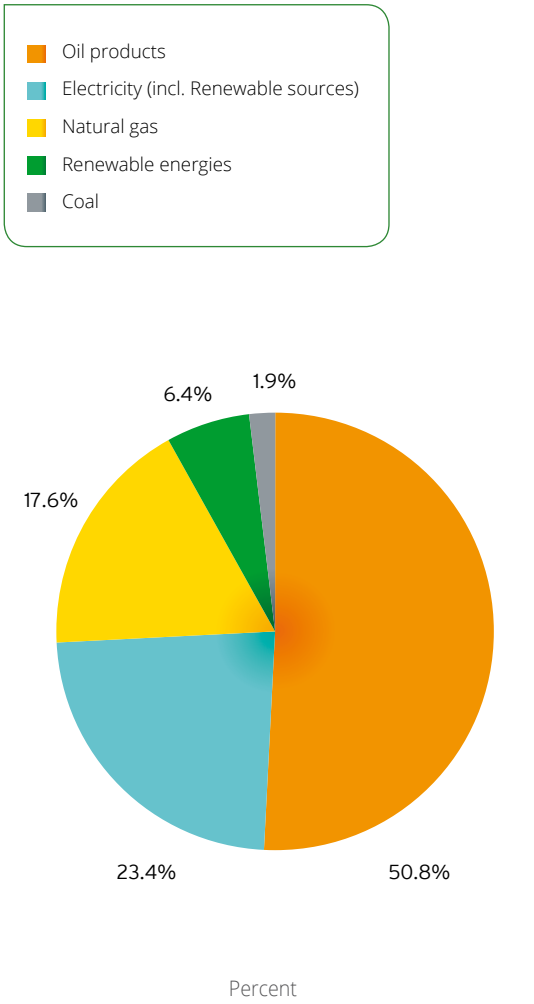
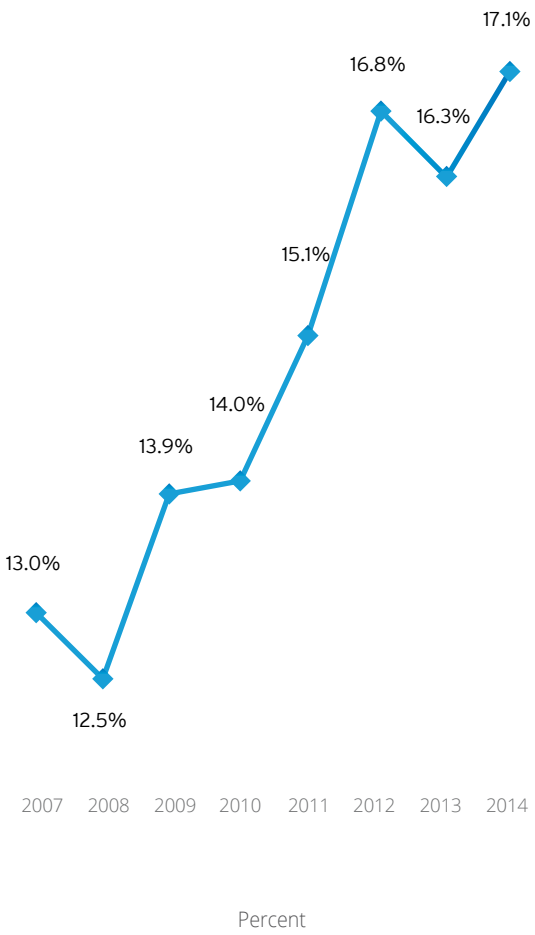


Chart 2.4

Renewable energies percentage on final energy

Source: MINETUR

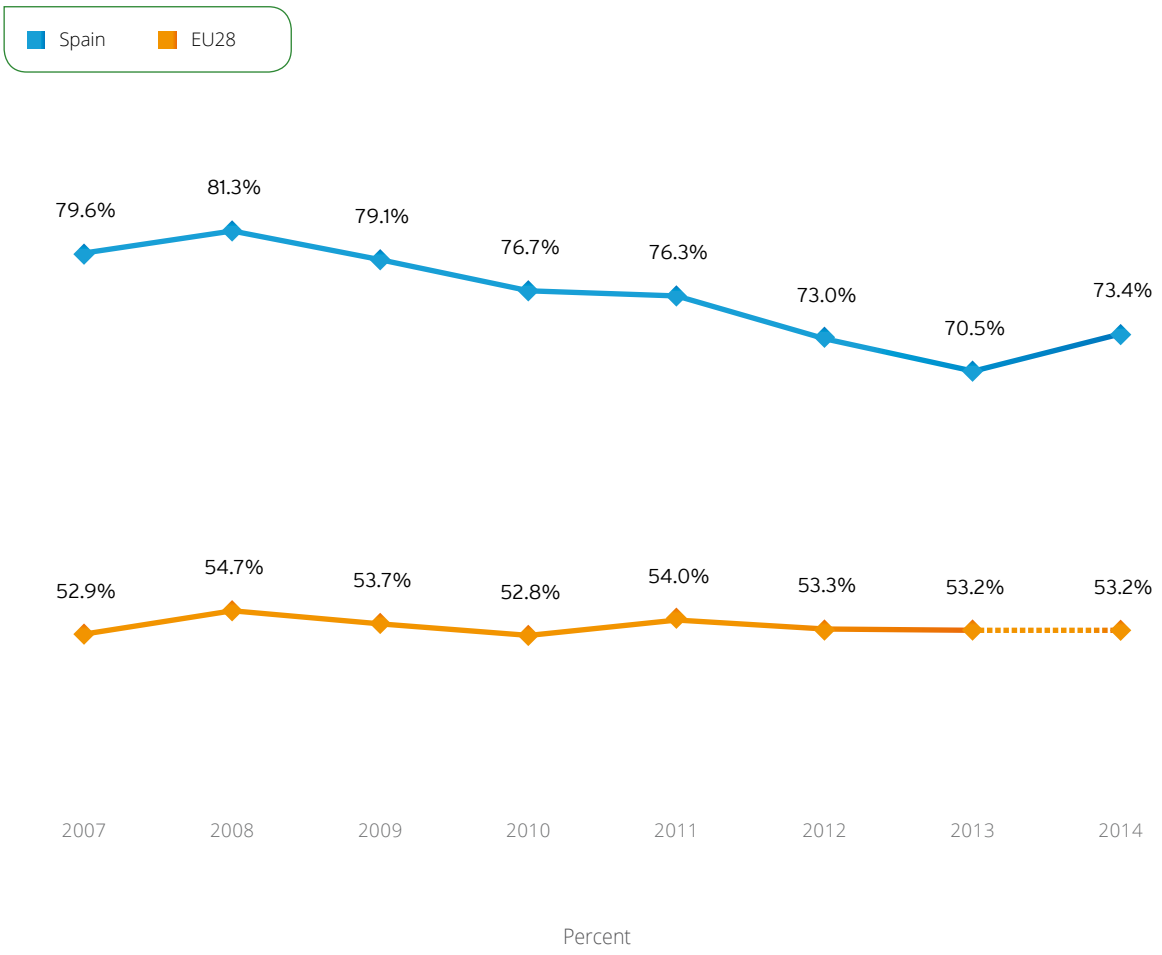


One of the main challenges for Spain' energy sector is its extremely high dependence on fossil fuels. This dependence was as high as 81.3% in 2008 and has decreased every year since then thanks, among other circumstances, to the generation of energy from renewable sources. Nonetheless, the energy dependence has increased again in 2014 up to 70% while the rest of Europe averaged slightly over 50% in 2013. Renewable energy sources offer a tremendous potential in resolving the serious problem of energy dependence given their local and clean nature, a very positive effect whilst avoiding fossil fuels imports. (Chart 2.5).

Chart 2.5

Energy dependence

Source: Eurostat and MINETUR



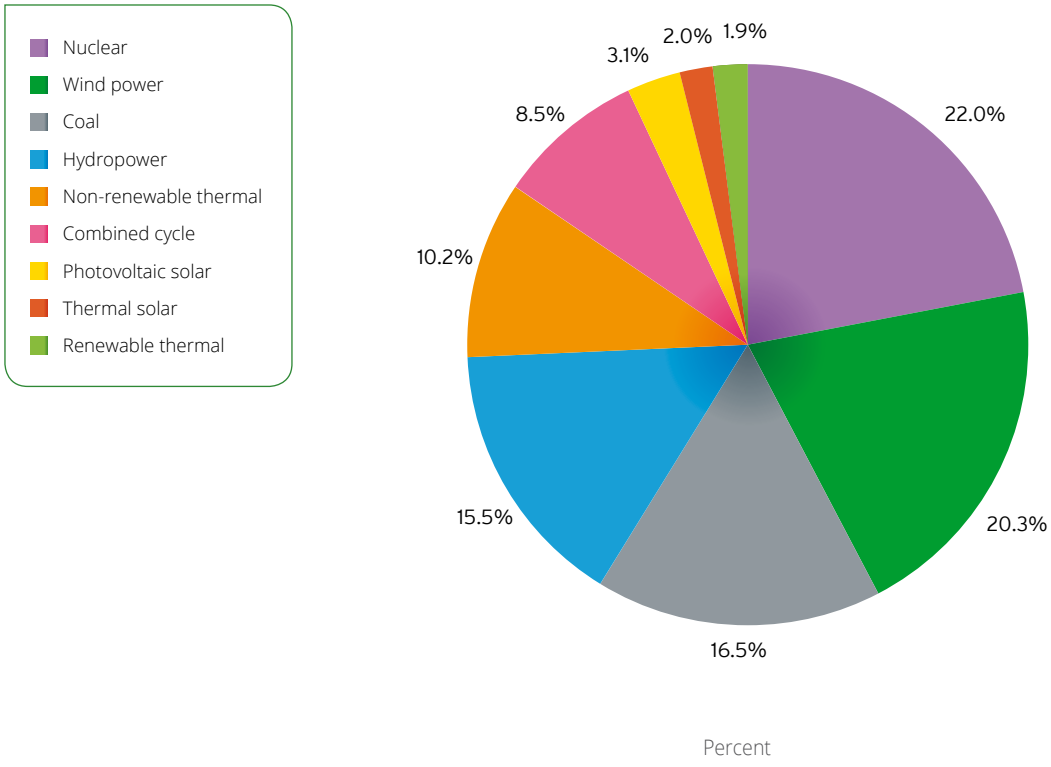
Electricity Sector

Including the production from large hydropower plants, renewable energy sources accounted for 42.8% of the domestic electricity balance in 2014. Wind power covered 20.3% of the demand, large hydropower covered 15.5%; solar photovoltaic 3.1%; solar thermal 2%; and renewable thermal covered 1.9% of the demand. (Chart 2.6). Noteworthy is the fact that on February 4th, 2014, between 8pm and 9pm, the peninsular annual demand for electricity reached its peak, 60.2 % of which was covered by renewable energies with wind power at the forefront, covering 34.5% of the demand.

Chart 2.6

Demand coverage, 2014

Source: REE



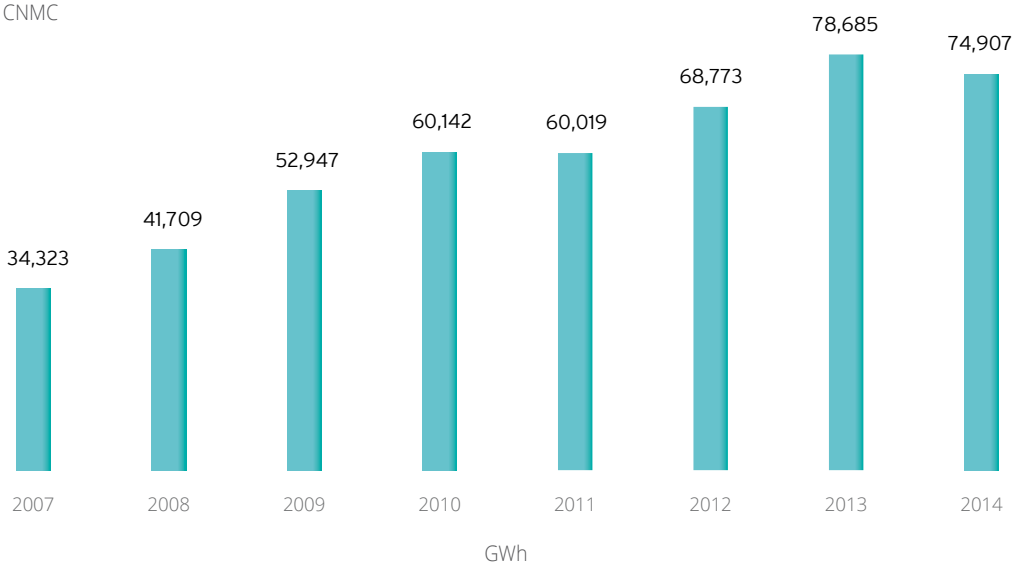
Renewable electricity production of the old Special Scheme was of 74,907 GWh in 2014, 4.8% lower than in 2013. By technology, wind power represented 68.1% of the total, followed by photovoltaic solar with 11%, small-scale hydropower with 9.4%, thermal solar with 6.6% and biomass with 4.9%. (Chart 2.7).

In terms of installed capacity, the total capacity from renewable energies in 2014 was 32,850 MW, representing an increase of only 43 MW compared to 2013. (Chart 2.8). Given that the average power plant registered had been greater than 2,500 MW within the analysed series, and nearly 2,000 MW were registered over the last three years, one could say that the sector is paralysed. Wind power, with 23,002 MW in installed capacity, represented 70% and was the renewable technology with the largest installed capacity, followed by photovoltaic solar power with 4,672 MW (14.2%), thermal solar power with 2,300 MW (7%), small-scale hydropower with 2,101 MW (6.4%) and biomass with 770 MW (2.3%).

Chart 2.7

Production from renewable sources under Special Regime

Source: CNMC



Broken down by Autonomous Regions, the largest installed capacity remained in Castilla y León, followed by Andalusia, Castilla-La Mancha and Galicia. These four regions

Chart 2.8

Renewable installed capacity under the Special Regime

Source: CNMC

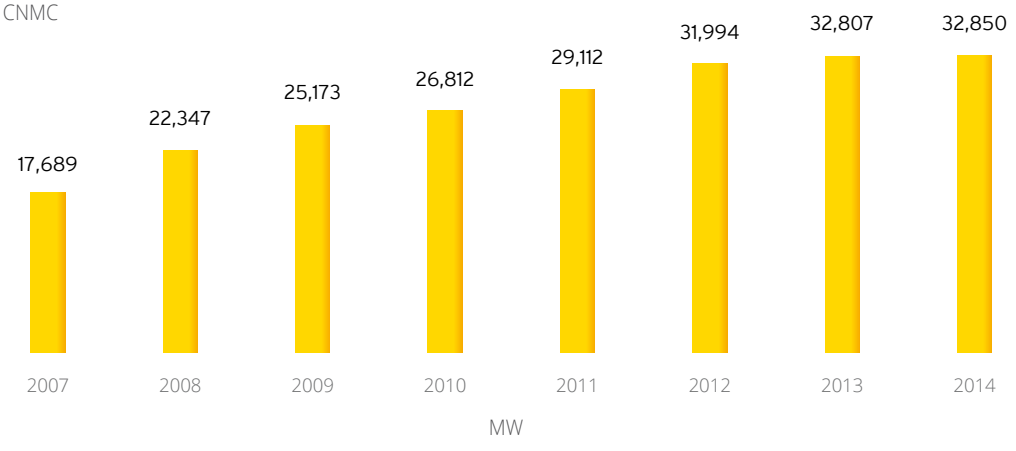
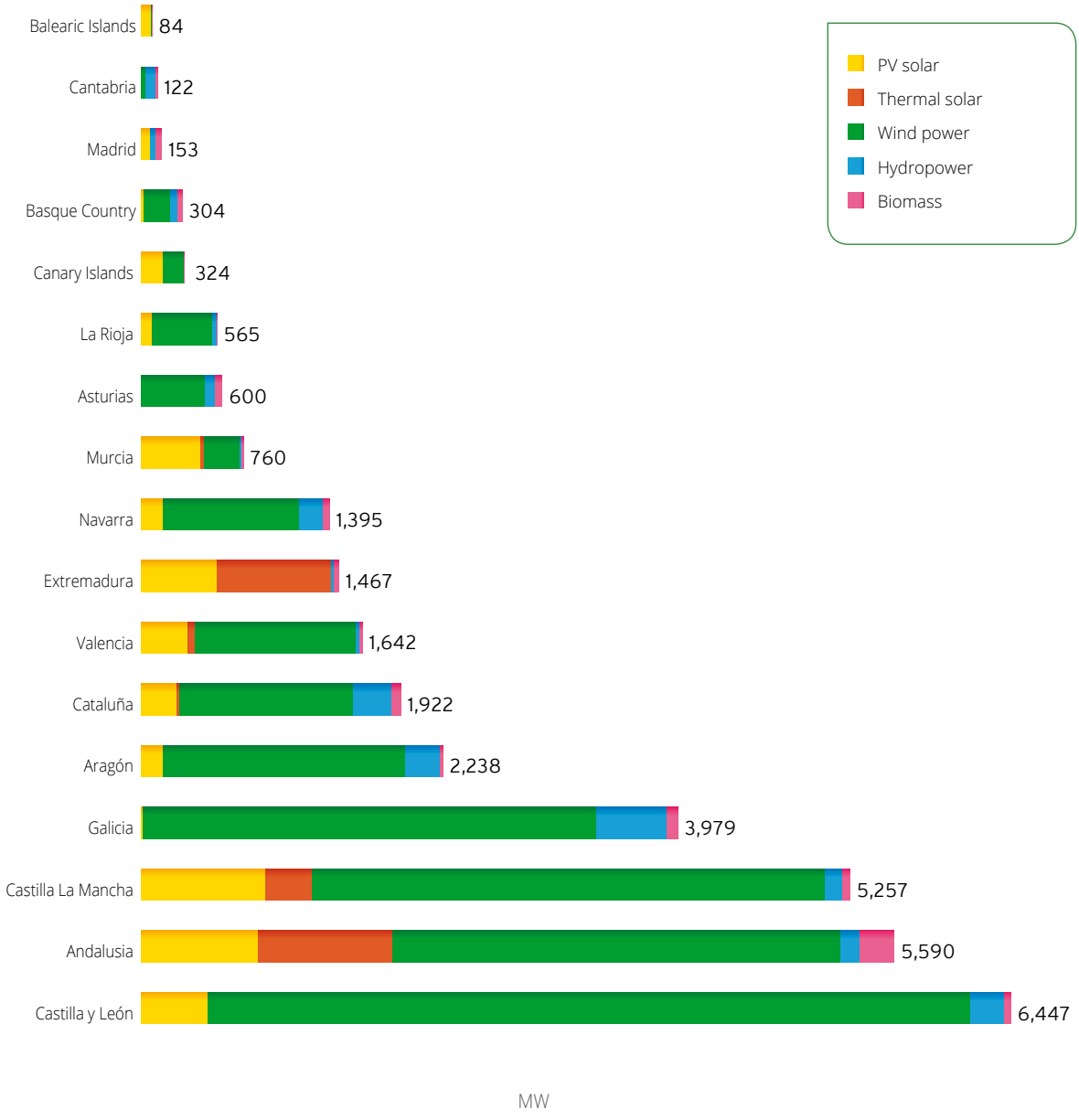


Chart 2.9

Installed capacity in renewable technologies under the Special Regime, by Autonomus Regions by the end of 2014

Source: CNMC



accounted for 64.8% of the total capacity installed in Spain. With the sole exception of Canarias that climbs a position ahead of the Basque Country the ranking remained unchanged compared to 2013. (Charts 2.9 and 2.10).

Chart 2.10

Installed capacity (MW) and electricity production (GWh) from renewable technologies under the Special Regime, by Autonomous Regions by the end of 2014

Source: CNMC

	Solar PV		Solar Thermal		Wind power		Hydropower		Biomass		Other		**Total**	
	Installed capacity (MW)	Electricity production (GWh)	Installed capacity (MW)	Electricity production (GWh)	Installed capacity (MW)	Electricity production (GWh)	Installed capacity (MW)	Electricity production (GWh)	Installed capacity (MW)	Electricity production (GWh)	Installed capacity (MW)	Electricity production (GWh)	Installed capacity (MW)	Electricity production (GWh)
Andalusia	869	1,565	997	2,124	3,324	6,450	143	267	252	1,373	5	0	**5,590**	**11,779**
Aragón	167	299			1,797	4,331	257	993	16	67			**2,238**	**5,689**
Asturias	1	1			476	1,049	77	223	47	244			**600**	**1,517**
Balearic islands	78	123			4	6			2	2			**84**	**131**
Canary Islands	166	298			154	389	0	3	3	9			**324**	**699**
Cantabria	2	2			35	76	72	204	13	86			**122**	**369**
Castilla La Mancha	923	1,685	349	734	3,800	8,292	126	541	58	227			**5,257**	**11,478**
Castilla y León	495	840			5,652	12,422	256	799	45	249			**6,447**	**14,310**
Catalonia	265	410	23	66	1,284	2,889	286	1,179	66	207			**1,922**	**4,751**
Ceuta & Melilla	0	0											**0**	**0**
Valencia	349	543	50	94	1,193	2,522	31	38	18	41			**1,642**	**3,237**
Extremadura	561	1,070	849	1,899			20	37	37	194			**1,467**	**3,201**
Galicia	16	19			3,362	8,398	522	1,860	79	427			**3,979**	**10,705**
La Rioja	86	129			448	948	27	88	4	7			**565**	**1,171**
Madrid	67	100					44	93	43	167			**153**	**360**
Murcia	440	795	31	41	263	511	14	65	11	47			**760**	**1,459**
Navarra	161	296			1,016	2,279	171	509	47	306			**1,395**	**3,391**
Basque Country	26	29			194	433	54	145	30	53	0	0	**304**	**660**
Total	4,672	8,203	2,300	4,959	23,002	50,995	2,101	7,043	770	3,706	5	0	**32,850**	**74,907**

Thermal Sector

In 2014, thermal renewable technologies reached an aggregate amount of 4,365.7 ktoe in terms of final energy consumption. This figure represents a slight decrease of 0.42% compared to 2013 and breaks the trend traced by the three previous years in which the contribution of the thermal sector had grown by 3.71% on average. By technology, biomass accounts for 92.68% of the total, followed by thermal solar with 5.91%, biogas with 0.96% and geothermal with 0.45%. (Chart 2.11).

Chart 2.11 Final consumption of energy proceeding from thermal renewable sources

Source: IDAE and MINETUR

Biofuels Sector

The overall target of biofuel sale or consumption in diesel and petrol set for 2014 (4.1%) was almost met as the volume of physically introduced biofuels in the Spanish market achieved a 3.9% market share thanks to the use of biofuels certificates over from the previous year.

Similarly, the specific annual target for biofuels in diesel (4.1%) was slightly exceeded (4.2%), also through the use of certificates over from the previous year, once its actual market share achieved a 3.9 % market share. Biodiesel from methyl esters of fatty acids (FAME) contributed to it in 2.5 percentage points while the remaining hydrobiodiesel contributed to it in 1.4 points.

The specific annual target for biofuels in petrol (3.9%) was reached in physical terms, since bioethanol consumed during the year achieved an actual 4.1% market share, which was reduced to 3.9% once the certificates to be transferred to the following year had been deducted. (Chart 2.12).

Chart 2.12 Biofuels actual market share, in energy terms

Source: CNMC

3

Macroeconomic assessment

In 2014, the Renewable Energy Sector reduced its contribution to Gross Domestic Product (GDP) for the second consecutive year as a result of the reform of the electricity sector implemented by the Government through a number of regulatory changes that have been particularly detrimental for renewable energies. In fact, the contribution of the sector to GDP is 30% lower than 2012. The impact of this reform has also adversely affected employment in the renewable energy sector. To be precise, the measures implemented by the Government have led to the destruction of more than 22,000 employments in the sector leaving the number of employments in the lowest level of the series analyzed.

Conversely, once again the sector showed a positive trade balance by exporting eight times more than what it imported, emerging as a net fiscal contributor with more than one billion EUR, and maintaining its commitment with the future of renewable energies, evidenced by its contribution to R&D&I.

Impact on GDP

In 2014, the total aggregated contribution to GDP of the Renewable Energy Sector was of 7,387 m EUR. The contribution of the sector to GDP was 0.7% of the total Spanish GDP, whereas in 2012 it represented 1% of the GDP with a contribution of 10,535 m euros. In fact, it is the second time this contribution decreases (22.1% when compared to 2013) in the annual series.

The reform undertaken by the Government has led to the loss of 3,148 million euros of the sector´s contribution to GDP and reduced the weight of the renewable energy sector by 30% in just two years. (Charts 3.1 and 3.2).

Chart 3.1

Renewable Energies direct, induced and aggregated contribution to GDP

Source: APPA

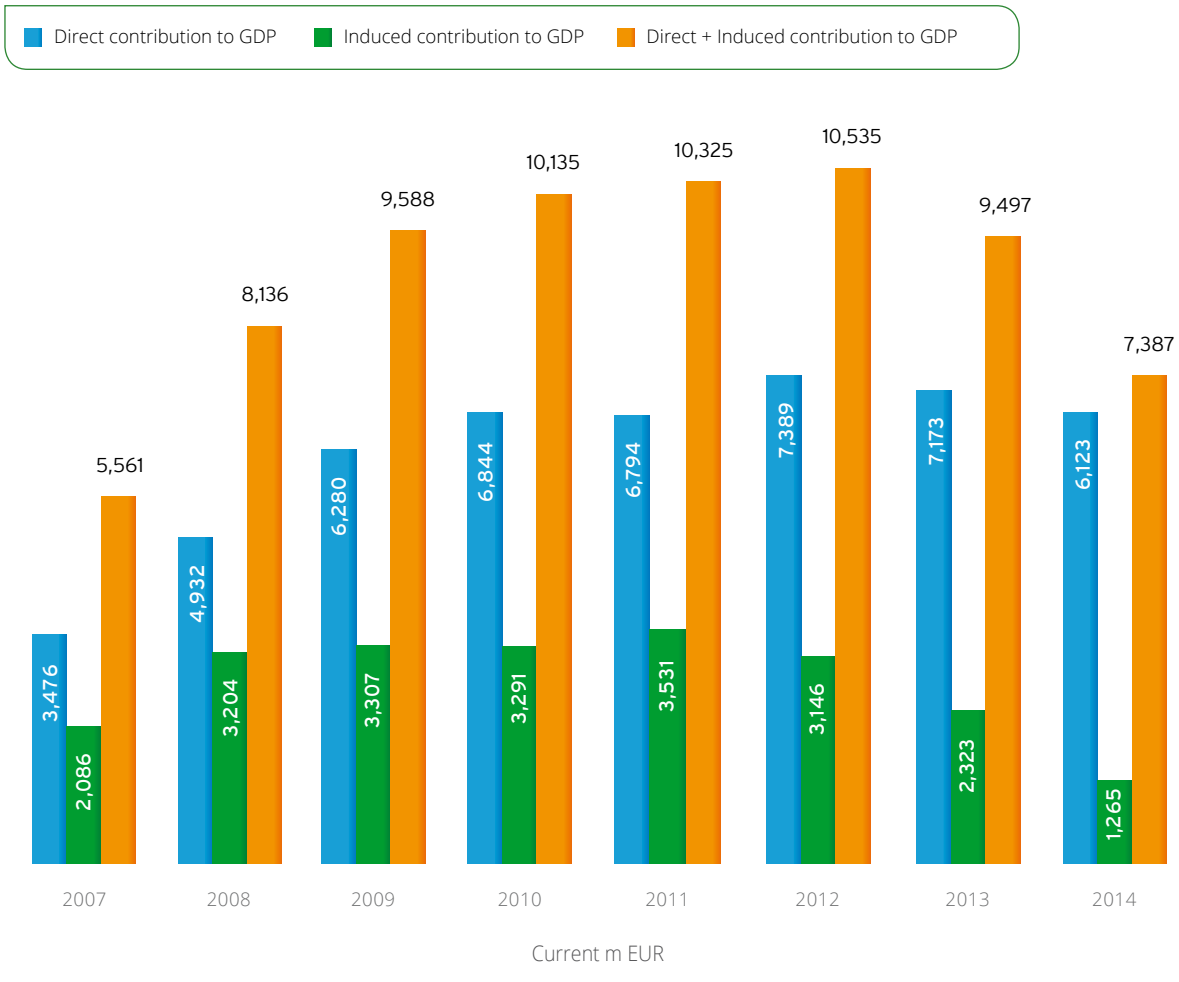
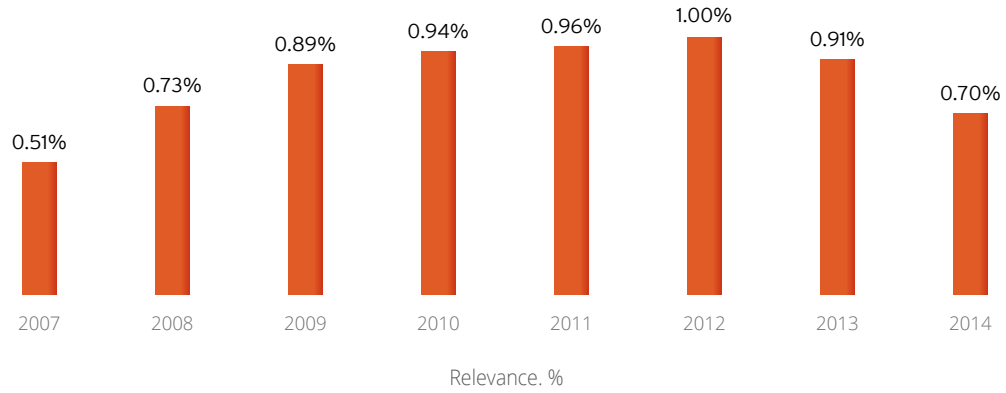


Chart 3.2

Relevance of Renewable Energy Sector in GDP terms

Source: APPA



Direct contribution of the Renewable Energy Sector to Spain's GDP was of 6,123 m EUR in 2014, a 14.5% decrease compared to 2013. This reduction in the sector's direct contribution to the GDP is particularly noteworthy, as it is the third time that such circumstance occurs in the annual series and being the lowest direct contribution within the last six years. (Charts 3.3 and 3.4).

Chart 3.3

Direct contribution to GDP from Renewable Energy Sector

Source: APPA

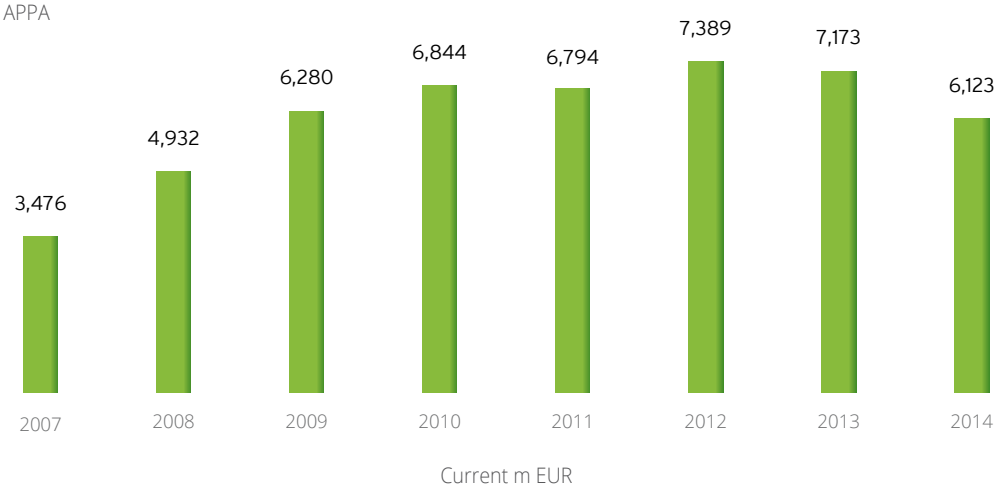
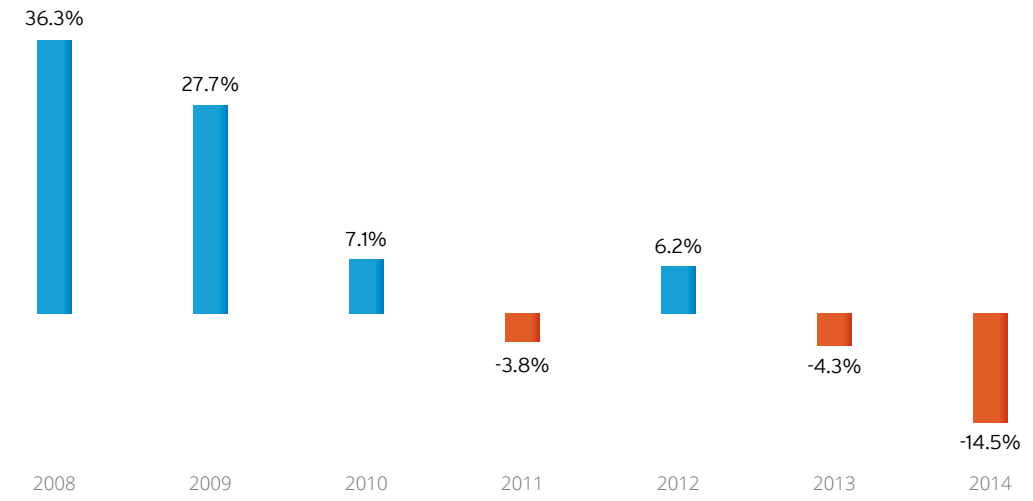


Chart 3.4

Growth rate of the Renewable Energy Sector's direct contribution to GDP

Source: APPA

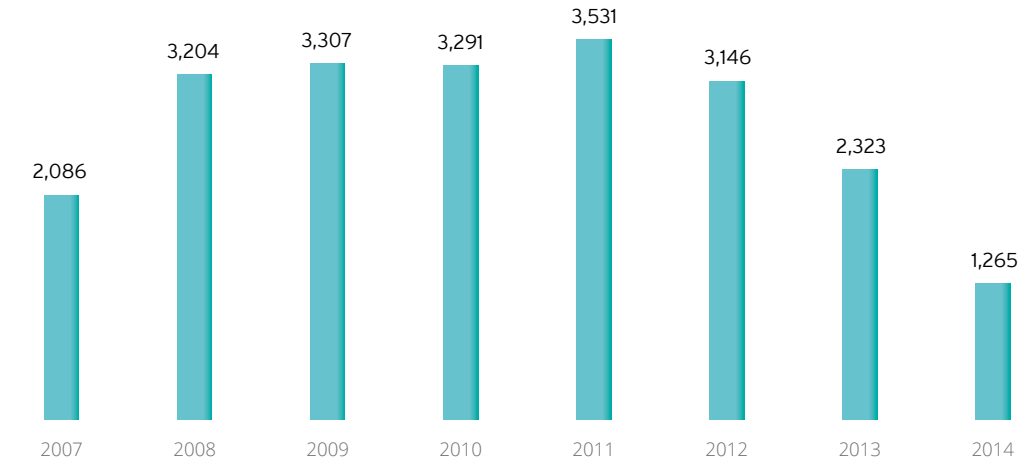


% in real terms

Chart 3.5

Induced contribution to GDP from the Renewable Eenergy Sector

Source: APPA



Current m EUR

The sector's induced contribution to GDP was of 1,265 m EUR in 2014, a tremendous fall of 45.5% compared to 2013. This is the lowest contribution within the entire series analysed herein and represents nearly a third of the sector's induced contribution in 2011 when it reached its highest value. The significant reduction in the sector's induced contribution to GDP is explained, mainly, by the stalling of building new generating plants. (Chart 3.5).

In 2014, contribution to the GDP from the different technologies was as follows: photovoltaic solar power (35.33%), wind power (20.66%),

CSP (17.72%), biomass electricity (13.93%), biofuels (5.65%) and small-scale hydropower (3.64%). Other renewable technologies contributed an aggregated 3.07% to Spain's GDP. (Chart 3.6).

Employment generated

In 2014 the entire Renewable Energy Sector employed 70,750 people, 22,665 less than in 2013 (-24.3%), which together with the 19,833

Chart 3.6 Total contribution to GDP from the Renewable Energy Sector, by technologies

Source: APPA

Current m EUR	2007	2008	2009	2010	2011	2012	2013	2014
Biofuels	147	151	350	494	426	359	299	418
Biomass electricity	1,055	1,103	1,044	1,089	1,150	1,310	1,395	1,029
Biomass thermal	68	79	78	76	72	69	72	79
Wind	3,294	3,803	3,214	2,984	2,623	2,898	1,928	1,526
High enthalpy geothermal	8	11	12	14	14	14	14	14
Low enthalpy geothermal	5	7	12	20	22	21	25	28
Marine	6	6	8	10	12	12	12	12
Small-scale wind	40	44	46	53	56	55	22	21
Small-scale hydropower	462	527	503	554	528	462	588	269
Photovoltaic solar	391	1,586	3,064	3,129	3,012	3,344	3,005	2,610
Thermal solar	42	95	75	63	50	49	65	73
CSP	45	723	1,182	1,650	2,360	1,942	2,072	1,309
Total contribution to GDP	5,561	8,136	9,588	10,135	10,325	10,535	9,497	7,387

employments lost in 2012, left the employment figure at its lowest level in the series analysed herein. The sector has lost nearly half of the jobs it had in 2008, when it reached its record with an aggregate amount of 136,163 employees. (Chart 3.7).

The technologies that registered a net employment increase in 2014 were biofuels (895), thermal biomass (171), thermal solar (97), low enthalpy geothermal (83) and small-scale wind power (12). In contrast, the technologies destroying the greatest number of employments

Chart 3.7 Direct and induced employment in the Renewable Energy Sector

Source: APPA

were biomass power (-13,135), thermal solar (-8,820), wind (1,097), photovoltaic solar (-823), small-scale hydro power (-41), high enthalpy geothermal (-6) and marine (-1). (Chart 3.8).

In 2014 the sector employed directly 43,479 people, registering a 14.6% reduction compared to 2013, and losing 7,434 direct employments. 2014 follows the trend traced by the previous

Chart 3.8 Breakdown of employment in the Renewable Energy Sector, by technologies

Source: APPA

Employments	2007	2008	2009	2010	2011	2012	2013	2014
Biofuels	7,060	7,283	6,347	5,172	3,797	2,909	3,364	4,259
Biomass electricity	38,541	40,144	40,866	37,289	38,649	41,109	40,557	27,422
Biomass thermal	2,438	2,927	2,886	2,887	2,754	2,613	2,736	2,907
Wind	37,189	41,438	35,719	30,747	27,119	23,308	17,850	16,753
High enthalpy geothermal	106	139	213	217	212	208	208	202
Low enthalpy geothermal	207	248	349	408	569	547	623	706
Marine	85	94	115	129	153	166	302	301
Small-scale wind	745	788	806	825	847	829	285	297
Small-scale hydropower	1,491	1,597	1,610	1,588	1,528	1,497	1,502	1,461
Photovoltaic solar	9,325	27,963	12,504	11,509	11,683	11,490	10,767	9,944
Thermal solar	772	1,818	1,468	1,218	984	990	997	1,094
CSP	535	11,724	18,600	23,844	33,555	27,582	14,224	5,404
Total employment	**98,494**	**136,163**	**121,483**	**115,833**	**121,850**	**113,248**	**93,415**	**70,750**

six years: since 2008, 45% of direct employments in the renewable sector have been lost. Noteworthy is the fact that direct employment accounts for 61.45% of the renewables sector taken in its entirety. (Chart 3.9).

In 2014 the Sector only generated 27,271 indirect employments, the lowest figure in the historical series. This employment segment was reduced by 35.8% compared to 2013, losing 15,231 indirect employments. Since 2011, when indirect employment reached its highest figure, 65,548 employments, the number of employees has been reduced by 58.4% in just four years. Indirect employment accounts for 38.55% of the renewables sector taken in its entirety. (Chart 3.10).

Chart 3.9 Direct employment in the Renewable Energy Sector

Source: APPA

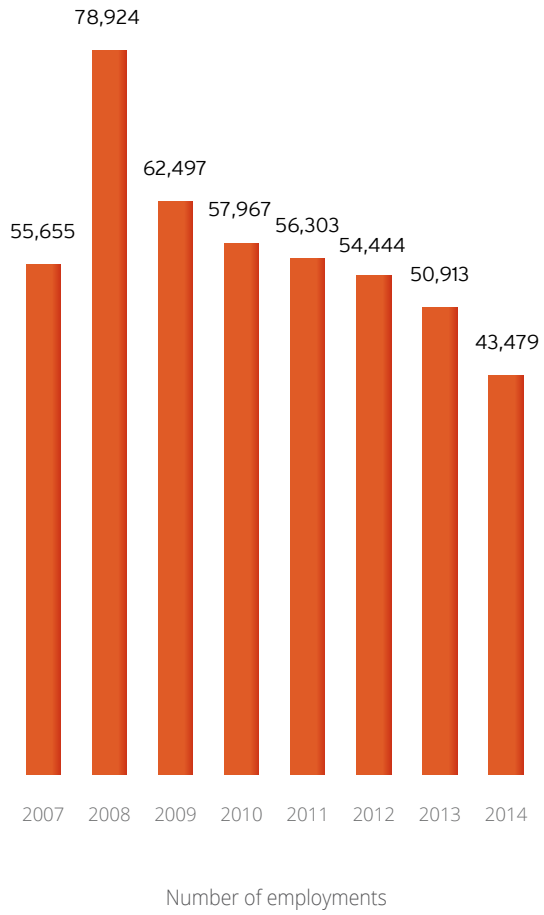
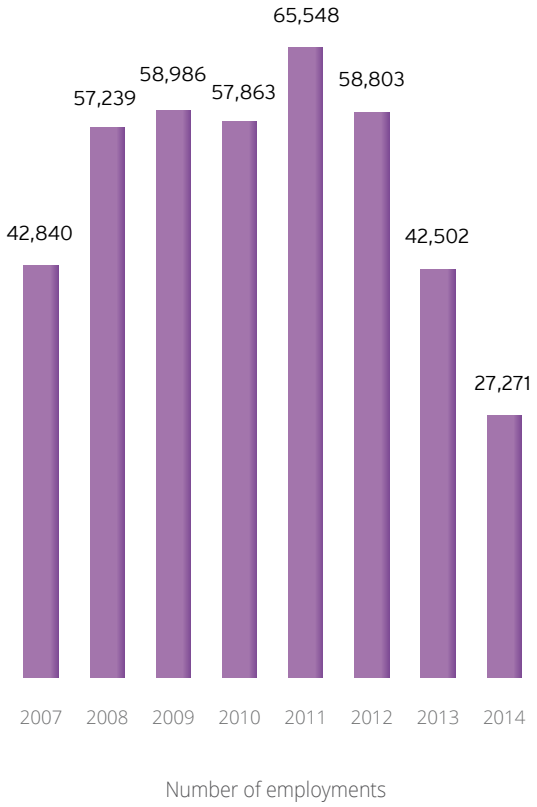


Chart 3.10 Indirect employment in the Renewable Energy Sector

Source: APPA

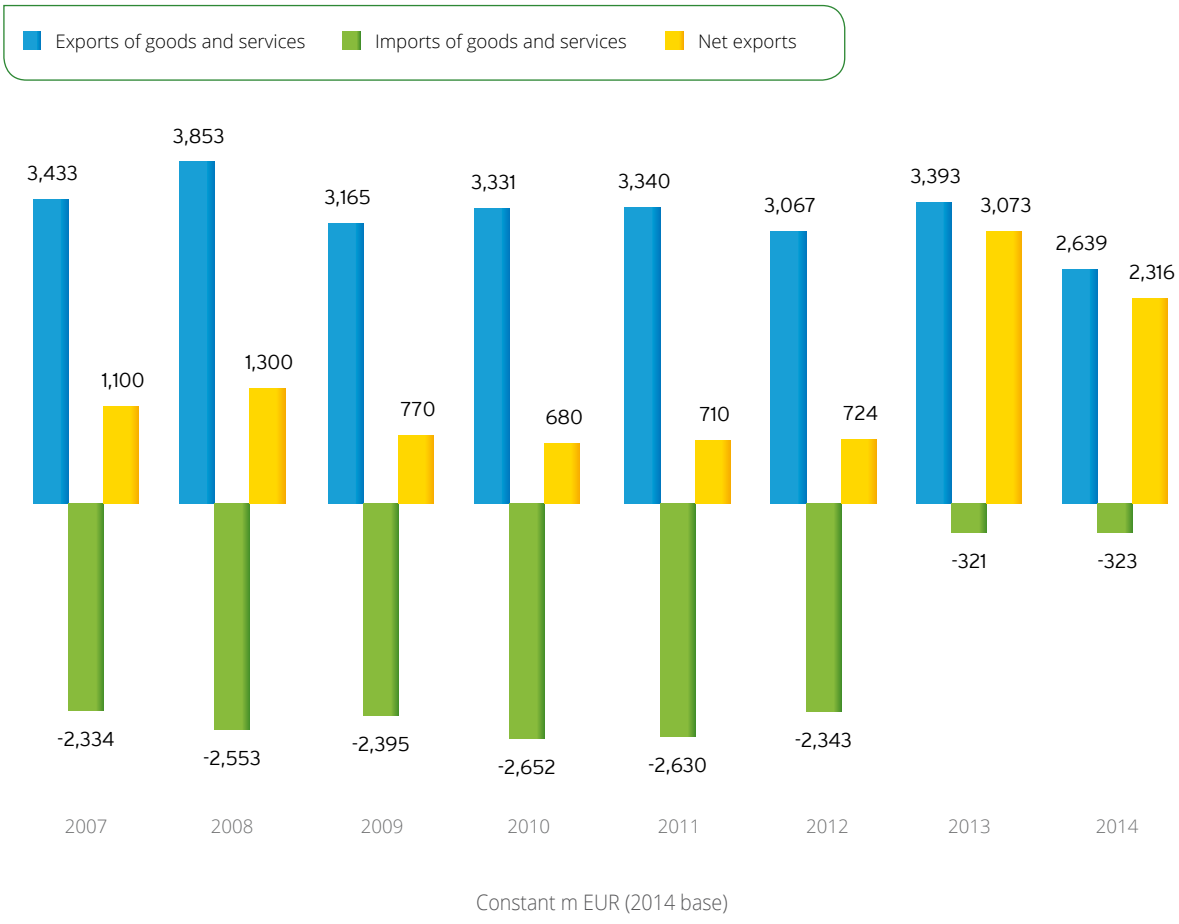


Trade balance

Once again, in 2014 the Renewable Energy Sector registered a positive trade balance. While exports of goods and services increased to 2.639 m EUR, imports amounted to a mere 323 m EUR, resulting in an aggregate amount of net exports of 2,316 m EUR. The significant reduction in imports is the consequence of the reduction of imports of goods and services initiated in 2012. The Renewable Energy Sector reached the second highest total of the series analysed. (Chart 3.11). The Renewable Energy Sector export balance contributed positively to level the Spanish trade balance, the latter amounting to 24,472 m EUR in 2014. The Spanish energy deficit (38,071 m EUR) decreased thanks to the 13,599 m EUR surplus achieved

Chart 3.11 Impact of renewable energies in exports, import and net exports

Source: APPA



Constant m EUR (2014 base)

by the Spanish renewable energy companies. (Chart 3.12). In 2014, Spain had to pay abroad 29,065 m EUR in petroleum and oil products, 8.239 m EUR in gas and 767 m EUR in coal and electricity.

Renewable energy sources constitute, given their tremendous potential and their local and clean nature, the sole alternative for sustainable energy self-sufficiency. It is clear that in a country like Spain, with enormous renewable resources and extremely high energy dependence on foreign energy, the Government should pay more attention to the numbers illustrated herein and encourage the use of renewable energies instead of preventing their development.

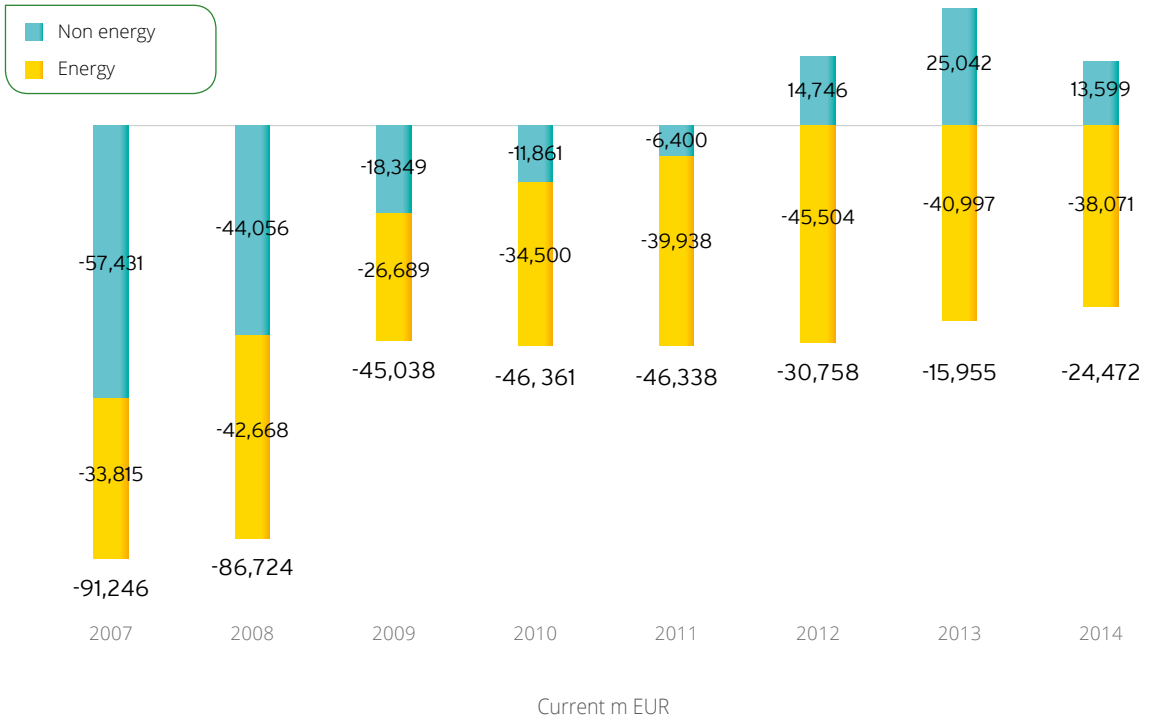
Fiscal balance

Once again, as every year in the annual series since 2005, the Renewable Energy Sector was a net fiscal contributor to the Spanish economy. The amount of taxes paid by Renewable Ener-

Chart 3.12

Spain's trade balance

Source: Spain's tax authorities

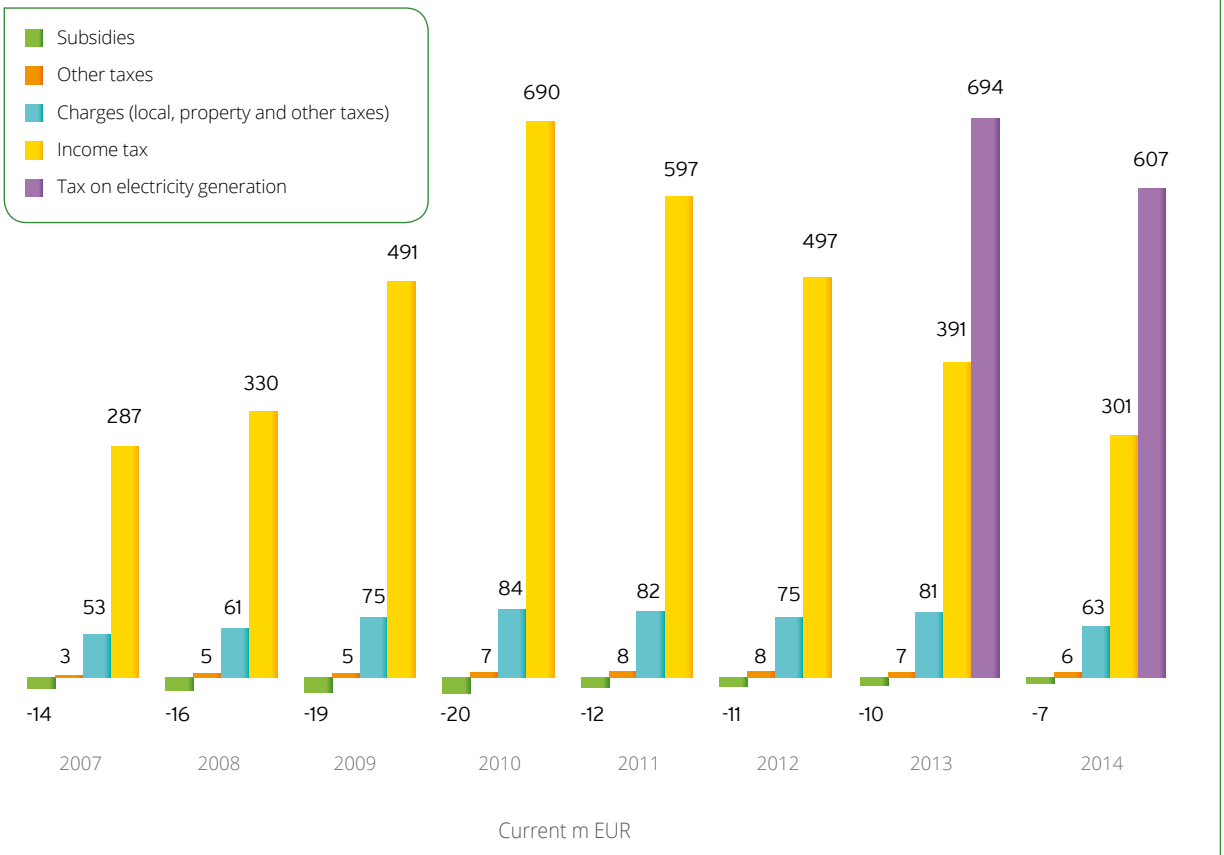


Current m EUR

Chart 3.13

Fiscal impact of the Renewable Energy Sector in Spain

Source: APPA



gy Sector companies has always been much greater than the amount of subsidies received. In 2014 the difference between taxes paid and subsidies received was 970 million euros. This contribution taxation has decreased due to the reduction in tax on company profits and the tax on electricity generation, both implemented in 2013. The tax on company profits has been reduced by over 56% since 2010. (Chart 3.13).

Contribution to R&D&I

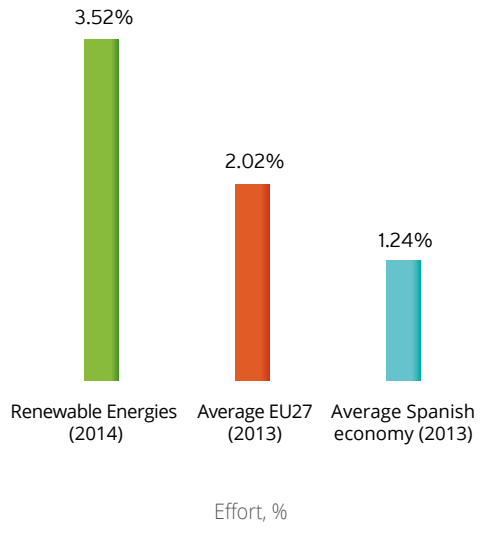
In 2014 investments in research, development and innovation (R&D&I) from companies in the Renewable Energy Sector amounted to 216 m EUR, representing in real terms 3.52% of the Sector's total contribution to GDP.

In order to assess the innovation effort of Spanish renewable energy companies, the

average percentage of its contribution to GDP (3.52%) has been compared with the average percentage of the Spanish economy in 2013 (1,24%). The renewable companies nearly tripled in percentage terms this type of investment. The figures show the Sector's strong commitment with innovation activities, seeking to help the economy towards the leading role worldwide. The sector´s effort can be also compared with the average percentage of the European Union in 2013 (2.02%), the latter being slightly higher than the Spanish economy's average percentage. It can be observed that the Spanish renewable energy sector´s average is almost two times the average percentage of investment of the European Union. (Chart 3.14).

Chart 3.14 R&D&I effort relative to GDP

Source: APPA, Eurostat and INE




4

Renewable energies: breakdown by technologies

In 2014 the different renewable technologies contributed with an aggregate of 7,387 m EUR to the Spanish GDP, representing 0,7% of it; employed 70,750 people; improved our trade balance in 2,316 m EUR; registered a positive fiscal balance amounting to 970 m EUR and invested 216 m EUR in R&D&I. And last but not least, remained committed to innovation, investing nearly the triple of the Spanish average in R&D&I.

This chapter shows the contribution of the different renewable technologies to Spanish economy over the year 2014 in detail, as well as their evolution since 2005, focusing on their respective contribution to GDP, the number of people employed and some additional information on their capacity and production.

The section includes all the renewable technologies that are currently implemented in Spain, both electricity production and thermal production technologies.

The following technologies were included:

- **Biofuels.**
- **Biomass for electricity and thermal production.**
- **Wind power.**
- **High and low enthalpy geothermal power.**
- **Marine power.**
- **Small-scale wind power.**
- **Small-scale hydropower.**
- **Photovoltaic solar power.**
- **Thermal solar power.**
- **CSP.**

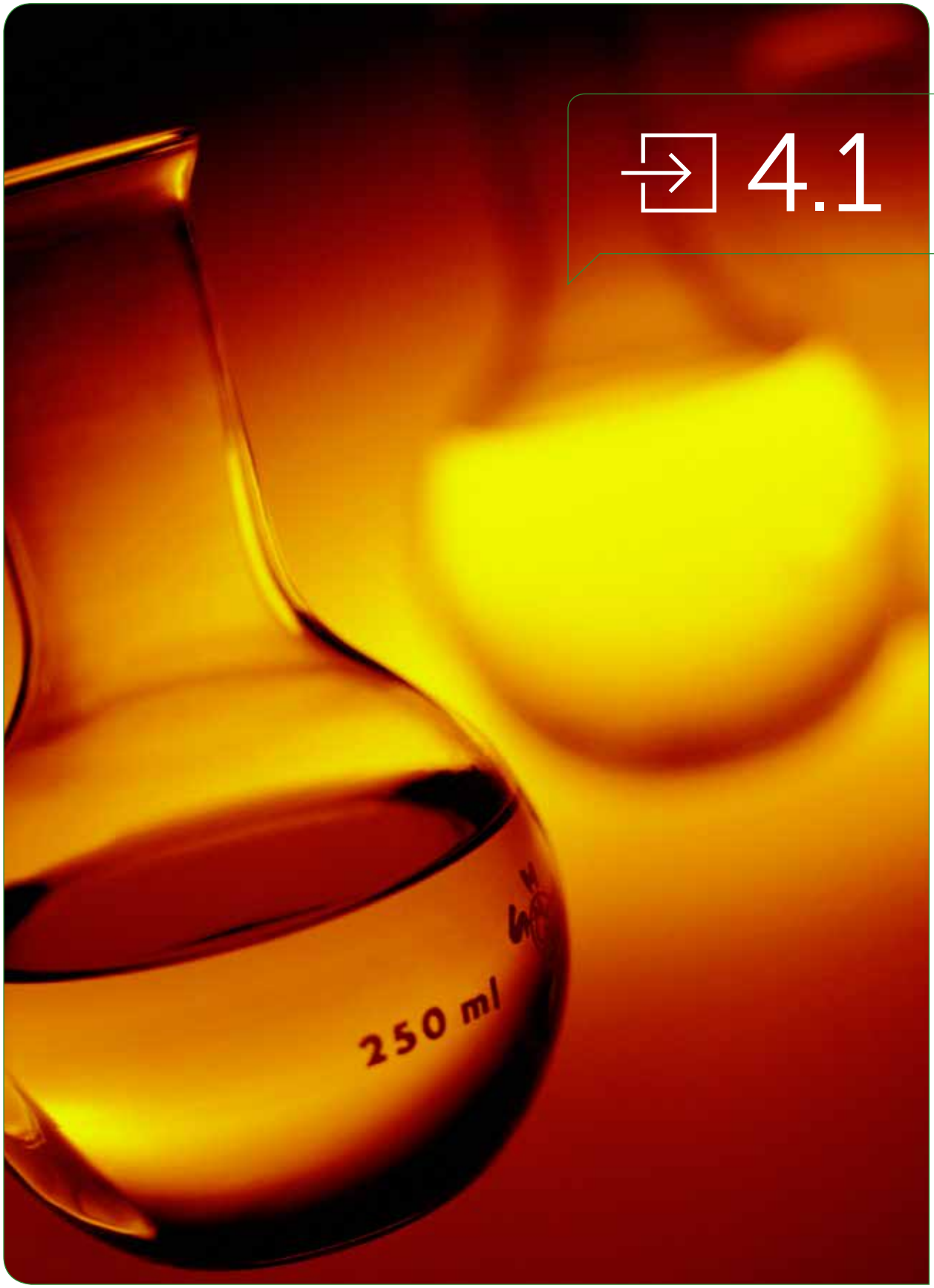

4.1
250 ml

Chart 4.1.1

Contribution to GDP from biodiesel and bioethanol sectors

Source: APPA

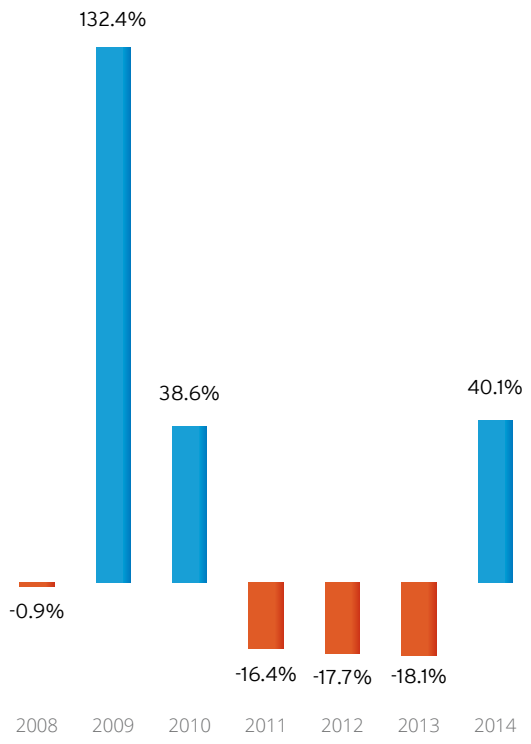
Biofuel

In 2014, total contribution to GDP from the biodiesel (hereinafter "FAME", fatty acid methyl esters) and the bioethanol sectors amounted to 417.7 m EUR of which 309.7 m corresponded to their contribution, whereas 108.0 m to induced contribution. Their aggregate contribution to GDP has increased in real terms by 40.1% compared to the previous year, resulting in a change in the downwards trend observed in the previous three years as shown in Charts 4.1.1 and 4.1.2.

Broken down by type of biofuel, in 2014 the aggregate contribution to GDP from the biodiesel subsector amounted to 308.2 m EUR, representing a 85.6% increase in real terms compared to 2013. The aggregate contribution to GDP from the bioethanol subsector amounted to 109.5 m EUR, a 17.1% reduction

Chart 4.1.2 Change in contribution to GDP from biodiesel and bioethanol sectors

Source: APPA



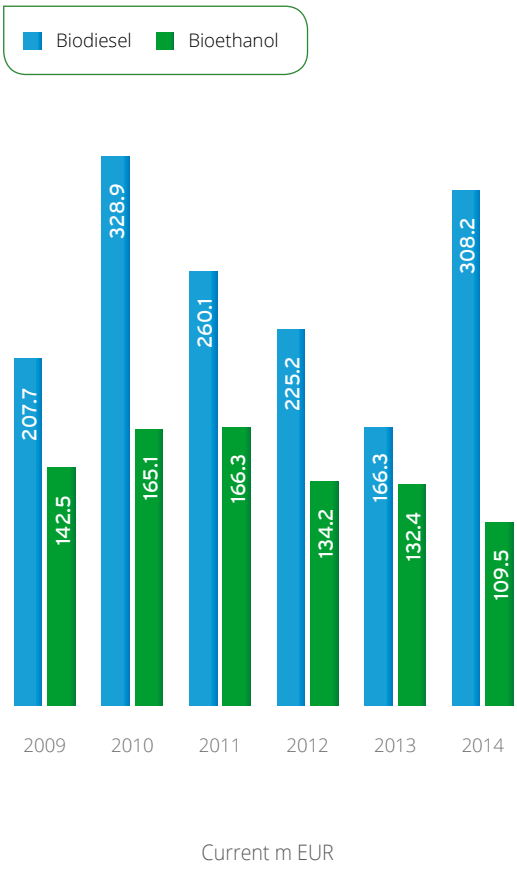
in real terms compared to the level reached in 2013 and represents its third consecutive decrease as shown in Chart 4.1.3.

The increase of the biodiesel sector contribution to GDP is due to the significant growth in production and sales in the domestic market experienced by Spanish plants. This has been possible thanks to the combination of two important regulatory measures: firstly, the launch in May 2014 of the system for the allocation of quantities in the production of biodiesel and, on the other hand, the application throughout the year of the antidumping rights to the biodiesel coming from Argentina and Indonesia.

This improvement in production occurred despite the drop in exports and the slight decrease in the consumption of biodiesel FAME in Spain in 2014. This contraction was mainly due to the increasing introduction of the hydrobiodiesel

Chart 4.1.3 Direct + induced contribution to GDP, by biofuel type

Source: APPA



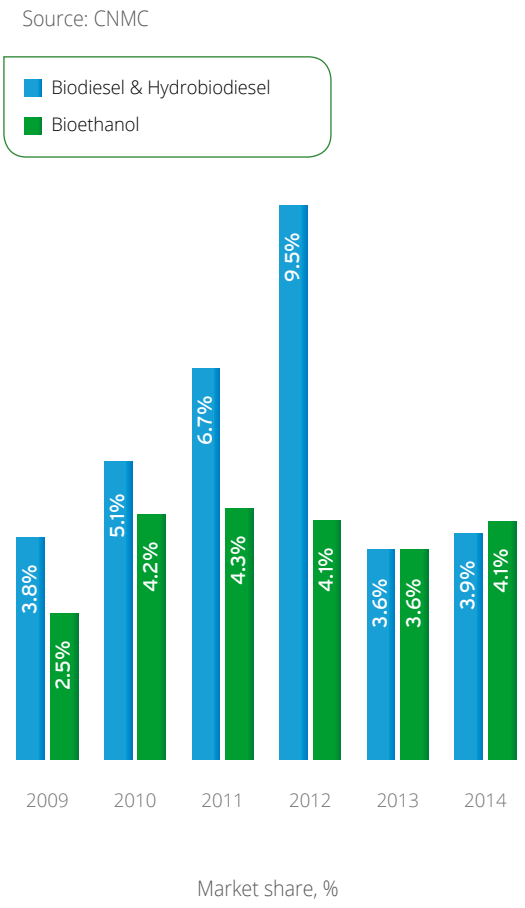
and the maintenance of the biofuel objectives set by the Government during the previous year, which were among the lowest in the European Union.

The decline in 2014 in the contribution of the bioethanol subsector to GDP can be attributed mainly to the decrease in market prices of this biofuel, since the production and sales experienced by the Spanish industry remained the same as during the previous year.

In 2014 the aggregate consumption of biofuels in Spain increased 9.2% compared to the figure for the previous year, rising from 1,071,678 to 1,169,978 tonnes ("T") according to the provisional data furnished by the Spanish Markets and Competition Comission ("CNMC"). This increase was contributed to the hydrobiodiesel (89,627 MT) and bioethanol (27,048 MT), whereas the demand for biodiesel was reduced down to 18,375 MT.

Chart 4.1.4 Actual market share of biofuels, in energy terms

Source: CNMC



Although in 2014 biofuels physically placed in Spain´s market achieved in energy terms an overall 3.9% share of the petrol and diesel markets, the overall compulsory target set for that year (4.1%) was -tightly- met thanks to the use of biofuel certificates carried over from 2013 into 2014.

Likewise, the minimum specific target for biofuels in petrol (4.1%) was slightly exceeded (4.2%) also thanks to the use of certificates that had been carried over from 2013 into 2014, representing a 3.9 % of the actual market share. The biodiesel FAME contributed to it with 2.5 percentage points, whilst the hydrobiodiesel contributed with the remaining 1.4 points.

Instead, the minimum specific target for biofuels in petrol (3.9%) was effectively reached in physical terms since the bioethanol consumed during the year achieved a real market share of 4.1% which, for accounting purposes was redu-

ced down to 3.9% once the certificates carried over into the following year were subtracted. (Chart 4.1.4).

Biodiesel situation

In 2014 consumption of FAME biodiesel in Spain represented 597,886 tonnes, a 3.0% reduction compared to the previous year and a 59.5% decrease compared to 2012. The biodiesel share in the Spanish market was 51.1%, which in its turn was slightly lower than the share achieved the previous year (57.5%).

Despite the slight decrease in demand, Spanish plants producing biodiesel managed to increase their domestic market share up to 72%, the highest since 2009, thanks to the effects of various regulatory measures applied during 2014. As an example, curbing the biodiesel dumped imports was allowed.

The production of biodiesel in Spanish plants during 2014 amounted to a total of 894,313 MT, representing an increase of 54.1% compared to the previous year and the highest production registered since 2010. Half of this production was for the domestic market, whereas the other half was exported.

Whilst the increase in production experienced by this sector helped raising the utilization ratio of the installed capacity (3.9 million tonnes) to 23%, the highest since the beginning of the biofuels target in 2009, this figure is still insufficient to ensure the sector´s economic sustainability.

Indeed, the improvement in some of the sector ratios cannot hide the deterioration of its industrial tissue in Spain: during 2014 three (3) of the thirty-eight (38) Spanish plants producing biodiesel shut down definitively in addition to the 15 that closed during the previous year, while 80% of the remaining facilities were idle or operating at minimum capacity.

Bioethanol situation

In 2014 consumption of bioethanol in Spain amounted to 292,955 tonnes, representing an increase of 10.2% compared to the previous year. For the same year, bioethanol share of Spanish market was 25%, slightly above the rate recorded the previous year (24.8%).

The increase in consumption has been favoured by the possibility of blending bioethanol and petrol directly throughout the year, once the European Commission authorised Spain by the end of 2013 to increase the steam pressure in such mixtures during the summer period.

This slight increase in demand was only experienced by the Spanish industry sales in the domestic market, which remained practically

stable in absolute terms, reaching a market share of 70%, which was lower than in 2013 (76%) but higher than the one recorded in the previous three years. Exports also remained at the same level as the previous year.

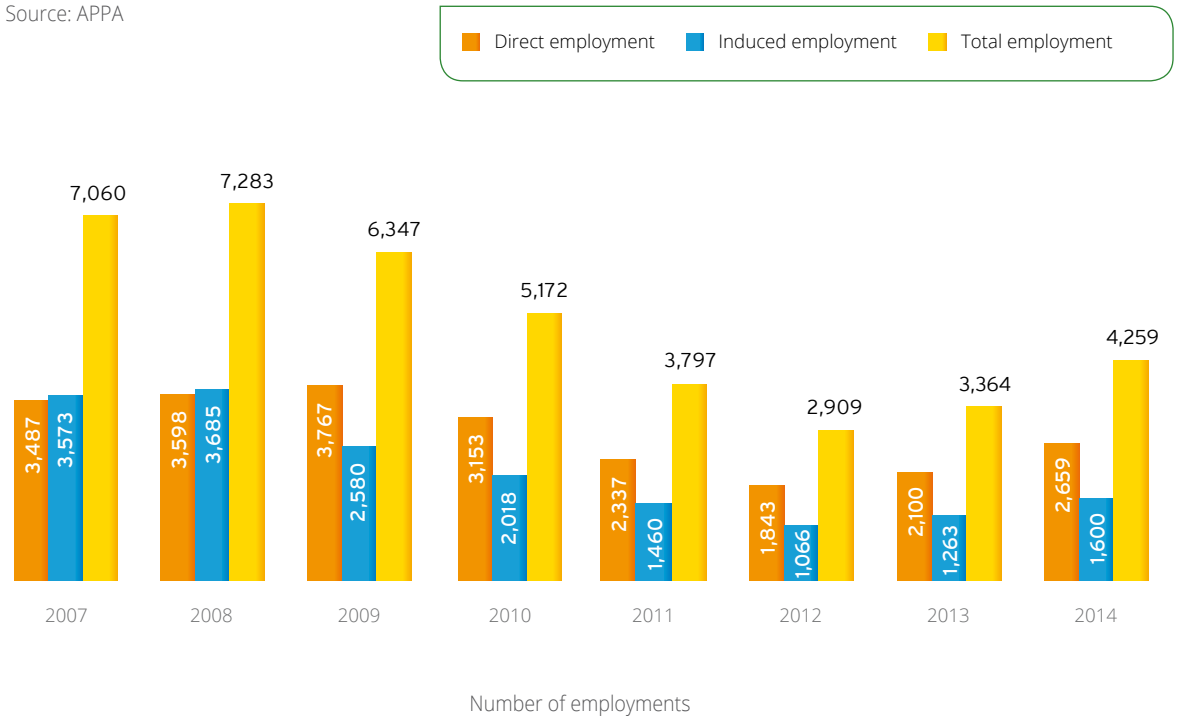
The production from the four existing plants in Spain increased slightly (+ 2.8%) compared to 2013, up to 359,262 t. On its turn, the utilization ratio of the installed capacity (389,703 tonnes) represented 92%.

In 2014 the aggregate number of direct and indirect employments generated by the biodiesel and bioethanol sector in Spain was 4,259, an increase in 895 jobs (+ 26.6%) compared to the previous year. Although these figures confirm the growing trend started last year, the fact is that the sector´s employment remains well below 40% achieved in 2008 (7,283).

The recovery of employment in the Spanish biofuels industry in 2014 is the result of the increased production, as compared to the previous year, both in biodiesel and bioethanol subsectors. This is despite the adverse impact on employment resulting from the biodiesel plants closed down in Spain. (Chart 4.1.5).

Chart 4.1.5 Direct and indirect employment in the biodiesel and bioethanol sectors

Source: APPA



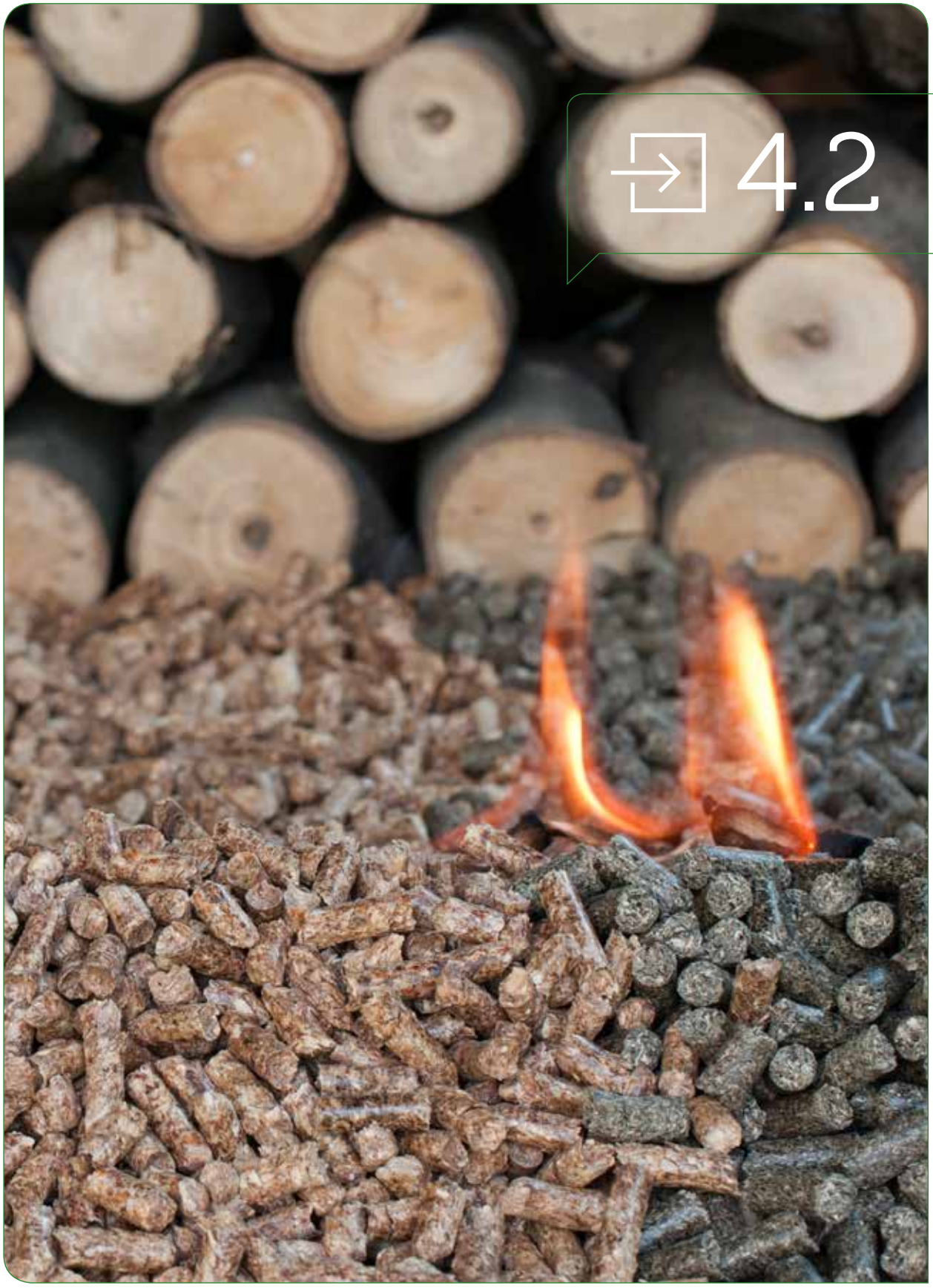

4.2

Chart 4.2.1

Contribution to GDP from the Biomass electricity sector

Source: APPA

Biomass

In 2014, the generation of clean energy from biomass in Spain has continued without reaching the expectations of the sector, especially in electricity, which has been paralysed since the energy reform took place, although in the thermal field the sector has maintained its growth. Biomass in Spain is far from occupying a prominent place in the energy mix, as happens in other developed countries, and as a renewable power generation technology it is the furthest one from meeting the REP targets for the period 2011-2020. To fulfill such targets there is a need to adopt a country strategy that fosters the development of biomass, a technology capable of generating significant economic, environmental and social value providing important benefits, such as the recovery of waste, fire prevention, the avoidance of emissions and an intensive generation of employment especially in rural areas.

Biomass for electricity production

In 2014 contribution to GDP from biomass for electricity production (solid biomass and biogas) amounted to 1,029 m EUR, a 26% decrease compared to 2013. It should be noted that out of this figure, 655 m EUR correspond to the direct contribution and 374 m EUR to the sector's induced contribution. Over 36% of the contribution of this sector to the Spanish GDP is a significant supplementary economic activity to the principal one (energy production) relating mainly to the supply of biomass (fuels) to the facilities where it is recovered. (Charts 4.2.1 and 4.2.2).

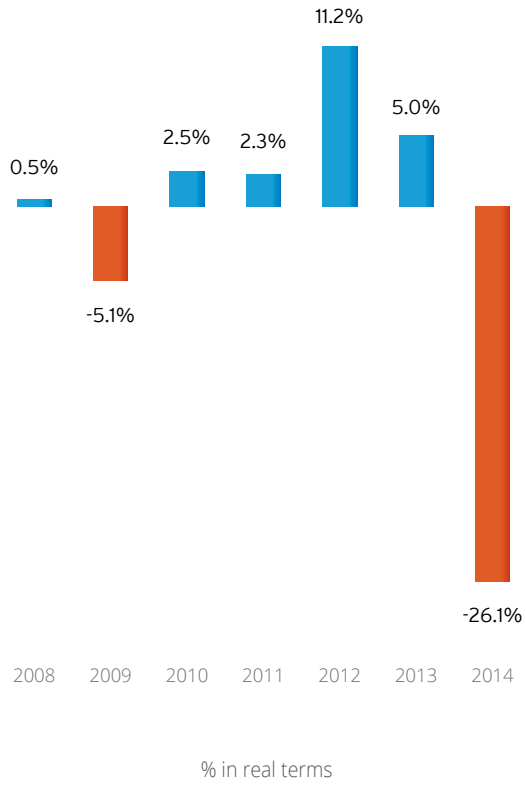
In 2014, biomass plants for electricity generation have seen their viability threatened due to the strong impact that the policy reforms implemented by the Government have had on the biomass sector for electricity production.

The regulation of the electricity production from renewable energy sources, cogeneration and waste, embodied in Royal Decree 413/2014, regulates a number of issues by sector, hampering the development of biomass power in Spain. The costs for fuel have not been modified in the said decree, costs which do not even remotely reach the figures illustrated in the official reports published by IDAE-MINETUR. On the other hand, limitations on the maximum number of hours for biomass production have not been removed, whilst such limitations have been eliminated from other similar sectors, such as cogeneration, even though biomass could be equally used.

The possibility of hybridizing with biogas and waste the production of biogas coming from the degassing of landfills with biodigestion -which came from the organic fraction of urban solid waste- has been removed, even though

Chart 4.2.2 Growth rate of the Biomass electricity sector

Source: APPA



% in real terms

it was a very common practice at the waste treatment premises. However, when calculating the compensation parameters, although "in theory" only the costs involved exclusively in the production of electricity were taken into account, also other revenues that correspond to other activities have been considered. For instance, the fee for waste treatment.

In relation to purines, the "survival plan" suggested by the purines sector has not been adopted. The aforesaid plan was mainly based on applying a transitional regime in order for the sector to prepare for the upcoming new scenario in the short term since it was unaffordable for these facilities do to this immediately. The non-adoption of the "survival plan" has led to the gradual shutting down of these facilities.

All this explains the decrease of the energy sold by this sector by 13.5% in 2014, due to the restrictions in the amount of production hours, which has resulted in a decrease in the aggregate compensation of over 20% according to the CNMC.

The decrease of installed capacity in 2013, registered in the data published by CNMC (Comisión Nacional de Mercados y la Competencia), is due to the new classification of biomass from the former group b.8.3 (RD 661/2007) into the new group c.2 (RD 413/2014). (Chart 4.2.3).

In 2014 biomass for electricity production (solid biomass and biogas) generated an aggregate of 27,422 employments, a 32% reduction compared to 2013. In the aggregate figure, 14,815 correspond to direct employments and 12,607 to indirect employments, most of them in rural areas (associated to agriculture, forestry and cattle industries). (Chart 4.2.4).

Chart 4.2.3 Evolution of installed capacity and energy sales in the Biomass electricity sector

Source: CNMC

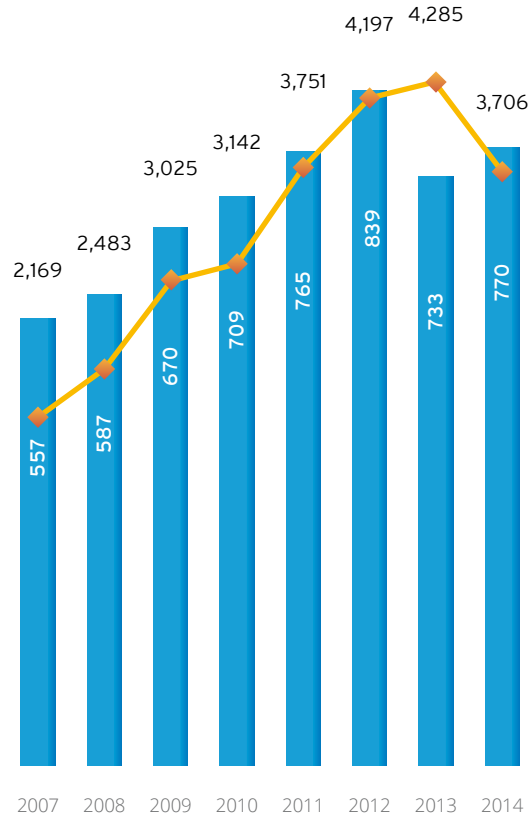
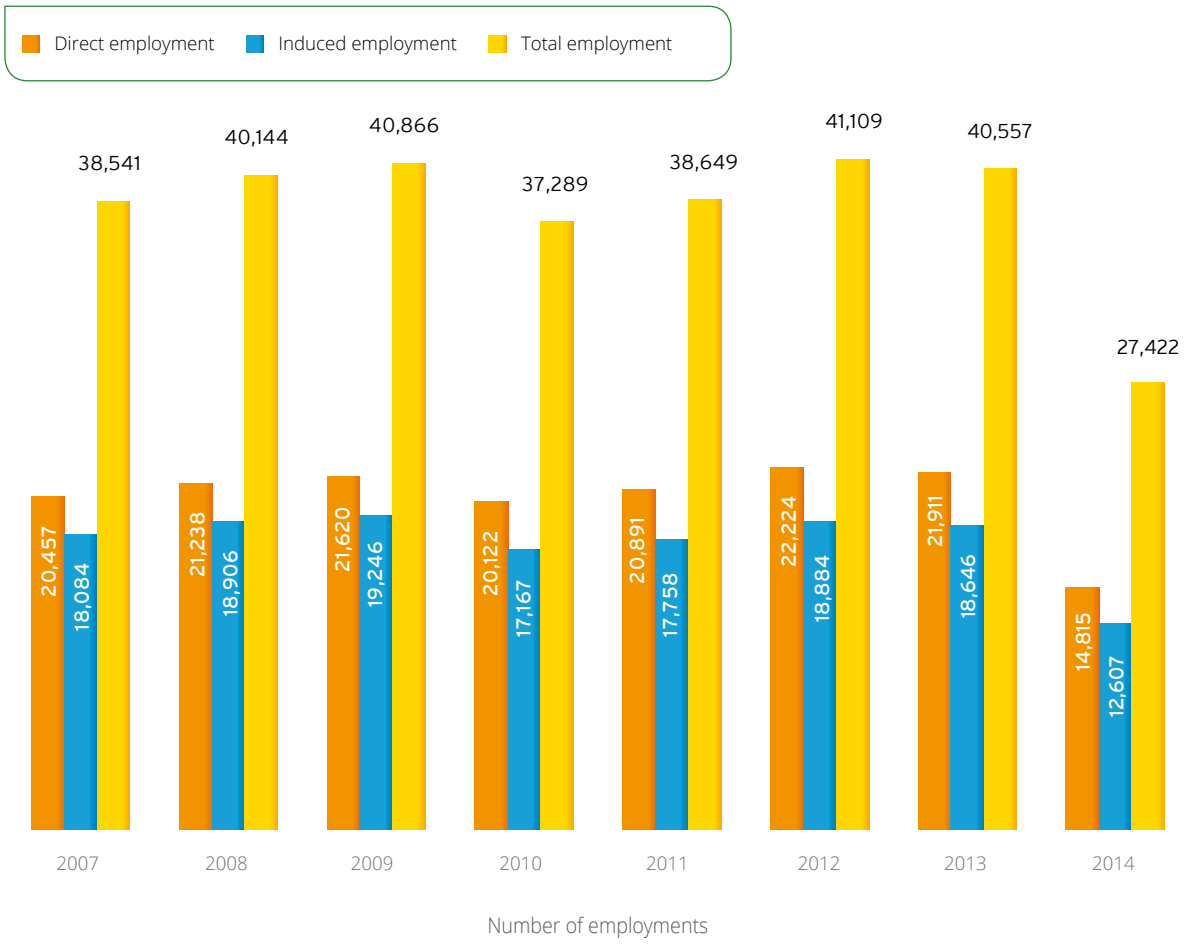


Chart 4.2.4

Direct and indirect employment in the Biomass electricity sector

Source: APPA



The decrease in production hours experienced in this sector is mainly due to the approval of Royal Decree 413/2014, which has forced the change in the management and operation of the facilities producing electric energy from biomass which, on its turn also has contributed to the loss of employments affecting, consequently, the employment figures of the industry.

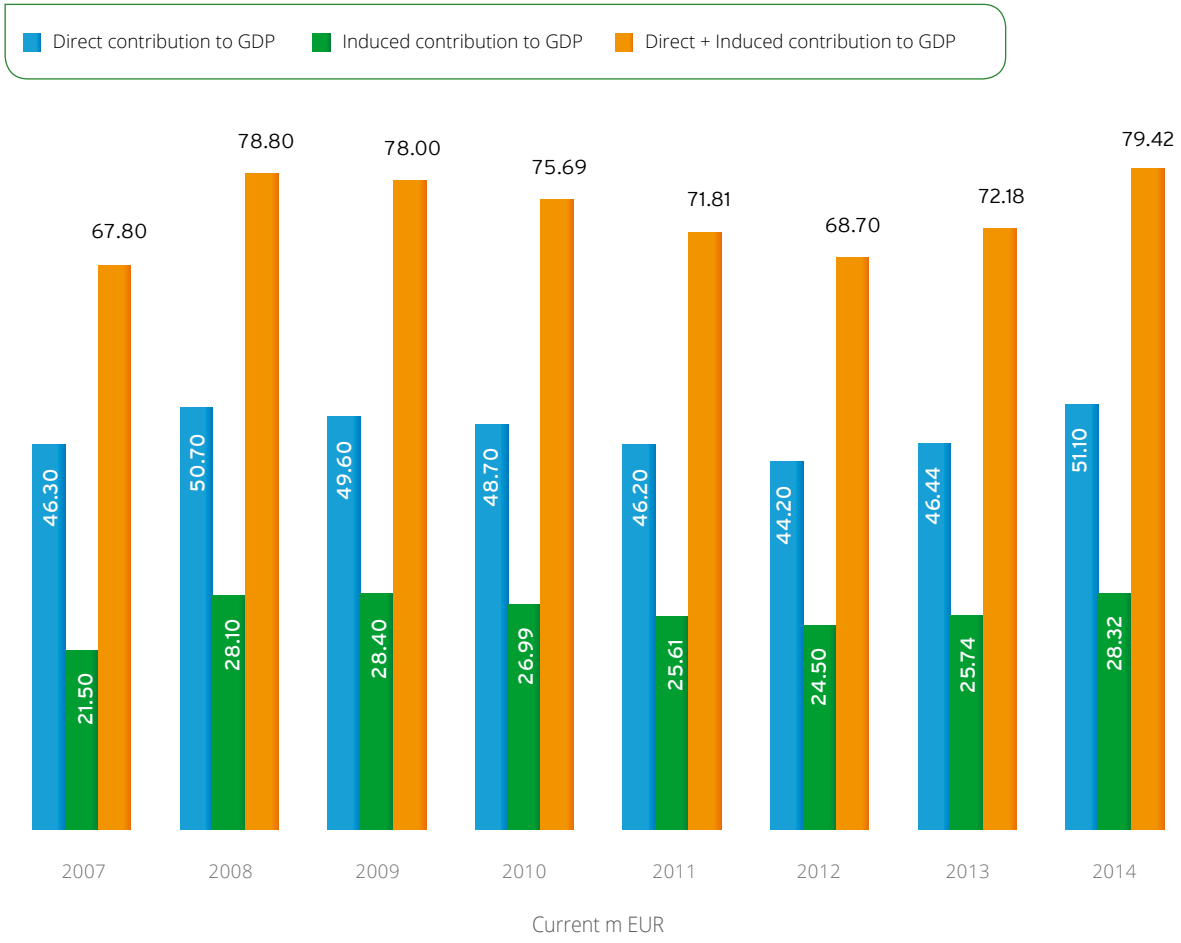
Biomass for thermal production

Charts 4.2.5 and 4.2.6 shows the contribution to GDP from biomass for the thermal production sector in 2014 as 79.42 m EUR, a 10.2% increase compared to 2013, mainly as the result of the increase in installed capacity re-

Chart 4.2.5

Contribution to GDP from the Biomass for thermal production sector

Source: APPA

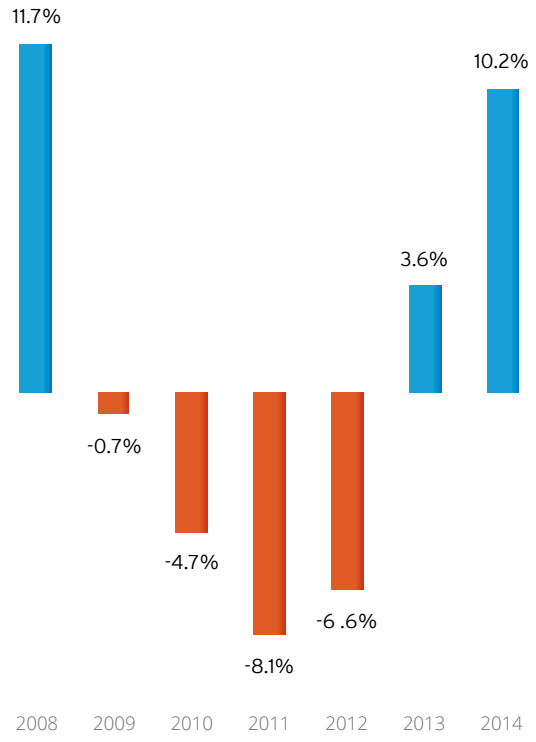


gistered in 2013. The aggregate figure includes 51.10 m EUR in direct contribution and 28.32 m EUR in induced impact. This means that over 35% of the biomass for thermal production sector´s contribution to GDP corresponded to supplementary activities to the sector's main activity, such as the collection, processing and transportation of biomass to facilities, in many cases including biomass densification. Out of the aggregate 4,088 ktep produced in 2014 from biomass for thermal generation, 4,046 Ktep corresponded to biomass and 42 Ktep to biogas. (Chart 4.2.7).

In 2014 biomass for thermal generation was the basis for the development of the biomass

Chart 4.2.6 Growth rate in the Biomass for thermal production sector

Source: APPA



sector in Spain, mainly due to the increasing introduction in home systems to generate heat and hot water. A growing interest in the possibilities offered by this renewable source has been shown in Spain, generating significant environmental and economic benefits. A very attractive energy option that offers stable and competitive prices compared to traditional fuels.

In 2014 the biomass for thermal production sector generated a total of 2,907 employments in aggregate, mainly located in rural areas where biomass resources are generated and where facilities are typically located. The aggregate figure includes 1,881 direct employments and 1,026 indirect employments. The number

Chart 4.2.7 Biomass for thermal production, evolution of generated Energy

Source: MINETUR

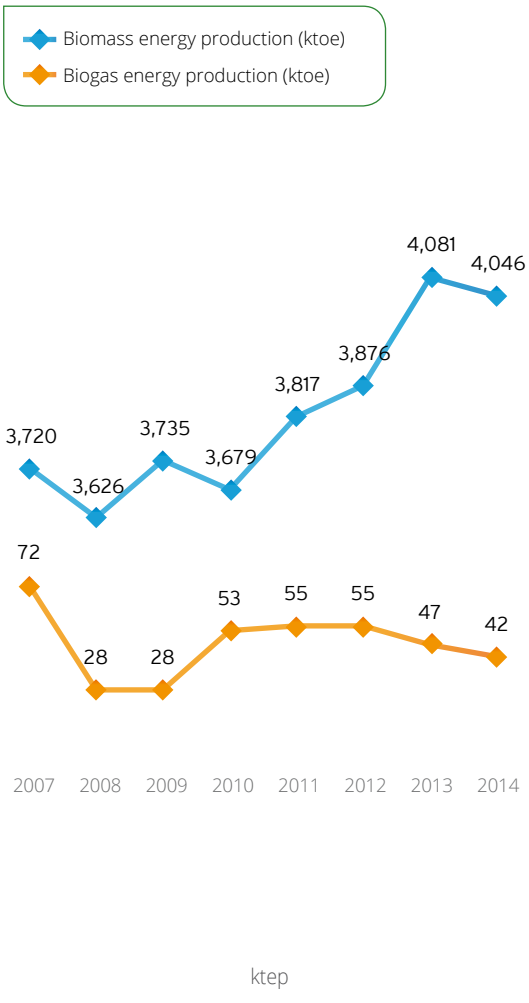


Chart 4.2.8

Direct and indirect employment in the Biomass for thermal production sector

Source: APPA

of employments generated by this sector represents a 6.2% increase compared to 2013. This increase is closely related to the substantial amount of labour required forinstallation and maintenance of facilities using biomass for thermal production. (Chart 4.2.8).

Biomass facilities for thermal production generate stable employments in rural areas where the biomass resources are located. Many of the employments are associated with the extraction, processing and supply of biomass needs of those facilities.

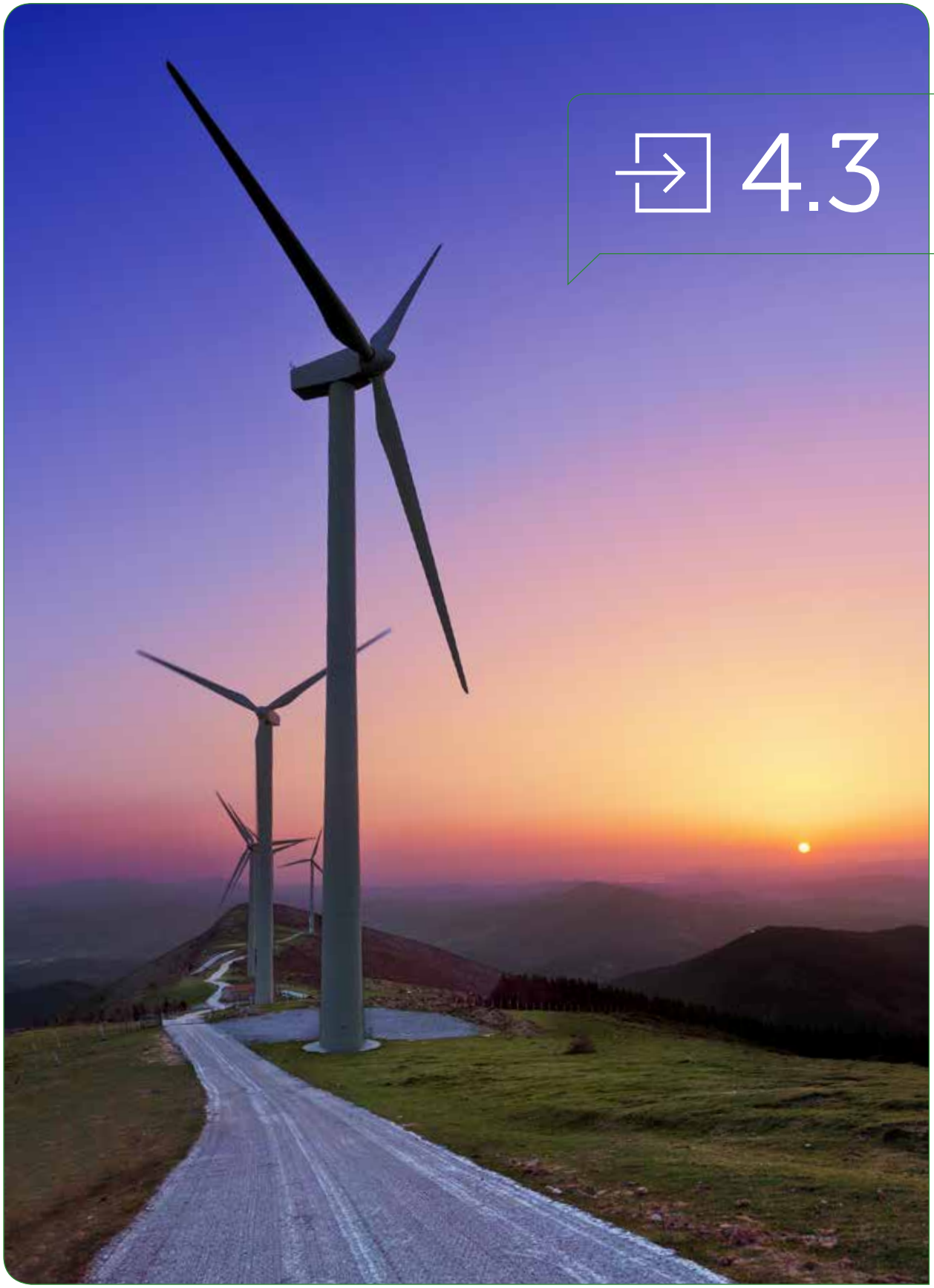
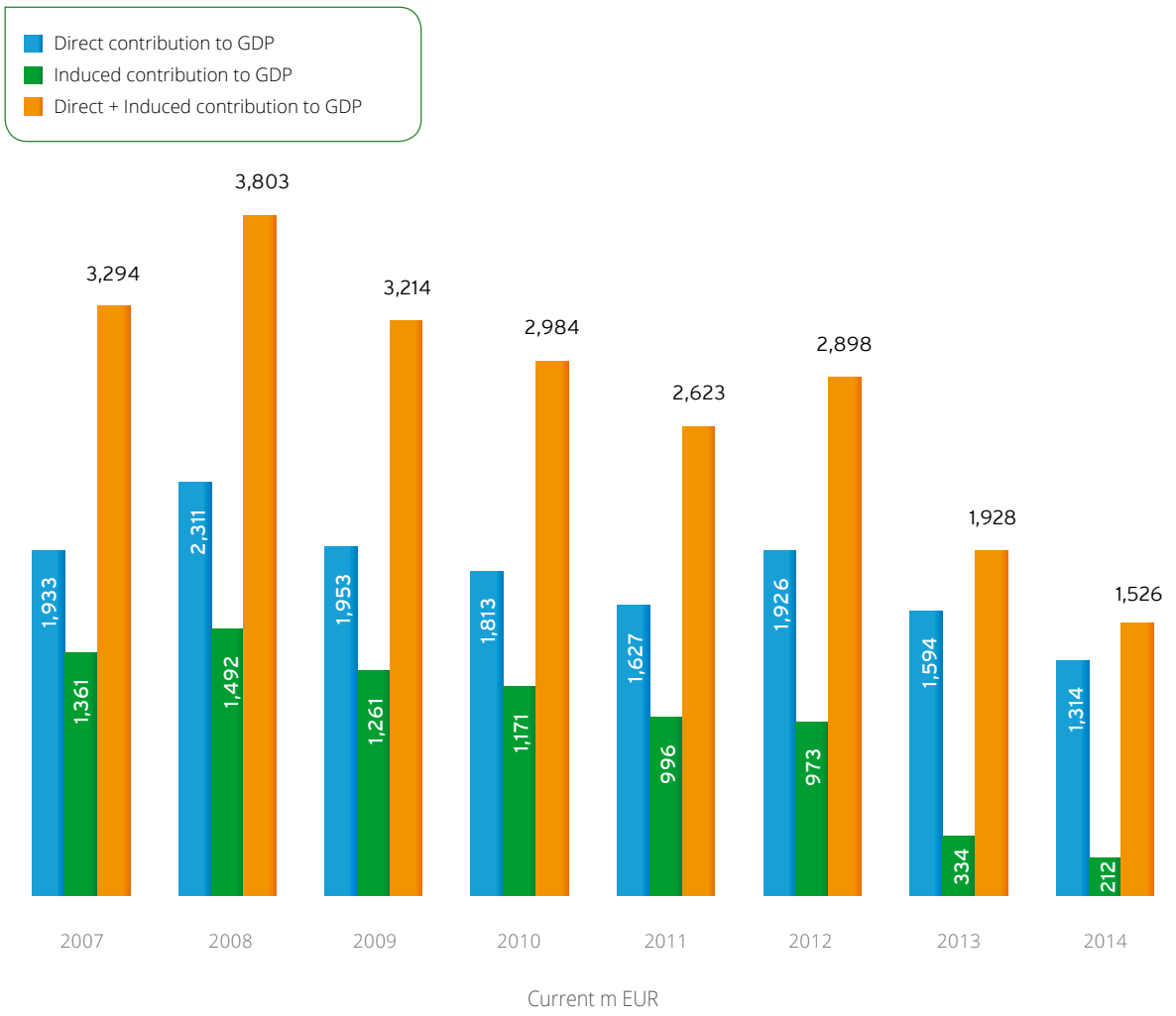

4.3

Chart 4.3.1

Contribution to GDP from the Wind power sector

Source: APPA



Wind power

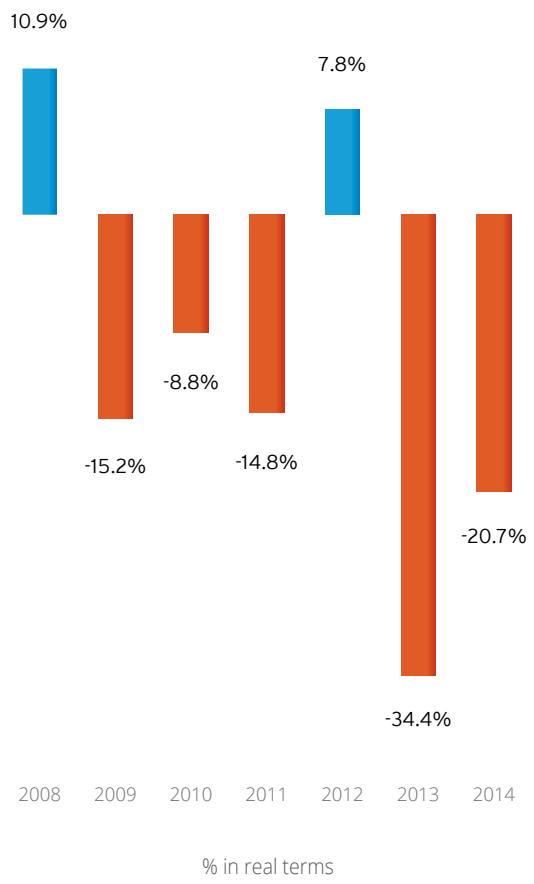
In 2014 the contribution of the wind power sector to GDP amounted to 1,526 m EUR, of which 1,314 m EUR corresponded to its direct contribution (86%), and the remaining 212 m EUR (14%) to its induced contribution. (Chart 4.3.1).

In 2014 the wind sector reduced its contribution to GDP over 20% compared to 2013. (Chart 4.3.2). The indirect contribution is the one with

Chart 4.3.2

Growth rate in the Wind power sector

Source: APPA



a greater decline. The reduction of the wind contribution to GDP compared to 2008 is about 60%. In the past seven years, the drag effect of the wind sector on the rest of the Spanish economy has been reduced over 85%. These values demonstrate the slowdown that the wind energy has suffered in the recent years and the negative impact it has had on the retribution of the power generated by this technology.

The aforementioned reduction confirms the negative impact of the disastrous energy policy recently implemented by the Spanish Government, which on the one hand, has reduced the industrial activity and, on the other hand, has decreased the revenues for the sector in 2014 caused by the retrospective measures implemented by the Ministry mid-2013. These measures have represented a reduction in wind power remuneration over 2 bn EUR compared to 2012.

The perverse methodology established in the Royal Decree 413/2014 and Ministerial Order 1045/2014 has entailed the lack of regulated remuneration for around 6,200 MW of the wind technology, thus wind power is only remunerated by the market price. Moreover, wind facilities counting with only 10 years of useful life, have to compete on equal terms with plants that have been amortising for decades.

The reduction of the contribution to GDP is the result of the aforesaid retroactive measures and the lack of a forward-looking approach for the wind sector. Another aspect to be considered is the lower energy production (-6%) in 2014 compared to the volume recorded the previous year – in 2013 wind appeared to be an exceptional resource.

If 2013 went down in history as the year in which wind was the main source of electricity generation in Spain, ahead of nuclear, 2014 will be the year in which the lowest volume of

MW has been commissioned since the birth of this technology in the mid-90s. In 2014 only 25 MW of wind technology were commissioned, representing 1% of the installed capacity, for example, in 2009. The figure also contrasts with the power commissioned in other European Union countries such as Germany and UK, with 5,279 in 2014 and 1,736 MW installed, respectively. However, wind power remains the most developed renewable energy in Spain with an aggregate installed capacity of 23,002 MW and generating almost 51,000 GWh under the Special Regime in Spain. (Chart 4.3.3).

Since 2009 there has been a constant reduction of the sector's growth rate. The reduced industrial activity has resulted from the lack of a stable and predictableregulatory framework and the implementation of the latest electricity reform. Still, wind energy remains as the industrial benchmark in Spain. Currently, the Spanish wind power sector has some 200 producing installations. Production centres continue to exist thanks to the Spanish wind power sector's export capacity, the highest among renewableenergies.

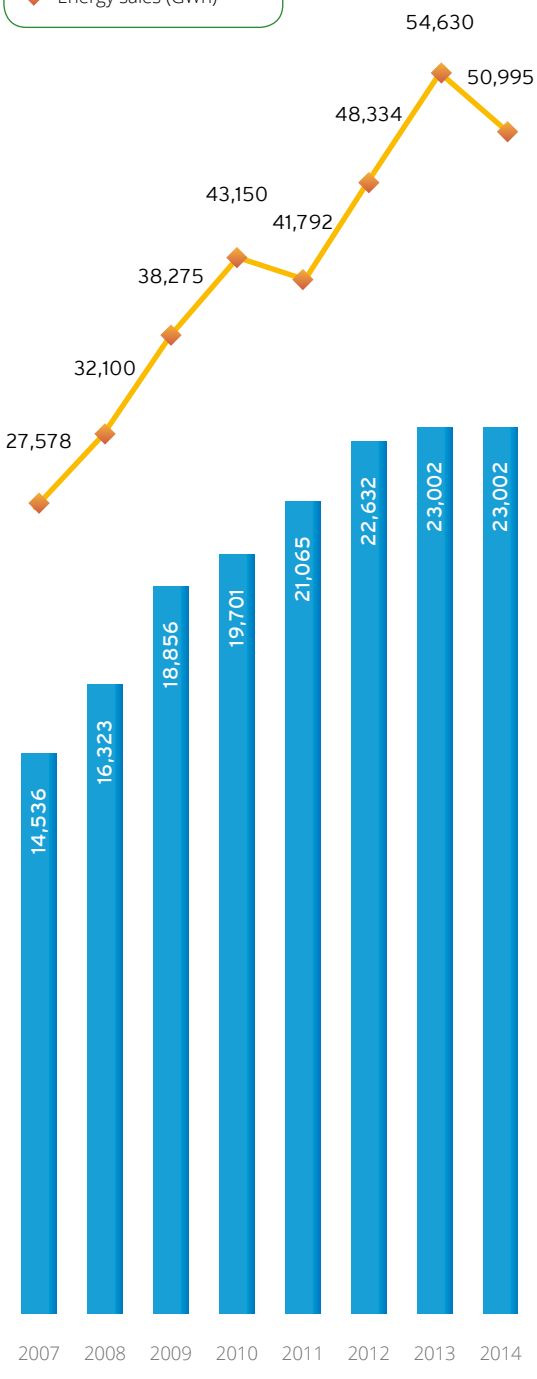
However, keeping the wind power industry in Spain will be all but impossible without the recovery of the domestic wind-power market.

According to the Energy Plan for 2015-2020 (draft) launched in mid-2014, which includes the binding targets set in the Directive 2009/28/EC, it is necessary to operate between 4,500

Chart 4.3.3

Evolution of installed capacity and energy sales in the Wind power sector

Source: CNMC



and 6,500 MW of wind technology to meet the targets established in the aforesaid Directive by 2020. Unfortunately, to date, the renewable moratorium established by the RD-Law 1/2012 is still applicable and thus, no steps have been followed towards the implementation of the Energy Plan.

It is an indispensable requirement for the future of the wind industry to put in place the necessary measures to ensure a stable and predictable regulatory and retributive framework. Such strategy should be implemented as soon as possible so new investments are attracted and the reduction experienced by the sector in the past few years as a result of the policies implemented by the Government is effectively overcome.

To this purpose, the Government should make a firm commitment to invigorate the wind power sector by, for instance, promoting the repowering of facilities or extending the useful life of those facilities where repowering is not possible due to environmental issues. These measures, together with the technological maturity of the wind would enable the sector keep being the leaders which would not only benefit the domestic sector but also the Spanish economy.

In 2014 the wind sector employed 16,753 jobs, 9,466 of which were direct employments and 7,287 indirect employments. Compared to 2013, the sector registered a reduction of

1,097 employments, the sixth consecutive year for 24,200 employments lost on aggregate. In 2014 the wind power sector generated 60% less employment than in 2008, when the number of people employed in the sector was the year in 41,438. (Chart 4.3.4).

Chart 4.3.4

Direct and indirect employment in the Wind power sector

Source: APPA

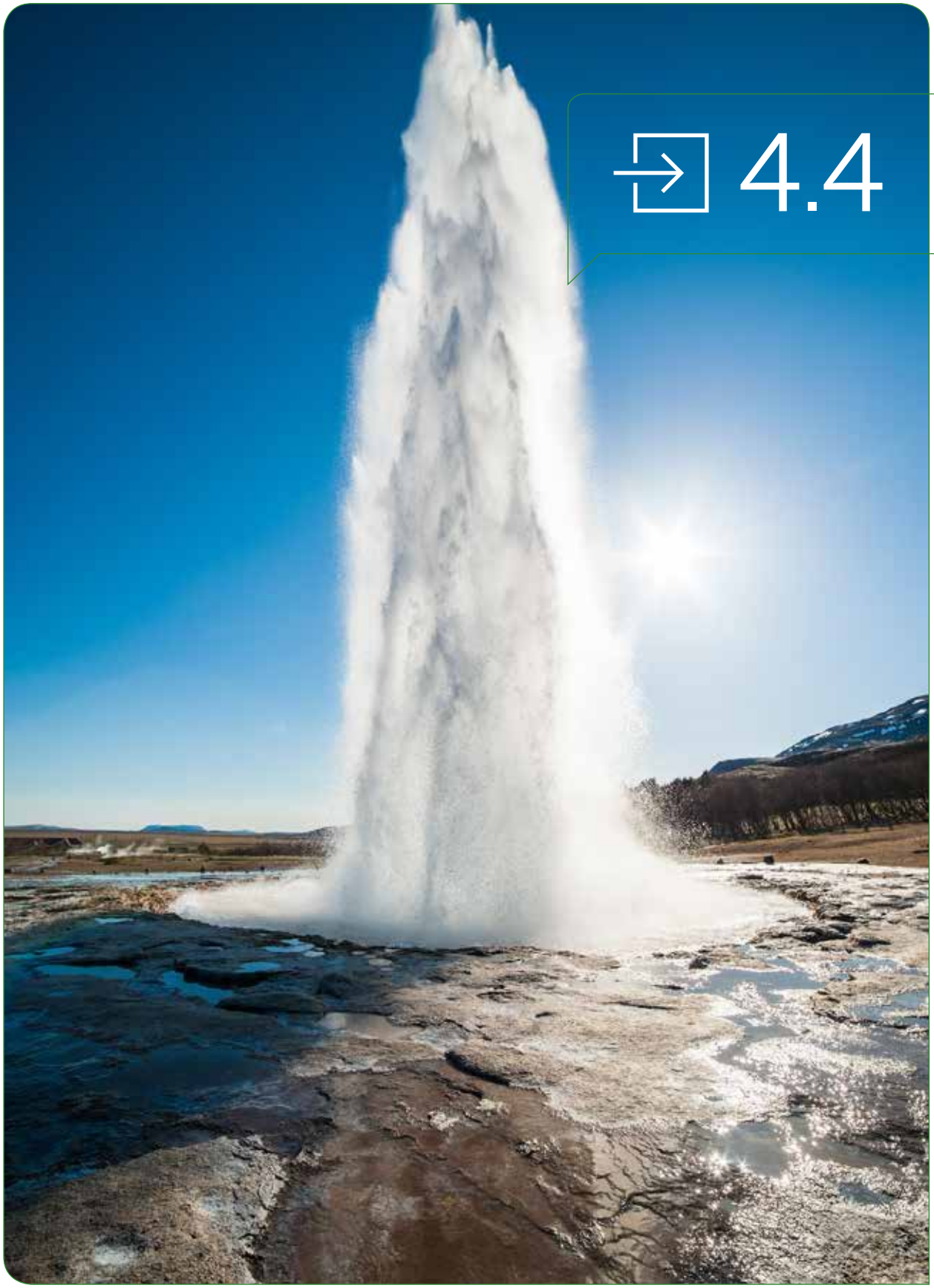

4.4

Chart 4.4.1

Contribution to GDP from the High enthalpy geothermal sector

Source: APPA

Current m EUR

Geothermal power

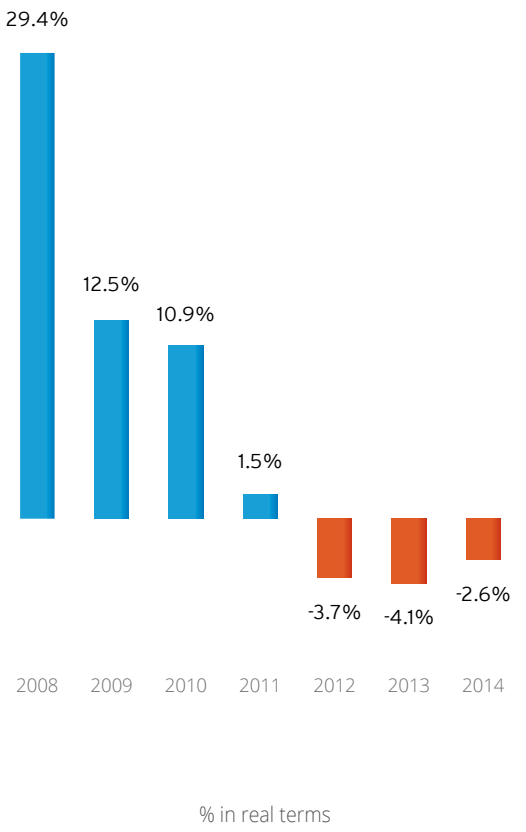
Despite its great potential for both domestic and industrial usage regarding electricity generation, in Spain geothermal energy has continued experiencing a slow penetration throughout 2014.

The production of electricity from geothermal energy can be uninterrupted and is 100% manageable so it can become a good regulator of the electrical system.

Geothermal energy is at an early stage of development but its enormous potential lies in the fact that it can contribute to the Spanish energy goals. Apart from the traditional geothermal energy, there is the opportunity to expand this technology on the basis of new induced geothermal systems and new thermodynamic cycles.

Chart 4.4.2 Growth rate in the High enthalpy geothermal sector

Source: APPA



% in real terms

High enthalpy geothermal power

In 2014 the high enthalpy geothermal power sector contributed with 15.53 m EUR to the Spanish GDP, representing a decrease of 2.6% over the previous year. Substantially almost the entirety of this amount is related to direct contribution resulting from actions in connection with R&D&I for the assessment of high enthalpy geothermal resources in Spain. (Charts 4.4.1 and 4.4.2).

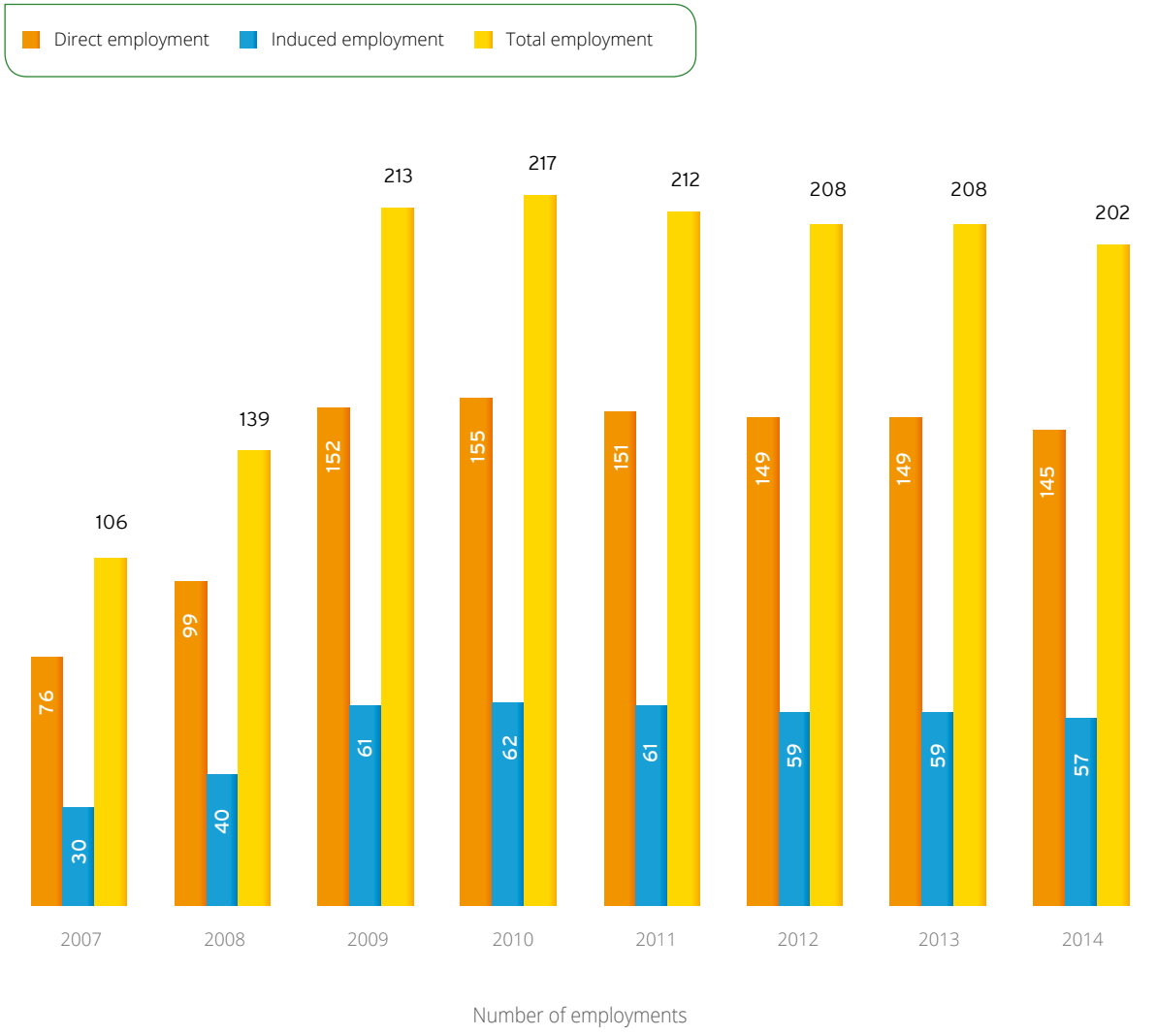
The development of geothermal energy for the production of electricity has been affected in 2014 by the situation of the Spanish electricity sector reform. The regulatory framework for this technology is absolutely unfavourable: Order IET/1045/2014, which establishes the compensation parameters applicable to those facilities that produce electrical energy from renewable energy sources, cogeneration and waste, does not even assign remuneration to the high enthalpy geothermal sector. This is the reason why not a single installation has been promoted in Spain despite the existence of important entrepreneurial initiatives to do so.

The employments associated to this technology are particularly located in the phases of engineering, procurement and construction. In 2014 the number of employments generated by the high enthalpy geothermal sector remained stable compared to 2013, due to the stagnation currently affecting the sector as a

Chart 4.4.3

Direct and indirect employment in the High enthalpy geothermal sector

Source: APPA



result of the lack of electric power being installed in Spain.

Chart 4.4.3 shows that high enthalpy geothermal energy for the production of electricity employed 202 people, of which 145 were direct employments (from engineers, drillers and equipment manufacturers to project managers) and 57 indirect employments (suppliers of raw materials and induced employees).

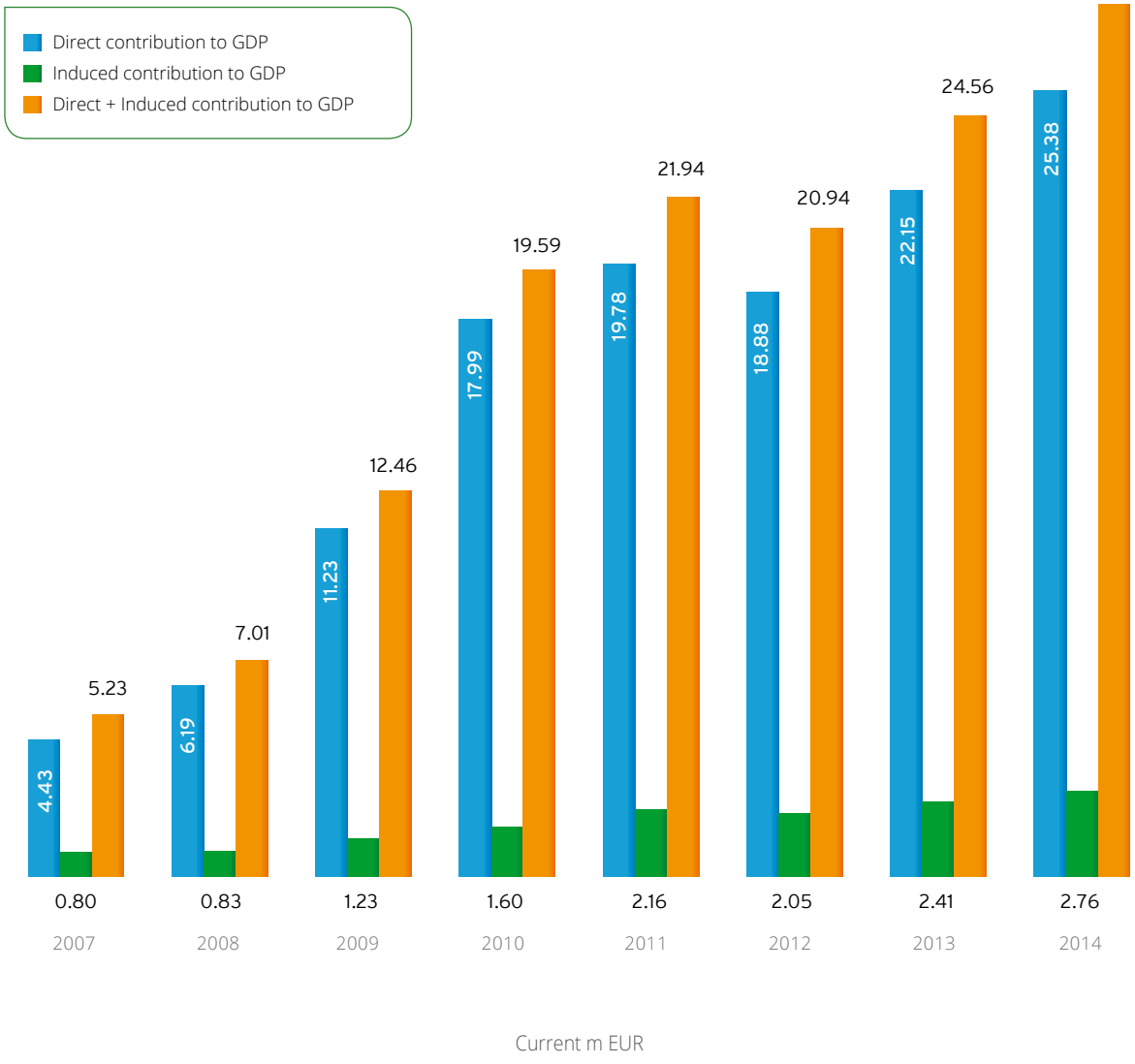
Low enthalpy geothermal power

In 2013 the low enthalpy geothermal power contributed with 28.14 m EUR to the Spanish GDP, 25.38 m EUR of which relate to its direct contribution and 2.76 m EUR to its induced contribution. (Chart 4.4.4). These figures represent a 14.8% increase in direct contribution to GDP compared to 2013. (Chart 4.4.5). The electri-

Chart 4.4.4

Contribution to GDP from the low enthalpy geothermal sector

Source: APPA



Current m EUR

city generated from low enthalpy geothermal power in 2014 amounted to an aggregate of 19.7 ktep, following the upwards trend of the series analyzed in Chart 4.4.6.

Chart 4.4.5 Growth rate in the Low enthalpy geothermal sector

Source: APPA

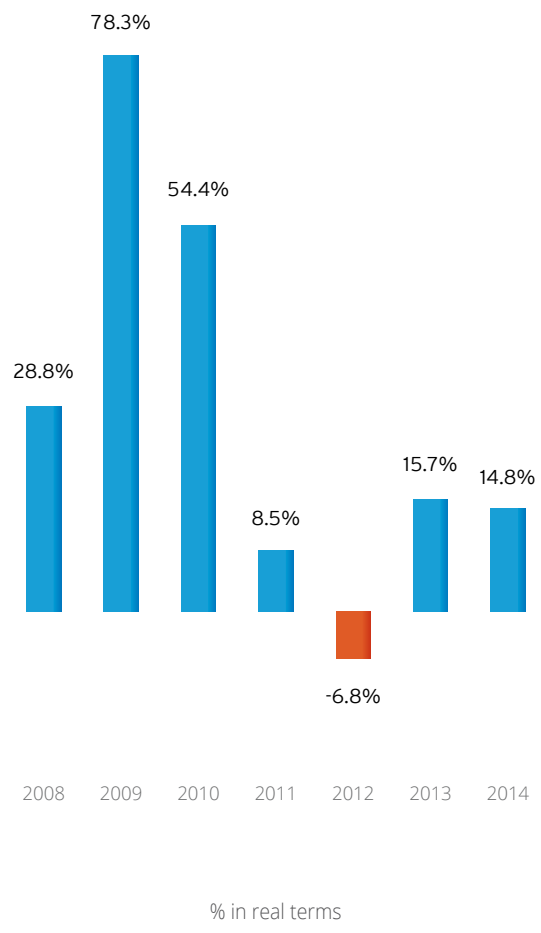
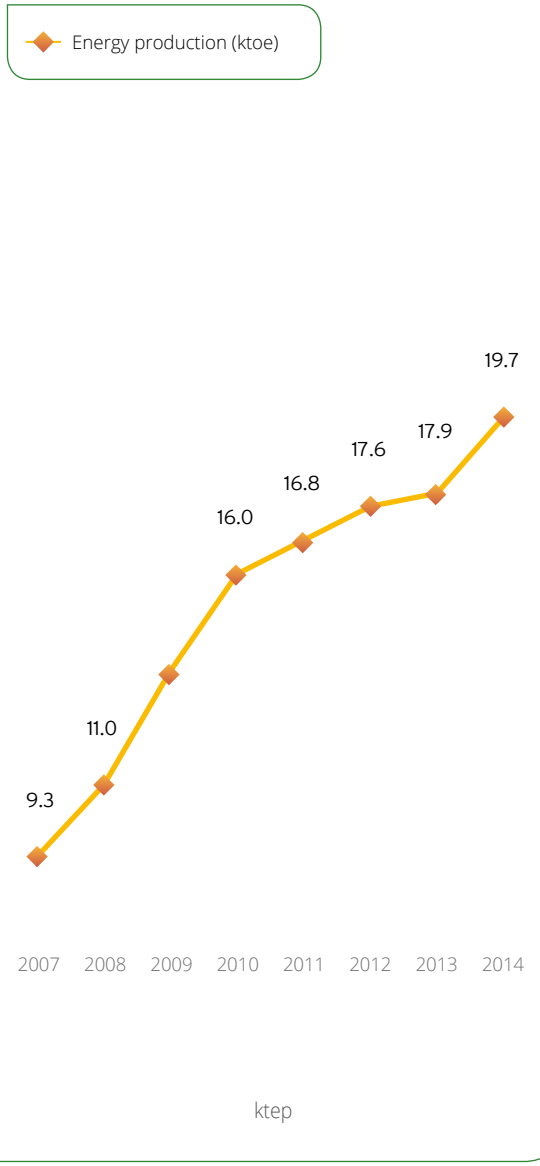


Chart 4.4.6 Evolution of energy generated from the Low Enthalpy Geothermal Sector

Source: MINETUR



In 2014, geothermal energy for thermal generation has improved the situation compared to the previous year. This was due to an increase in the installed capacity, thanks mainly

to a greater participation in the rehabilitation of the residential buildings sector, where low enthalpy geothermal power can also offer unbeatable performances.

In Spain there is an installed thermal capacity which can exceed 100 MWt and geothermal potential for thermal uses that can exceed 50,000 MWt, according to the PER 2011-2020. Reducing the cost of thermal generation and increasing the efficiency of heat pumps are the main challenges that the sector must overcome in order to encourage its development and reach the potential set up in PER.

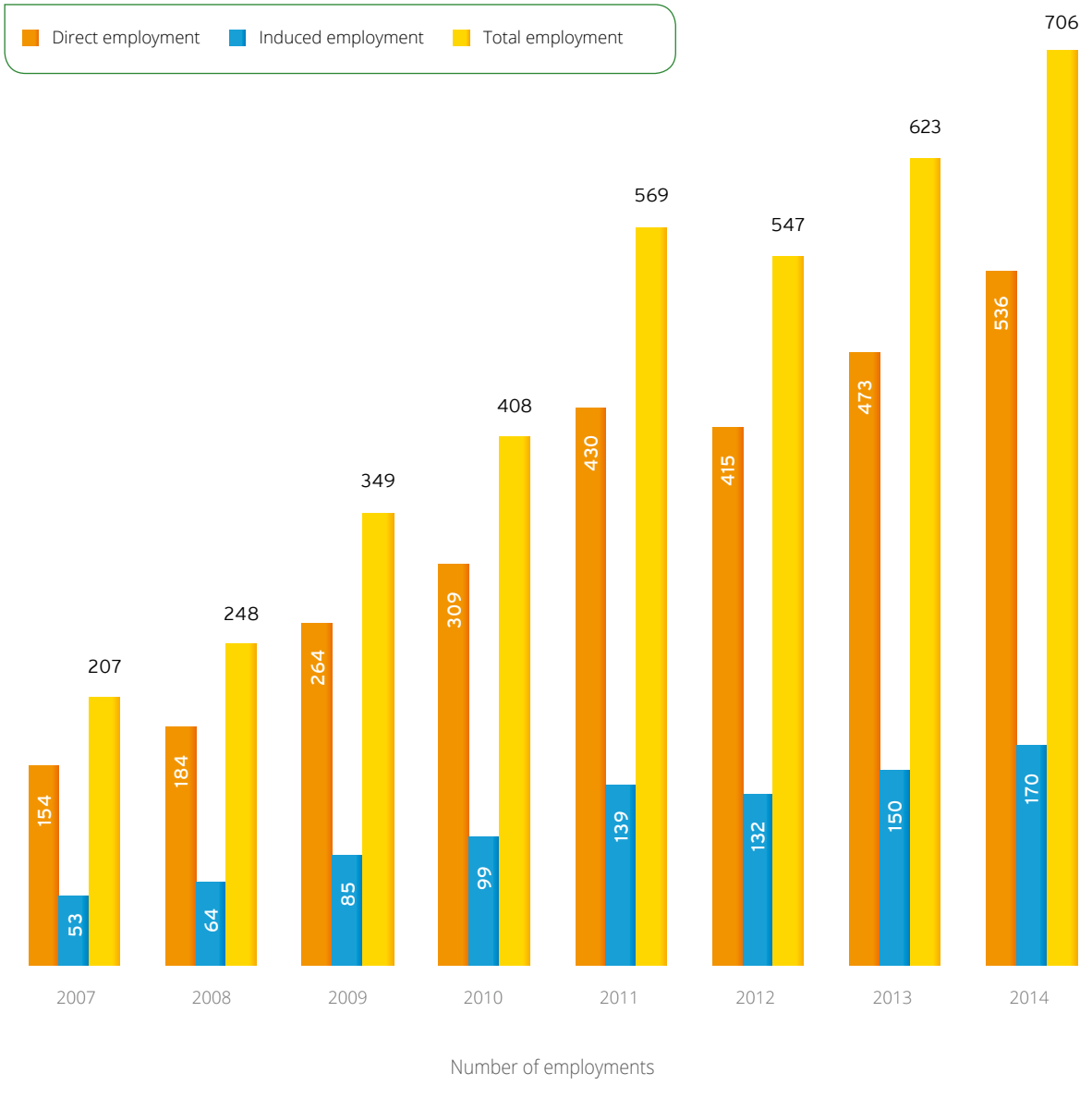
Equally important is the promotion and development of district cooling networks, which can supply large residential and service areas where geothermal can play aprimary energy role for the generation of heat and cooling. It is also necessary that the sector enhances the design and development of systems that foster the competitiveness of this energy compared to conventional systems. Furthermore, their implementation in areas with thermal demands beyond ACS is of essence, especially in a scenario where the subsidies received by low-enthalpy geothermal energy are gradually reduced.

In 2013, the low enthalpy geothermal power sector employed a total of 706 people, 536 of which were direct employments, and 170 indirect employments. Employment in the sector registered an increase close to 13% compared to 2013. (Chart 4.4.7).

This is due, on the one hand, to an increase in installed capacity that has led to a concentration of employments, particularly "rehabilitation of residential buildings" which also contributes to the generation of associated employments.

Chart 4.4.7 Direct and indirect employment in the low enthalpy geothermal sector

Source: APPA



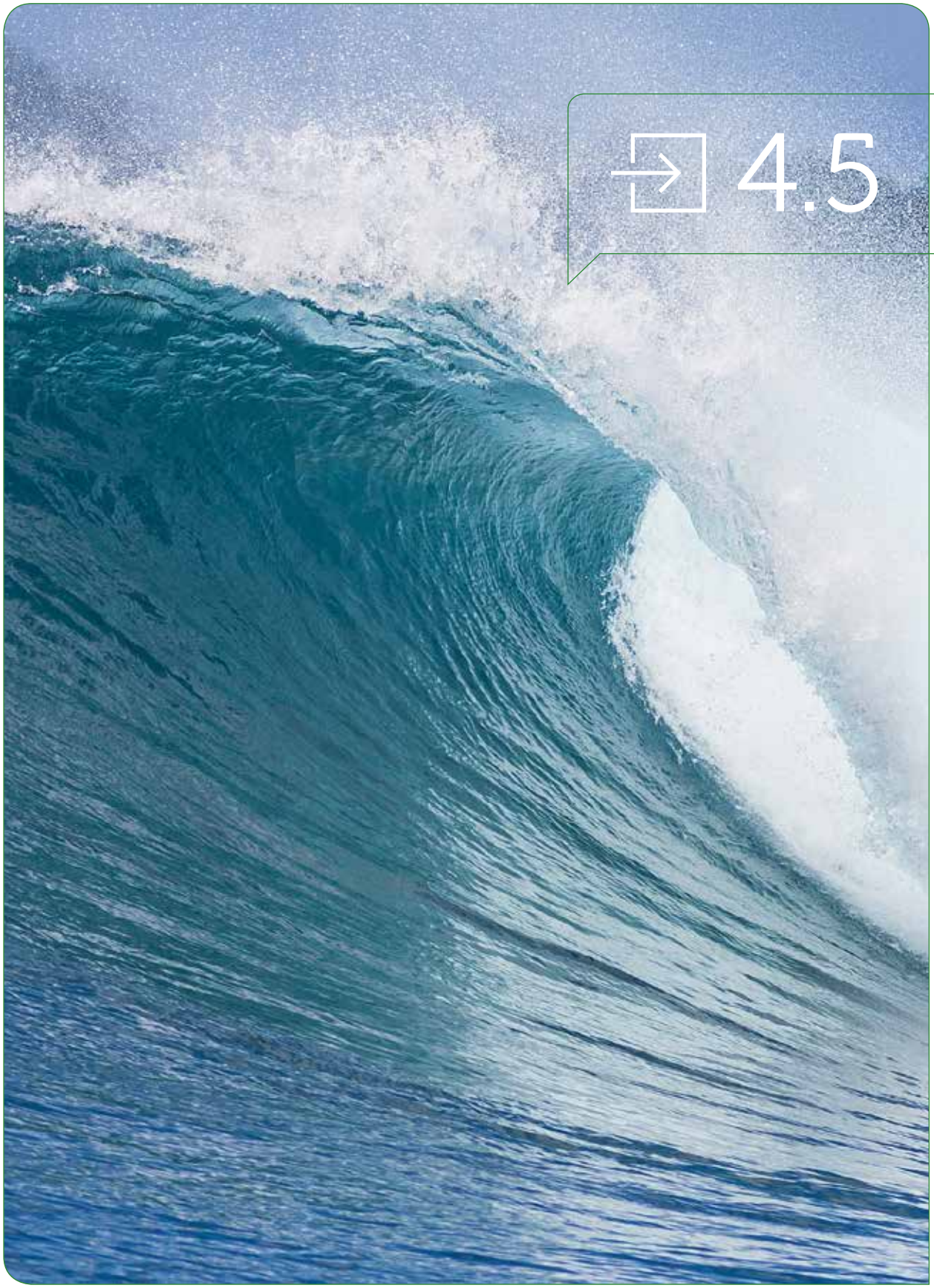
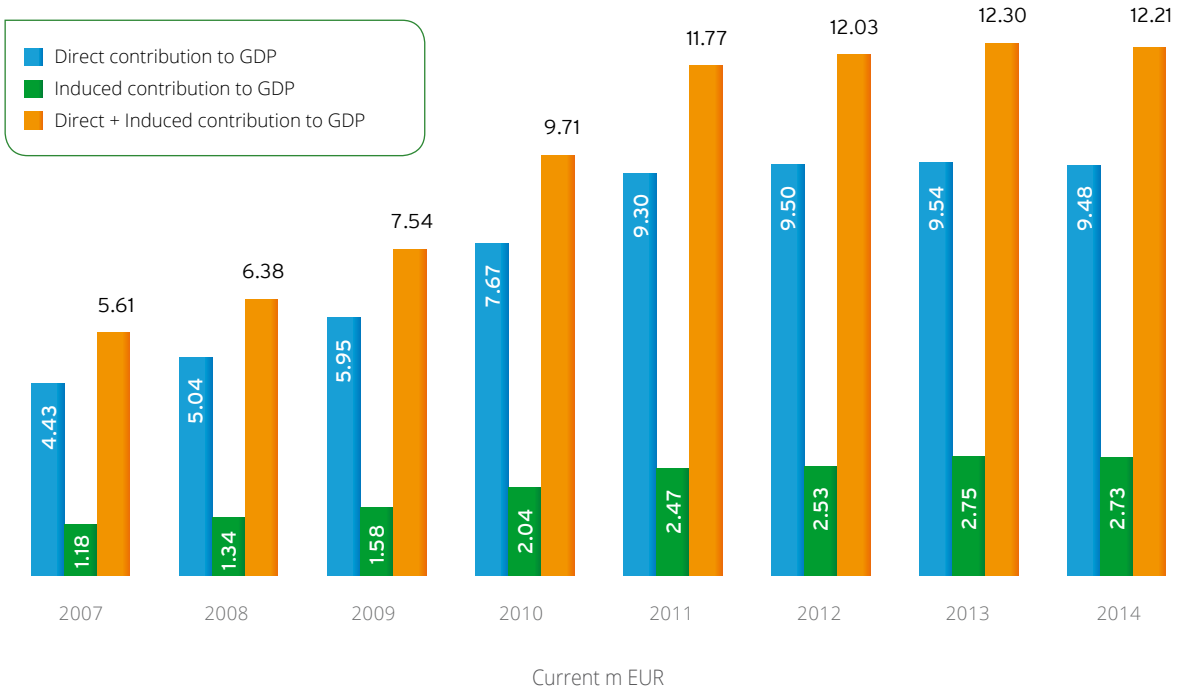

4.5

Chart 4.5.1

Contribution to GDP from the marine power sector

Source: APPA



Current m EUR

Marine power

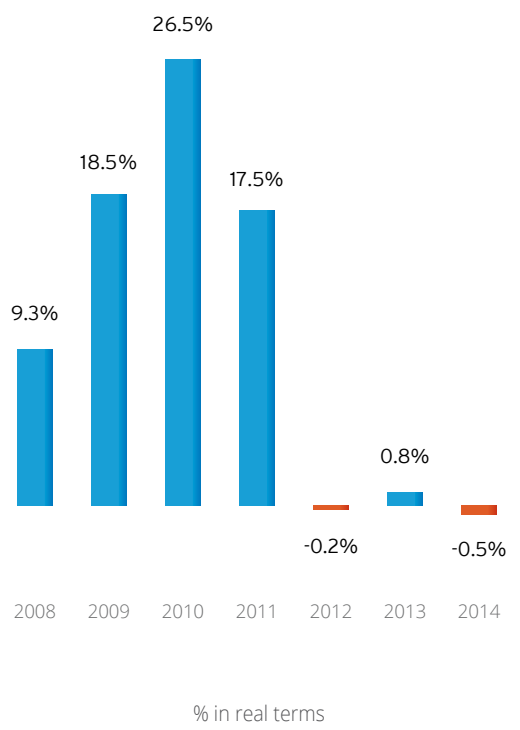
In 2014 the contribution to GDP from marine power —also called ocean power (waves and currents)— amounted to 12.21 m EUR, 0.6% less than in 2013, of which 9.48 m EUR corresponded to the sectors' direct contribution. Data available for 2014 are very similar to those for 2013. However the slowdown in growth that the sector has been experiencing in previous years can be noted. (Charts 4.5.1 and 4.5.2).

This is explained, on the one hand, by the changes implemented in the European tenders for R&D&I (7th edition of the Horizon Programme 2020), which, with the corresponding time delay, has created certain discontinuity in the launch of new projects. It has also changed the typology of the tenders, which has required some time to adapt for the participating companies and institutions.

On the other hand, there has been a general reduction of Spanish Plans and Programmes dedicated to the investment in R&D&I and

Chart 4.5.2 Growth rate in the Marine power sector

Source: APPA



thus a decrease in the funding for marine energy projects.

However, the sector of marine energy is actively working towards technological improvements, access to funding and political and institutional support, at a national and international level. Some agencies´ reports indicate that the marine energy sector will grow considerably in the medium and long term, thus increasing its contribution to GDP.

The technological development of marine energy is in phase of functionality and reliability, in order to reach a commercial development in the medium term. Currently several projects are close to reaching technological maturity, which will demonstrate their industrial viability and facilitate the access of such technology to market. In this sense, the commitment of the European Commission and some member countries is strong, as shown by European funds for such kind of projects (Horizon 2020, Ocean Energy Forum, etc.).

In Spain the industry has focused basically on wave energy technologies in line with the excellent resources offered by our coasts, principally in the Gulf of Biscay and in the Canary

Islands, which we know perfectly thanks to the study conducted by the IHC Custom IDAE for the PER 2011-2020.

The increasing number of Spanish projects in the field of wave energy should also be noted. There are two main focuses: the utilization of the national resources and, above all, the export of technology to the international market, which is close to reaching the commercial phase like in the UK, Ireland, Canada or France.

Several projects associated to the marine energies (wind and wave) are being run currently in Spain. Moreover, the country counts with the first commercial plant of wave power in Europe: project Mutriku, owned by the

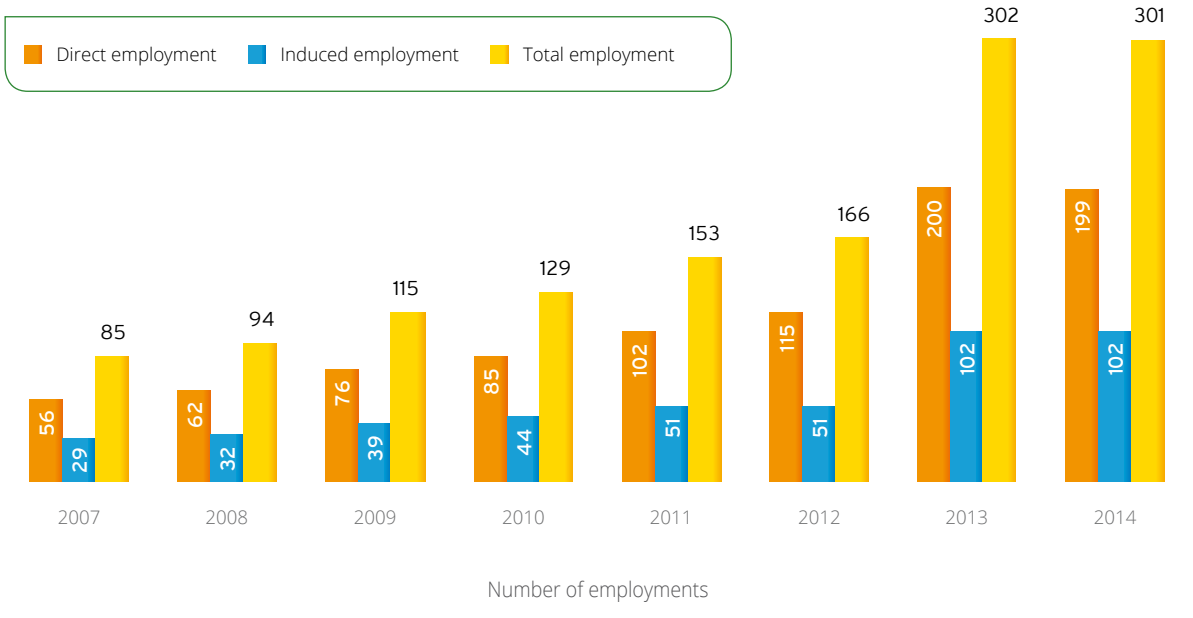
Basque Energy Board (EVE). In addition, the Spanish technology and industry are ready to become a world reference. Test centers as BIMEP, IHC and PLOCAN, are located in Spain, completing this offer that attracts world-class technologists.

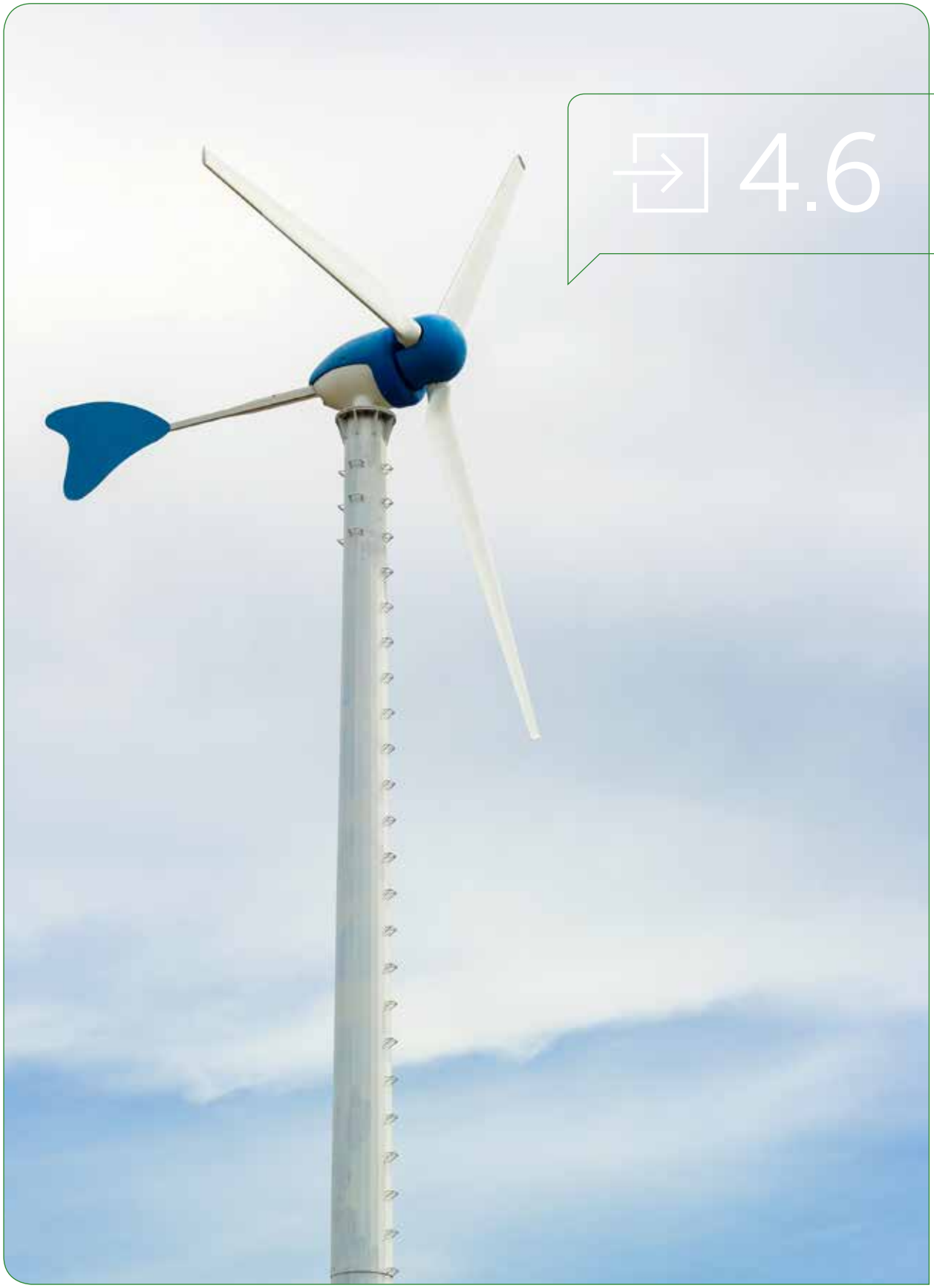
Chart 4.5.3 shows that the marine power sector generated 301 employments in 2014, of which 199 were direct and 102 indirect employments, bringing the employment in the sector to remain unchanged compared to 2013. In fact, the employment data illustrates a slowdown in the growth experienced in recent years. It shall be noted that the economic context influences the marine energy directly, where the R&D&I activity generates most of the employment generated by the sector.

Ocean power is still in the research phase and has a long way to run ahead of it. Nonetheless, the sector offers great business opportunities thanks to the important efforts from the entrepreneurial world that has continued providing resources, particularly for R&D&I, in order to be well placed for the time the technology finally takes off and attains a global leadership position. Which on its turn will be translated in an important contribution in the creation of highly qualified employment for the development of projects, components, manufacturing or operating facilities.

Chart 4.5.3 Direct and indirect employment in the Marine power sector

Source: APPA





4.6

Chart 4.6.1

Contribution to GDP from the Small-scale wind power sector

Source: APPA

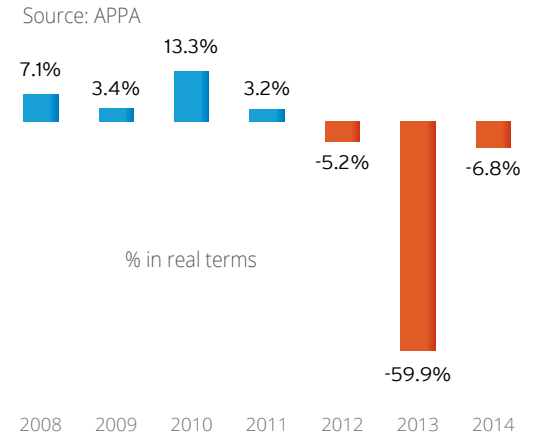
Small-scale wind power

In 2014 the contribution to GDP from the small-scale wind power sector went down to 20.68 m EUR, of which 15.66 m EUR corresponded to the sector's direct contribution to GDP and 5.02 m EUR to its induced contribution to GDP, a substantial 6.8% reduction compared to its contribution in 2013, as shown in Charts 4.6.1 and 4.6.2.

Although Spain pioneered the development of the small-scale wind technology in the early seventies, this sector has recently seen its contribution to GDP dramatically reduced due to the excessive regulatory and bureaucratic barriers.

The Spanish small-scale wind power sector has a great potential and offers a first-level technology for both low power range (from 600 W to 6 KW) and high power range (100 kW), in horizontal and vertical axis.

Chart 4.6.2 Growth rate in the Small-scale wind power sector



The main obstacle to the development of the small-scale wind industry at domestic level is still the lack of a specific regulatory framework that fosters the implantation of this technology. Without it, it will be impossible to produce a sufficient volume to industrialise this technology at domestic level and reduction in manufacturing costs, both indispensable for the technological maturation, profitability and competitiveness of the sector.

The Government seems to ignore the industrial opportunity that unblocking the situation offers. On the contrary, the Government's lack of interest in this sector causes rather a legal uncertainty which is very negative for the domestic small-scale wind technology industry and international actors who have shown their interest in the Spanish market. Thus, 2014 has been a difficult year for the renewable energy sector in general and for the small-scale wind technology in particular. Specifically, the non-approval of the legislation relating to self-consumption, hinders the future development of the sector in Spain.

In response to this lack of a sufficient legal framework, the renewable sector agents have joined efforts to make a modality of self-consumption and provide solutions viable before the failed Royal Decree proposal, the successive drafts of which seem to be designed to rather make unfeasible the implementation of this technology and hinder the domestic and industrial consumers access to it. Throughout 2014, the small-scale wind power sector has continued to demand the social and environmental benefits that would accrue from this technology. In particular, they claim for its great potential to generate employment when accompanied by a high quality industrial, technological and business tissue.

Meanwhile, Spanish manufacturers are forced to move their activities to other countries where their respective Government focuses on the renewable sector, as stated in the European directives. In 2014 the brand SmallWind was created in order to promote the small-scale wind technology in international congresses and fairs, such as the Small Wind World Conference, held in Husum, Germany.

The small-scale wind is already mature enough to provide significant benefits to Spain if the current or future governments value its enormous

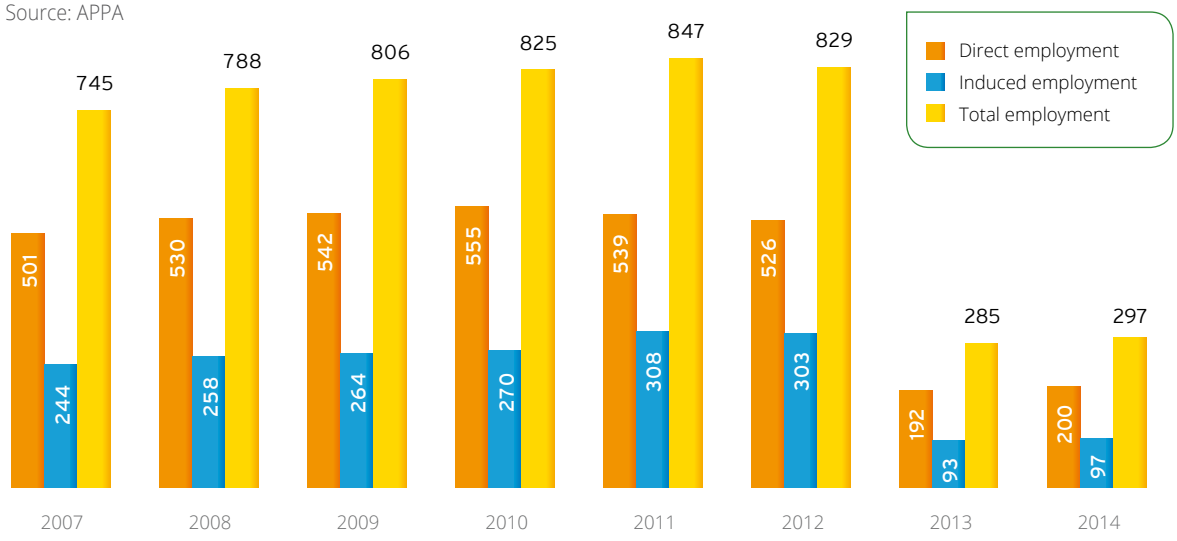
potential. Should the right conditions for its ongoing consolidation be created and the development of strategies for the medium and long term be boosted, successful projects, pilot experiences and demonstration plants will be carried out. We are still on time to leverage the strengths of small-scale wind technology in Spain.

The small wind energy sector in 2014 generated a total of 297 jobs. Of these, 200 were for direct jobs and 97 indirect jobs. This figure improves the number of 200 jobs in 2013 but is still far from the data obtained by the industry years ago that exceeded eight hundred jobs a year. If the great potential of small wind industry is promoted, or at least its development is not impeded, this technology may be able to create jobs distributed throughout the country in a short time. Chart 4.6.3 shows that the small-scale wind power sector only employed 297 people in 2014, 200 of which were direct and 97 indirect employments. This figure improves the number of employments compared to 2013 but is still far from the data obtained by the industry years ago when it exceeded the eight hundred employments per year. The sector should be promoted, or at least not be hindered, given its great potential for generating employments throughout the entire country and excellent possibilities for the consolidation of the associated technologic and industrial fabric and for the immediate creation of employment, an important consideration to make in the Spanish current economic situation.

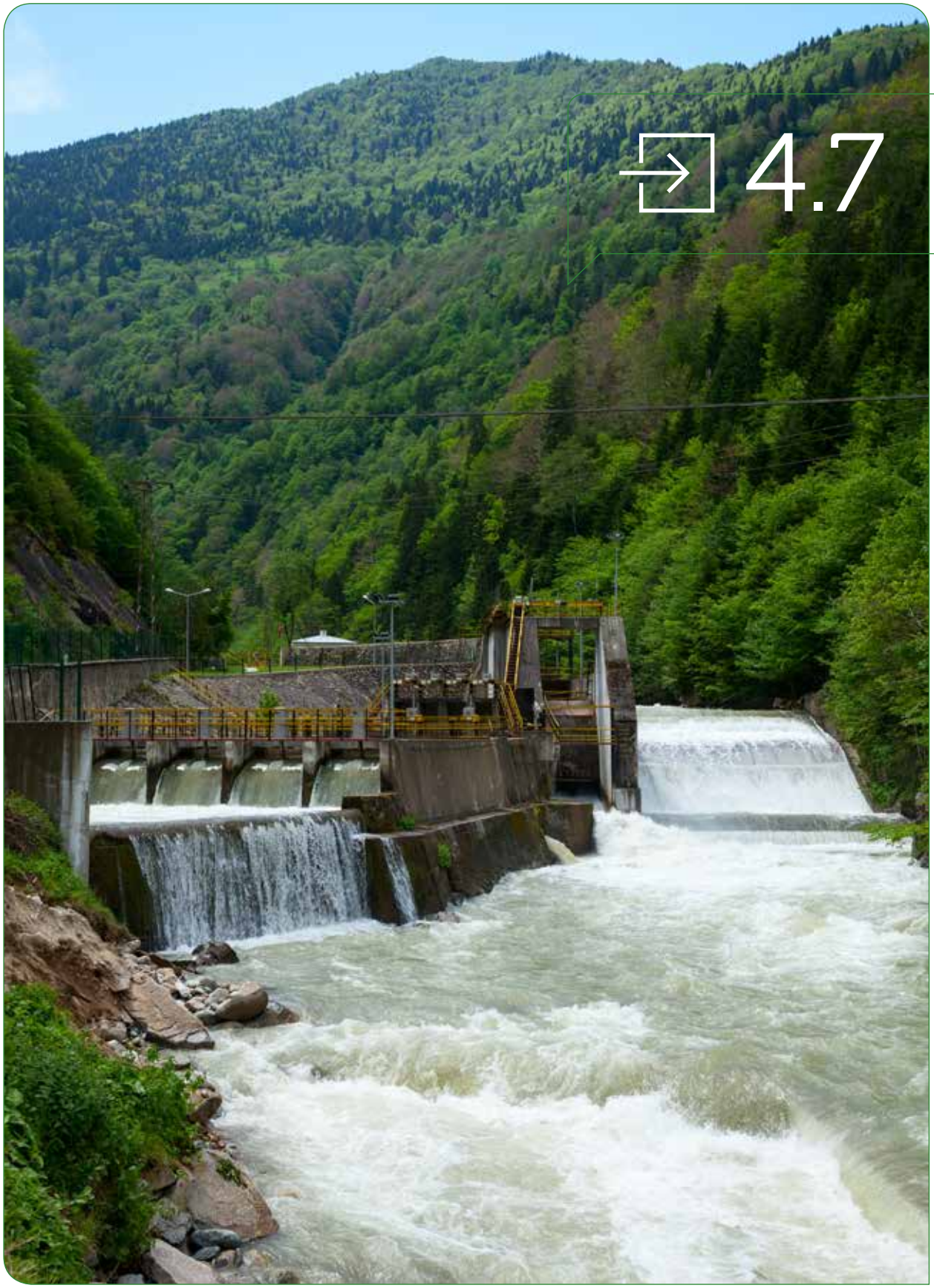
Chart 4.6.3

Direct and indirect employment in the small-scale wind power sector

Source: APPA



Number of employments



4.7

Chart 4.7.1

Contribution to GDP from the small-scale hydropower sector

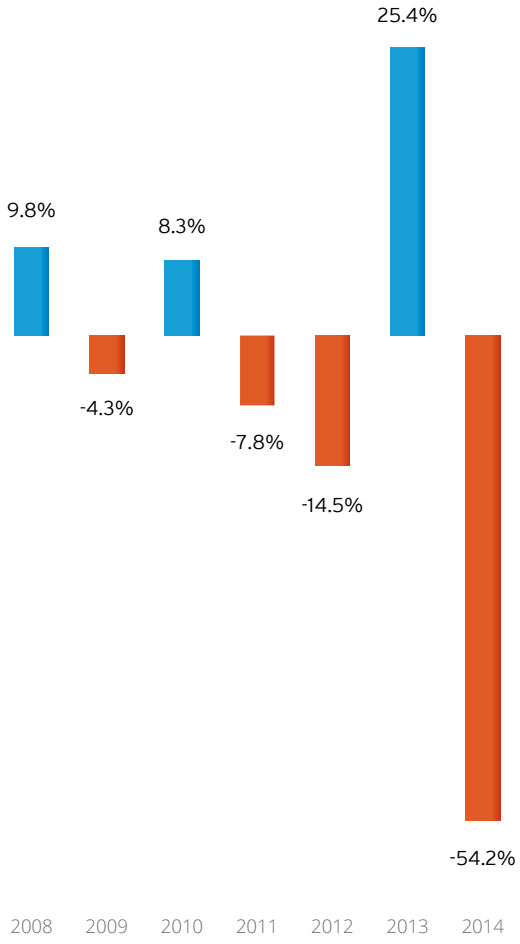
Source: APPA

Small-scale hydropower

In 2014 the aggregate contribution to GDP from the small-scale hydropower sector amounted to 269 m EUR. Direct contribution to GDP amounted to 208.5 m EUR while the sector induced contribution amounted to 60.5 m EUR. This contribution represents a decrease of 54.2% compared to 2013, which was 587.7 m EUR. (Charts 4.7.1 and 4.7.2).

Chart 4.7.2 Growth rate in the small-scale hydropower sector

Source: APPA

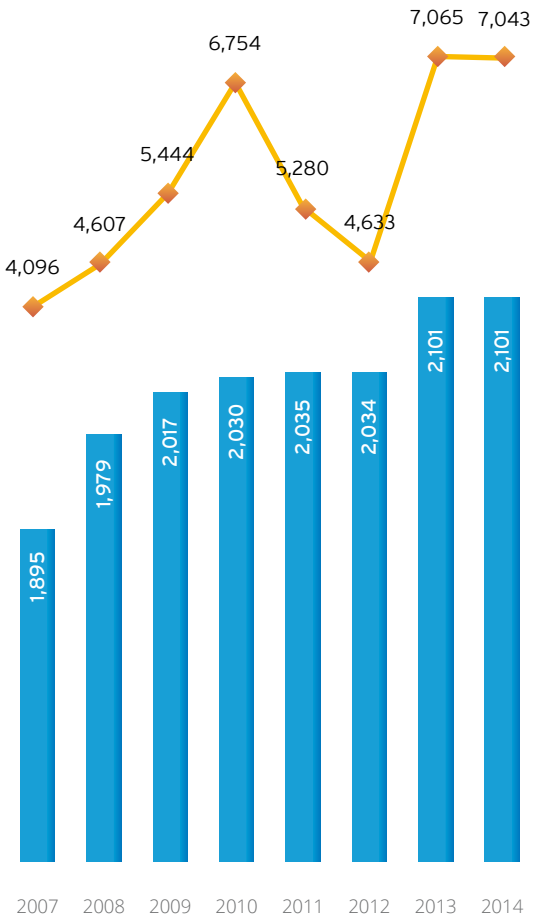


The reduced contribution to GDP from the small-scale hydropower sector responds to the fact that no new plants were installed, the production of electricity was left stagnant and the aggregate remuneration obtained by this technology was reduced by 46% compared to 2013.

In 2014 small-scale hydropower produced 7,043 GWh, almost equal to 2013 when the production reached 7,065 GWh, an output corresponding to two exceptionally rainy years.

Chart 4.7.3 Evolution of installed capacity and energy sales in the small-scale hydropwer sector

Source: CNMC



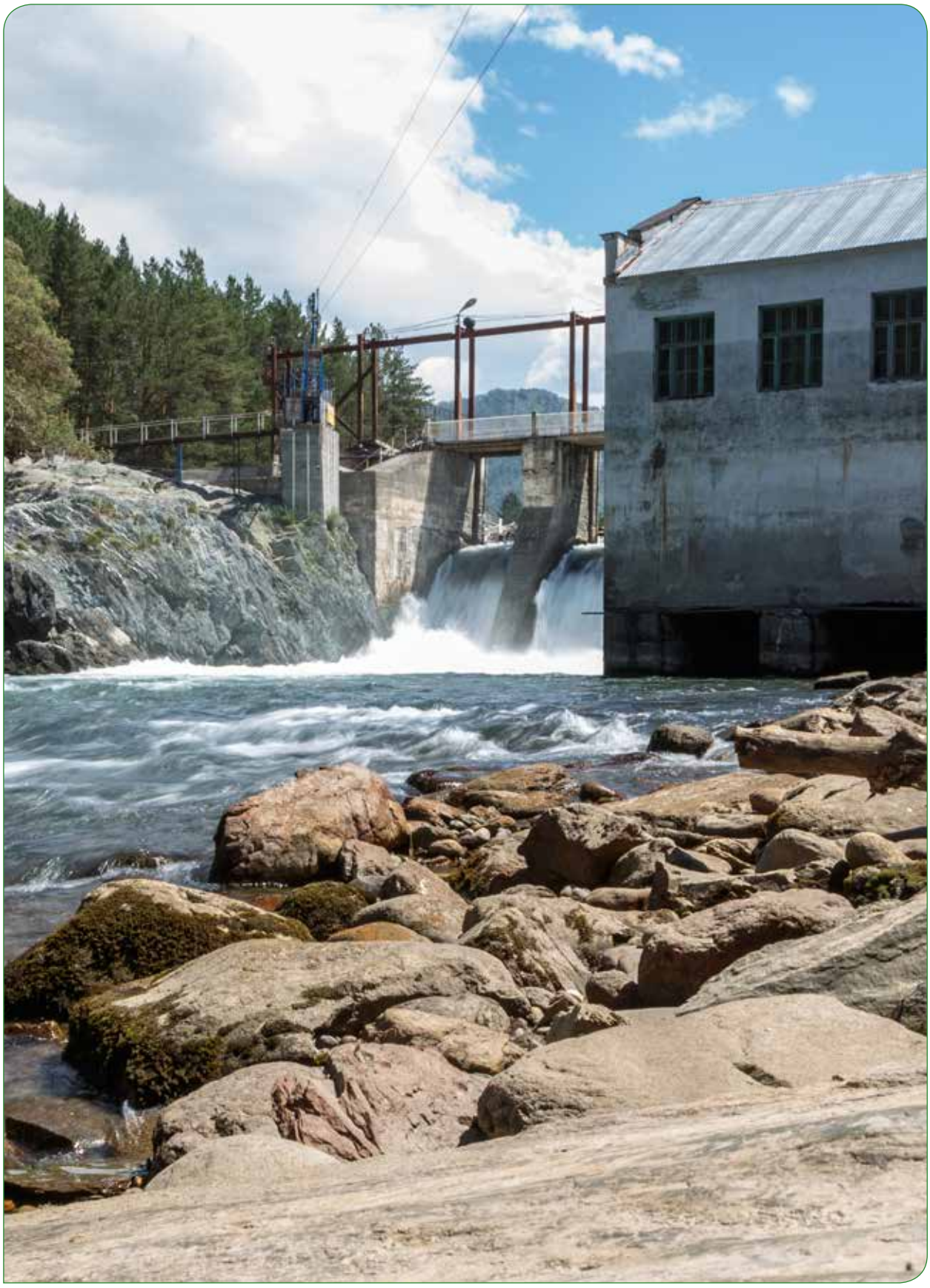


Chart 4.7.4

Direct and indirect employment in the small-scale hydropower sector

Source: APPA

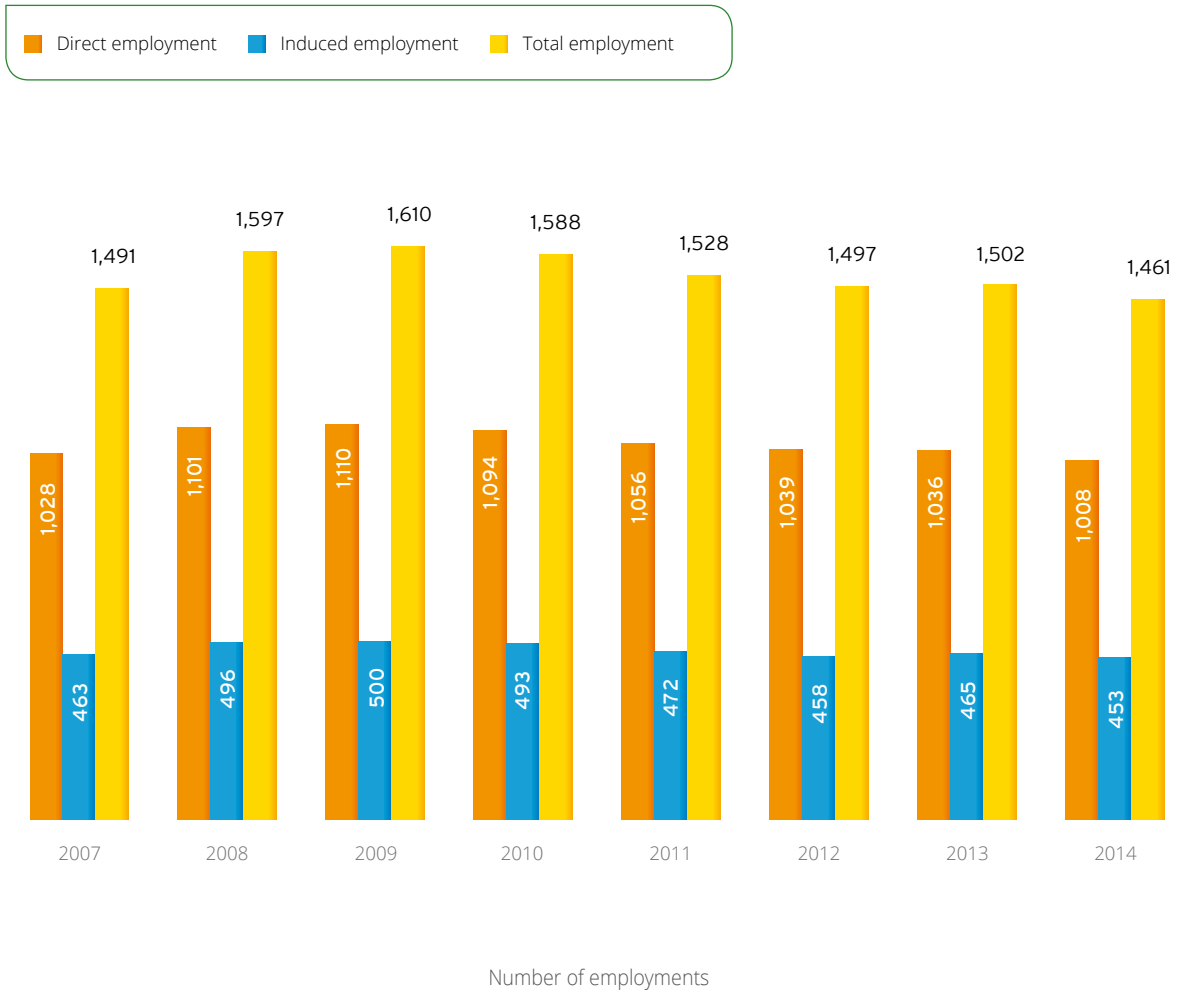


Chart 4.7.3 shows that installed capacity remained almost unchanged from prior years, at 2,101 MW, still short of the 2.199 MW target set in REP 2005-2010. The average growth of small-scale hydropower has barely exceeded the 2% in the last ten years, with an almost symbolic annual increase of 39 MW.

The causes for this stagnation of installed capacity lie in the lack of legal certainty, in the risks associated to this kind of projects, in the increased business complexity, in the administrative barriers (i.e. too onerous environmental requirements) that turn the process of obtaining permits and licenses

into an extremely difficult and expensive one in terms of time and resources for obtaining permits and licenses for the installation of new plants.

For the sake of developing small-scale hydropower industry, efforts shall have to be put into overcoming the above mentioned issues and streamlining the process for granting permits and licenses, in addition to reversing the regulatory changes that have been implemented.

The new river basin management plans incorporate new difficulties in the implementation of power plants. In addition, there is a misconception that hydropower hinders the achievement of the objectives of the Water Framework Directive.

Once again, in 2014 the small-scale hydropower sector still has not seen the implementation of the measures that could allow the increase in installed capacity. These measures are essentially three: to streamline the current procedures for water planning, encouraging the rehabilitation, modernization and / or replacement of plant and equipment in small-scale hydropower plants up to 10 MW of installed capacity, and establishing a new unified administrative procedure for granting water permits, or modification of existing procedures, to regulate those facilities with power exceeding 50 MW.

None of the aforementioned measures has been established yet but, on the contrary, on top of the 7% tax on the turnover of small-scale hydropower plants, which is also applicable to other renewable technologies, another specific 2.2% tax of that turnover,which is not applied to other renewable plants, has been added.

The electricity reform has especially punished the small-scale hydropower technology, despite its low contribution to the deficit tariff and environmental impact. To the extent that the industry has seen how inevitably many of their plants have gradually shut down as soon as a breakdown of a certain scale occurred. The necessary repairs could not be funded with the low remuneration provided by the measures implemented by the Government only. As a result, the repairs didn´t take place.

The small-scale hydropower sector has maintained the trend from previous years regarding the destruction of direct employment (41 jobs less than in 2013). In 2014 the sector registered 1,008 direct employments; while indirect employment registered 453 indirect jobs. (Chart 4.7.4).

These figures are consistent with the stagnation of installed capacity and with the likely automation of some facilities. If the current conditions as described herein do not change urgently, many of the plants will be forced to shut down causing the corresponding loss of employments.

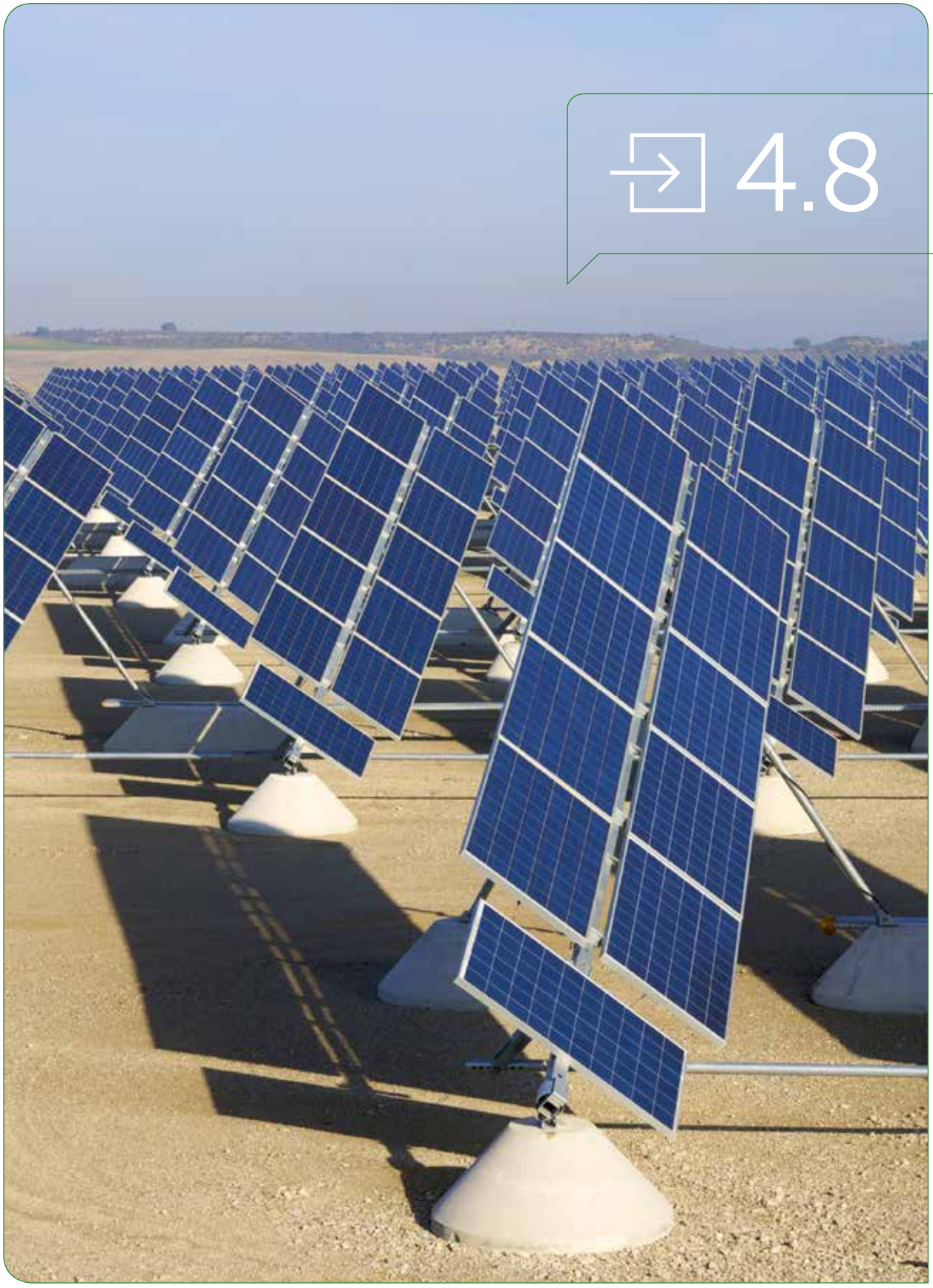
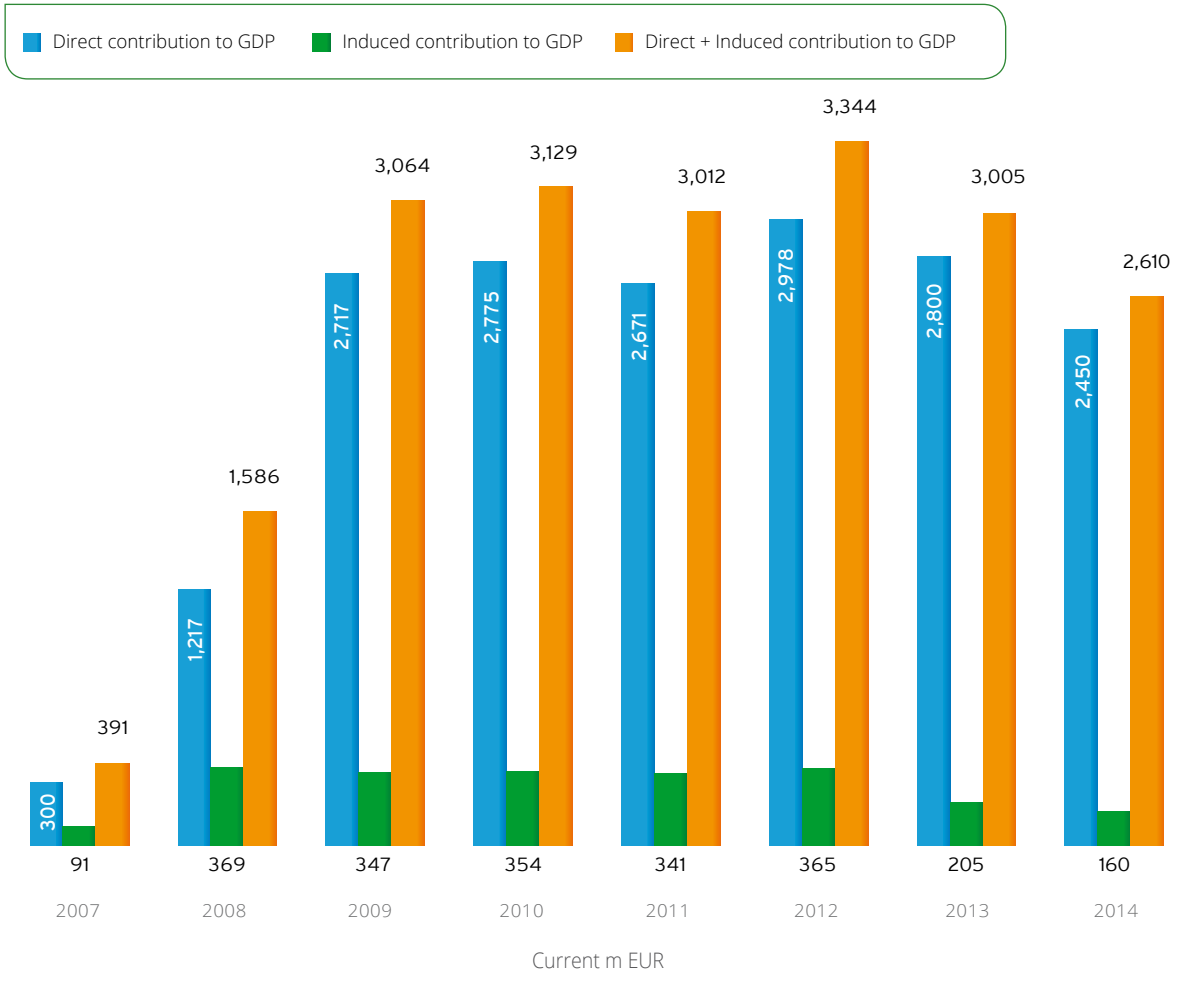

4.8

Chart 4.8.1

Contribution to GDP from the Photovoltaic Solar power sector

Source: APPA



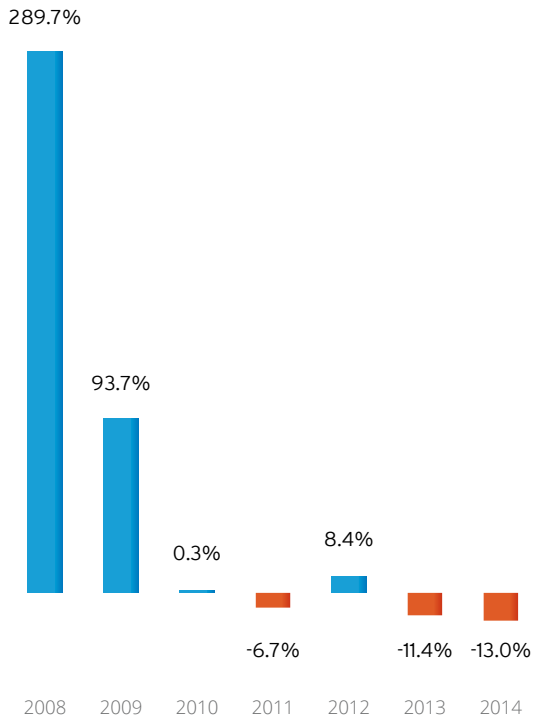
Photovoltaic solar power

In 2014 the aggregate contribution to GDP from the photovoltaic solar power sector amounted to 2,610 m EUR. The direct contribution of this sector to GDP registered a significant reduction to 2,450 m EUR (94%), while its induced contribution was similarly reduced to 160 m EUR (6%). (Chart 4.8.1).

In 2014, the sector registered a positive growth rate (as sown in Chart 4.8.2), increasing a 13%

Chart 4.8.2 Growth rate in the Photovoltaic Solar power sector

Source: APPA



% in real terms

compared to previous year. If we look at 2012, the sector has decreased its contribution to GDP by 22 percentage points since then. These figures show the reduced revenues from the sale of energy resulting from the implementation of a poor regulation. (Chart 4.8.2).

Moreover, the contribution of the sector to GDP has been the lowest in the last six years. Also, it is noted that those measures, together with the complete lack of visibility towards the future, have led both companies owning facilities and thousands of families to critical situations, as in many cases the amount of expected revenues as per the new regulation does not even cover debt service obligations.

Similarly, this scant future projection has caused the disappearance of industrial fabric associated to this technology, the closure of many manufacturing plants and production centres and the relocation abroad of a number of companies.

The Renewable moratorium and the delay in the publication of the royal decree that regulates the self-consumption of electricity has caused the disappearance of industrial fabric associated to this technology. Thanks to the foreign market some of the industry has kept producing. The 2014 data confirms that the energy reform has mantained, and in most cases, increased the cutbacks to the remuneration expected by many photovoltaic solar plants. The application of the RD 413/2014 and 1045/2014 OM, includes retrospective measures implying, in some cases, a reduction close to 50% in the remuneration expected by many photovoltaic solar plants. On average the cutback exceeds 30% . Thousands of companies and small producers are now in this situation, responding to the call of the institutions and reflected in the BOE, to invest their savings in this technology. Now the vast majority of them are found in ruin.

In terms of installed capacity, 2014 was the worst year ever for the photovoltaic solar power industry, only 5 MW were commissioned. Derisory when compared to neighboring countries such as United Kingdom, Germany and France where 2,300, 1,900 and 1,000 MW, respectively were commissioned. It is expected that in the next five years this technology will grow 177% worldwide, reaching 500 GW.

The Spanish Government policies do not follow the trend traced by most OECD countries, where solar photovoltaic technology seems to be the technology with the best prospects. This trend has largely been enabled by cost reduction achieved by this technology over the last six years, by more than 80%.

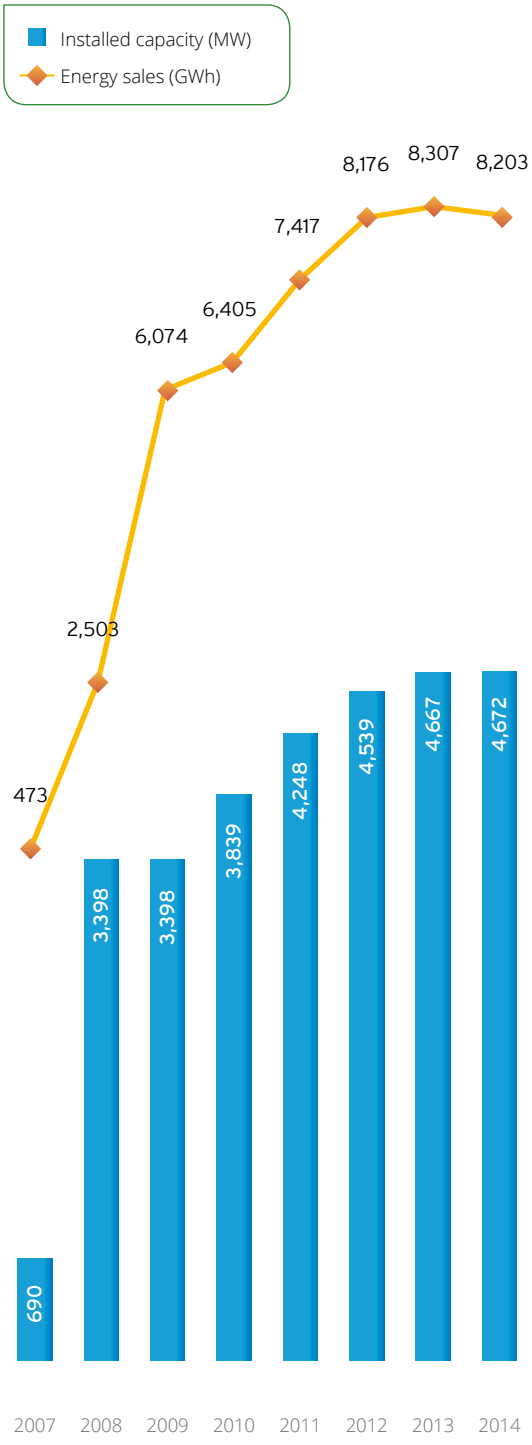
Photovoltaic solar power was the second renewable technology in installed capacity in Spain in both installed capacity 4,672 MW, and power generation, 8,203 GWh. (Chart 4.8.3).

The renewable moratorium and the absence of a regulatory framework for the development of self-consumption make the photovoltaic solar sector have no projection in the future. While the Renewable Energies Plan 2011-2020 had planned to install about 400 MW per year, since 2011 Spain is recording much lower figures and in some cases, as in this 2014, virtually nil.

One of the possible ways to develop the photovoltaic technology in Spain is the implementation of self-consumption facilities the

Chart 4.8.3 Evolution of installed capacity and energy sales in the Photovoltaic Solar power sector

Source: CNMC



regulation of which has been delayed since 2011. To date, the Royal Ddecree regulating the self-production of electric energy hasn't been published. Its drafts, (the last was issued mid-2013), does not include the possibility of net metering. The proposal does, include the notion of 'support fee' that seriously penalises self-consumption and makes it more profitable to acquire electricity from the supplier company than self-producing photovoltaic electricity. The result of this delay and the renewable moratorium have led the photovoltaic solar sector in Spain to a situation of standstill.

Future development of the sector greatly depends on the development of distributed generation, consumption and the integration of this technology. It depends on the right regulation being approved on reasonable terms that consider the benefits of distributed generation and of energy self-consumption. Its different applications, both large and small consumption facilities offer a wide range of benefits that make of this technology one of the future sources of energy, as is currently occurring in most developed countries.

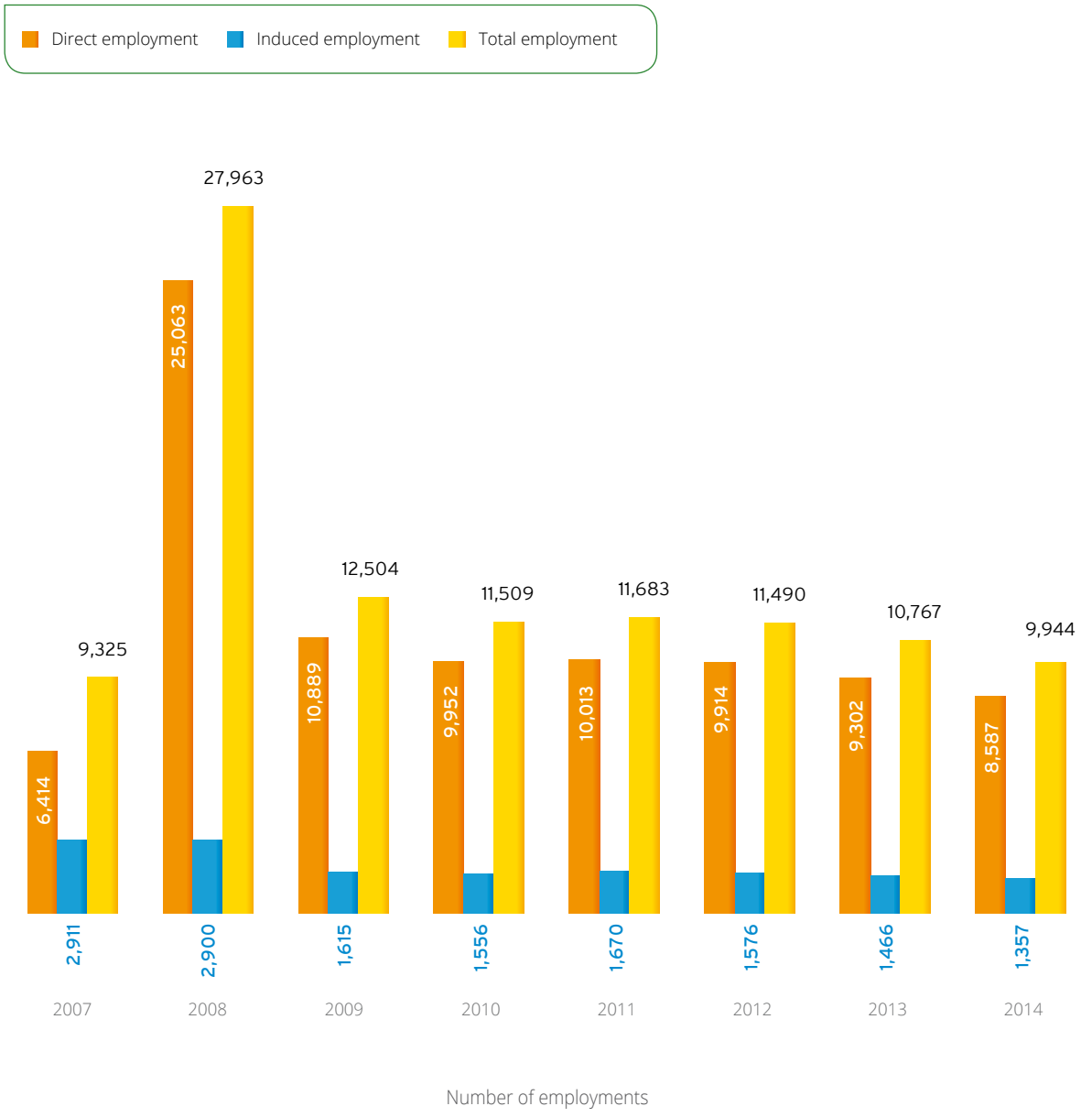
In terms of employment, in 2014 the photovoltaic solar power sector employed 9,944 people, 8,587 of which were in direct employments and 1,357 in indirect employments.

These figures imply that the number of employments lost in 2013 by the photovoltaic solar

sector amounted to 823. These figures also show the critical situation the photovoltaic solar sector is currently going through in Spain. Since 2008 the photovoltaic solar sector has lost over 18,000 employments, both direct and indirect. (Chart 4.8.4).

Chart 4.8.4 Direct and indirect employment in the Photovoltaic Solar power sector

Source: APPA



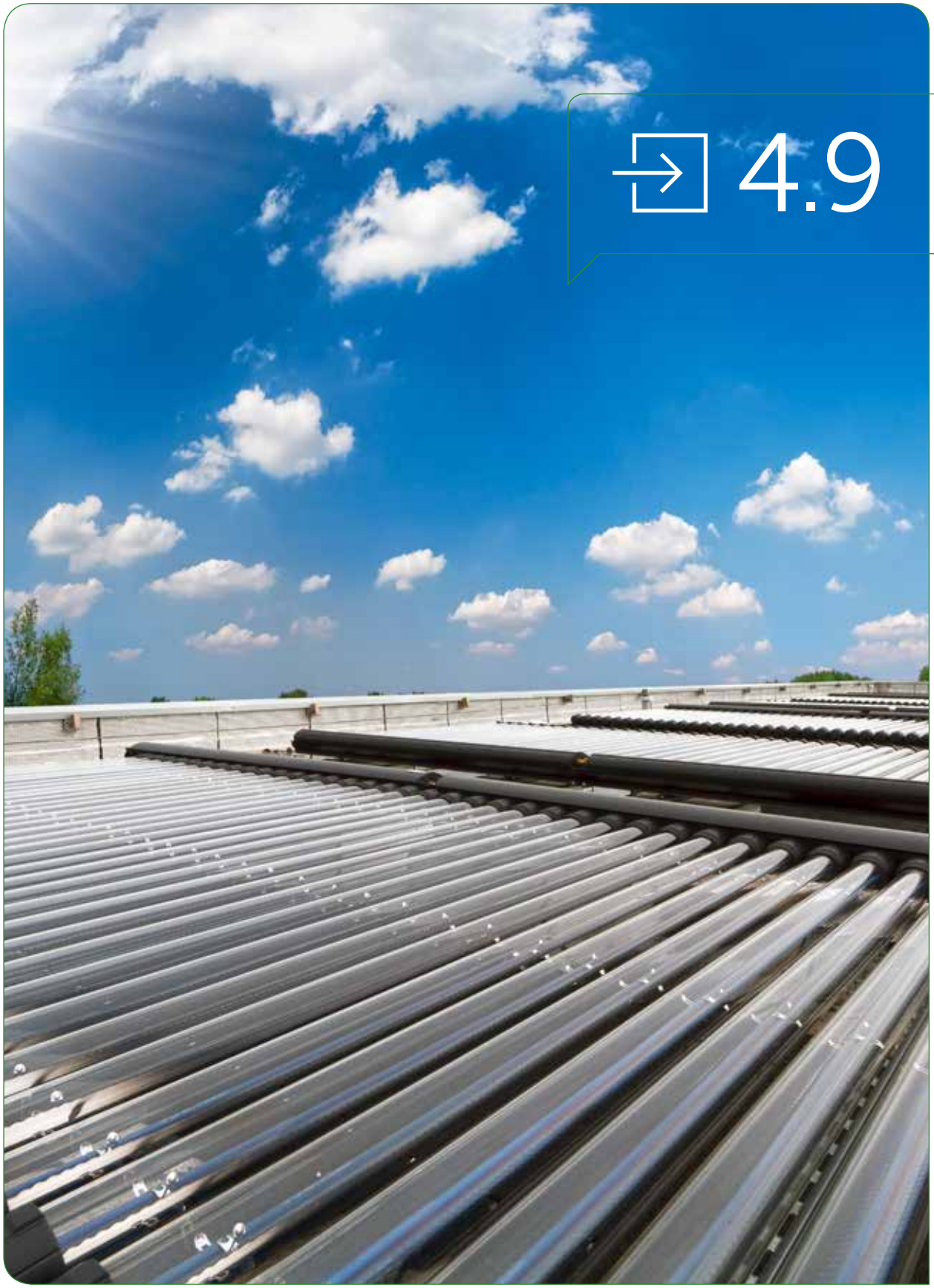
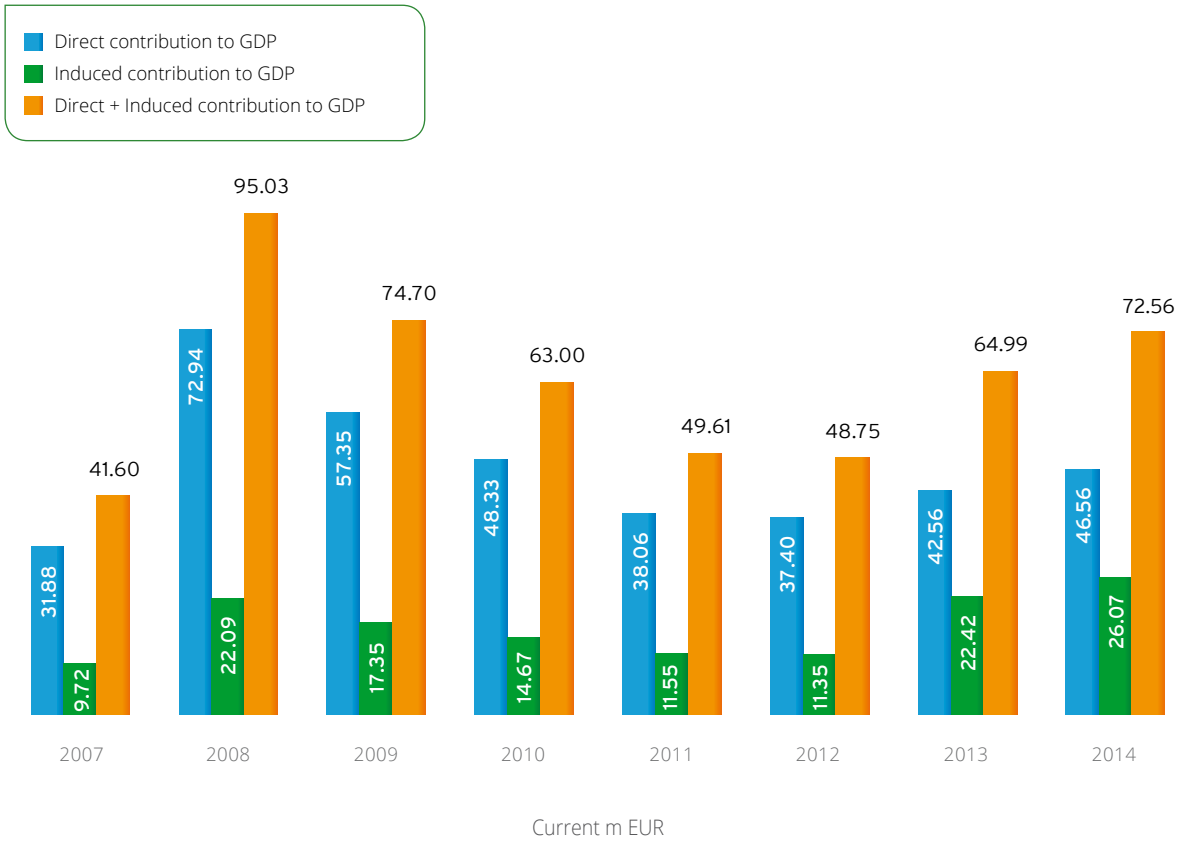

4.9

Chart 4.9.1

Contribution to GDP from the Thermal Solar power sector

Source: APPA



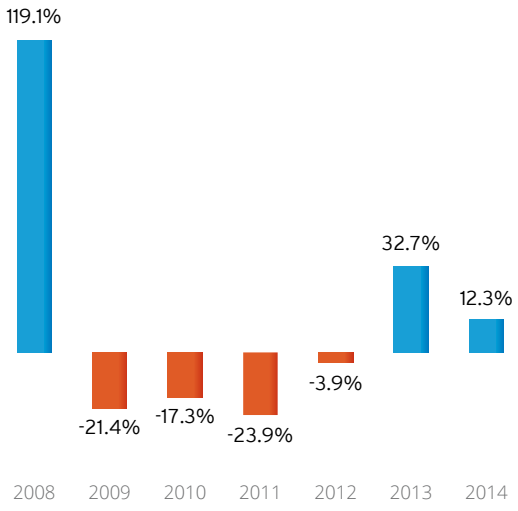
Thermal solar power

In 2013 the direct contribution to GDP from the Thermal Solar power sector increased to 46.5 m EUR while its induced contribution amounted to 26.07 m EUR, for an aggregate 72.56 m EUR contribution to GDP. This represents a 12.3% increase compared to 2013, being 2014 the second consecutive year of positive growth. (Charts 4.9.1 and 4.9.2).

In 2014, the Spanish thermal solar power sector registered revenues of over 204 m EUR. According to market data, 66% of these revenues correspond to compliance with the Technical Code for Building ("TCB"); 33% to installations subsidized by Autonomous Regions and 1% to industrial applications.

Chart 4.9.2 Growth rate in the Thermal Solar power sector

Source: APPA



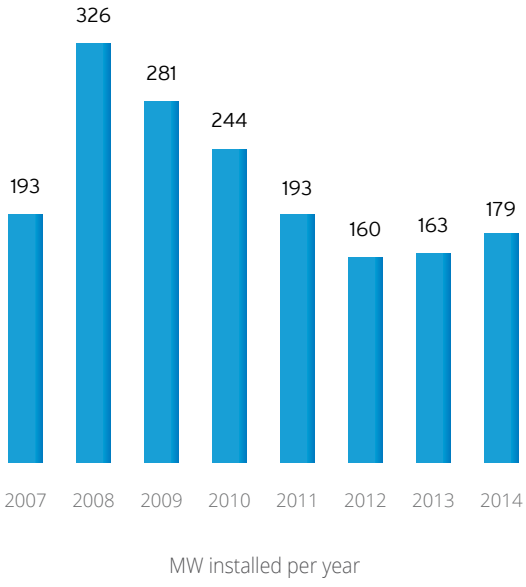
The solar thermal sector had an installed capacity of 2,416 MWth at the end of 2014, year in which the energy generated stood at 258 ktoe. Spain has a production capacity of approximately 1,300,000 m^2. In 2014 it produced 219,150 m^2, slightly less than 17% of its potential; of these, 140,600 m^2 were installed in the domestic market and 78,550 m^2 was dedicated to export markets. (Chart 4.9.3).

The figures show a significant improvement in the sector. In particular, according to the results from the economic survey "Survey on the Thermal Solar Sector activity" carried out by ASIT, in 2014 179 MWth (232,500 m^2) were installed in Spain. This confirms the growing trend started in 2013 with an increase in MWth installed compared to 2012. (Chart 4.9.4).

Despite the change in trend which for four years had brought the market down to 50% of its capacity, and although the sector has grown for the second time since 2009, we can not talk of recovery given the negative reality of the Spanish thermal solar sector. Thanks to their industrial, technological and competitive strength, thermal solar companies have managed to position themselves in the international market and thus survive the Spanish crisis, a crisis which is the result of the absence

Chart 4.9.3 Annual change in installed capacity in the Thermal Solar sector

Source: ASIT



of political will, both at state and regional level. On the positive side, the implementation of the programme for the promotion of the Thermal Solar Power Sector in the country region of Andalusia should be noted.

In 2014 the employment associated to the thermal solar power sector has increased slightly, with an aggregate of 1,094 employments since 2013. Of these, 851 were direct employments and 243 indirect employments. In fact, employment in the sector has grown slightly over the last three years, after registering falls since 2008, when the sector registered 1,818 employments. (Chart 4.9.5).

Chart 4.9.4 Evolution of installed capacity and energy generated from Thermal Solar Sector

Source: ASIT and MINETUR

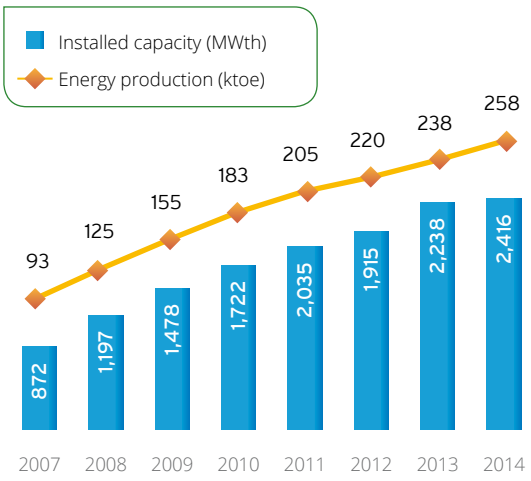
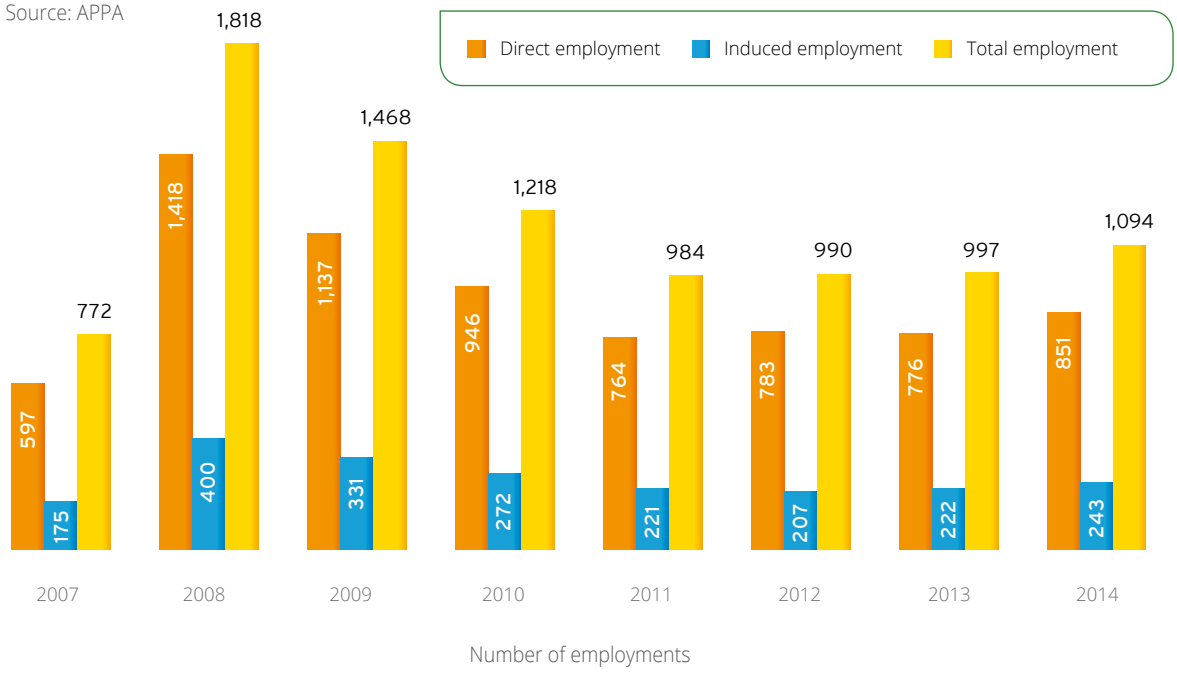


Chart 4.9.5 Direct and indirect employment in the Thermal Solar power sector

Source: APPA



Number of employments

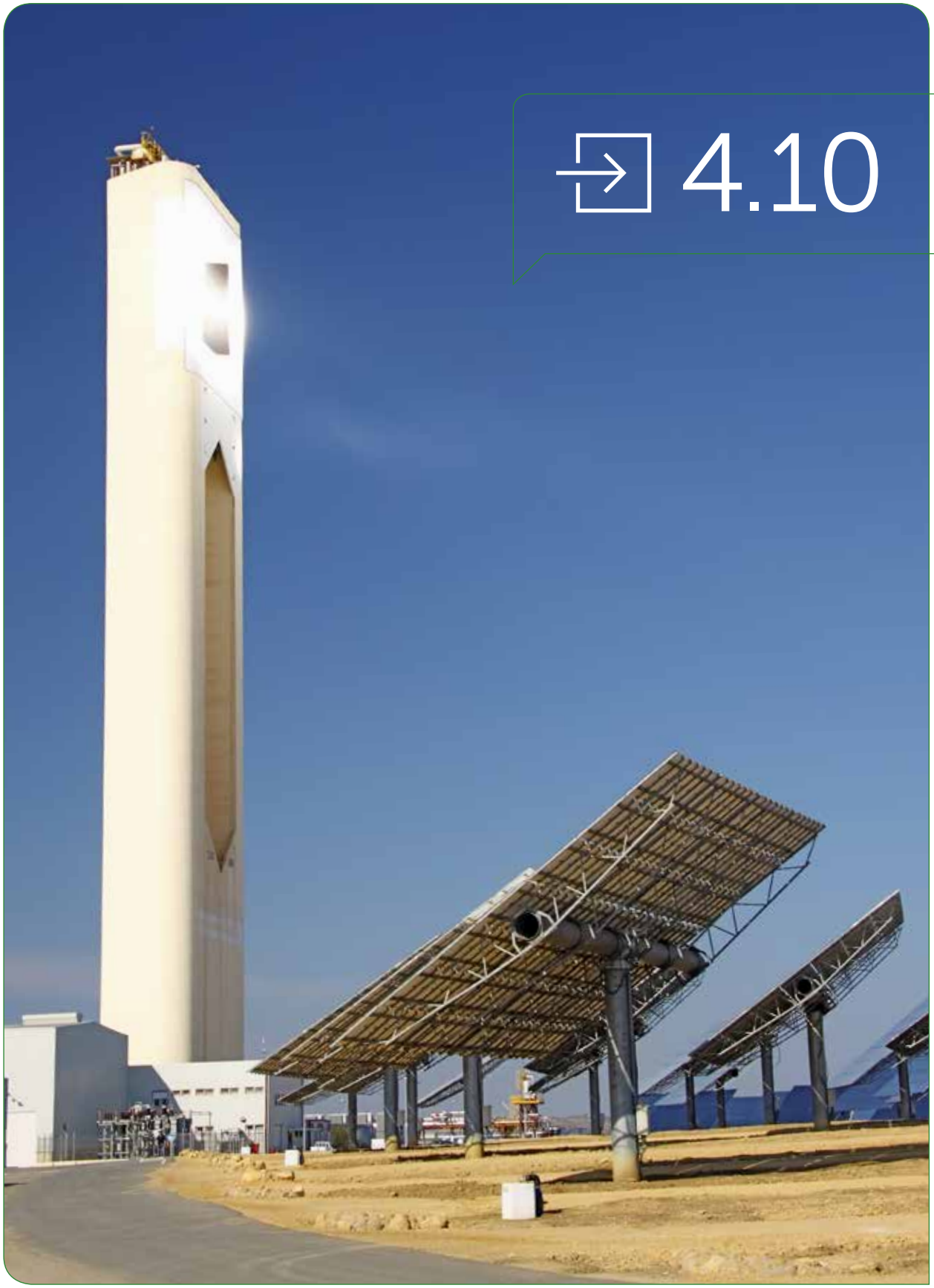
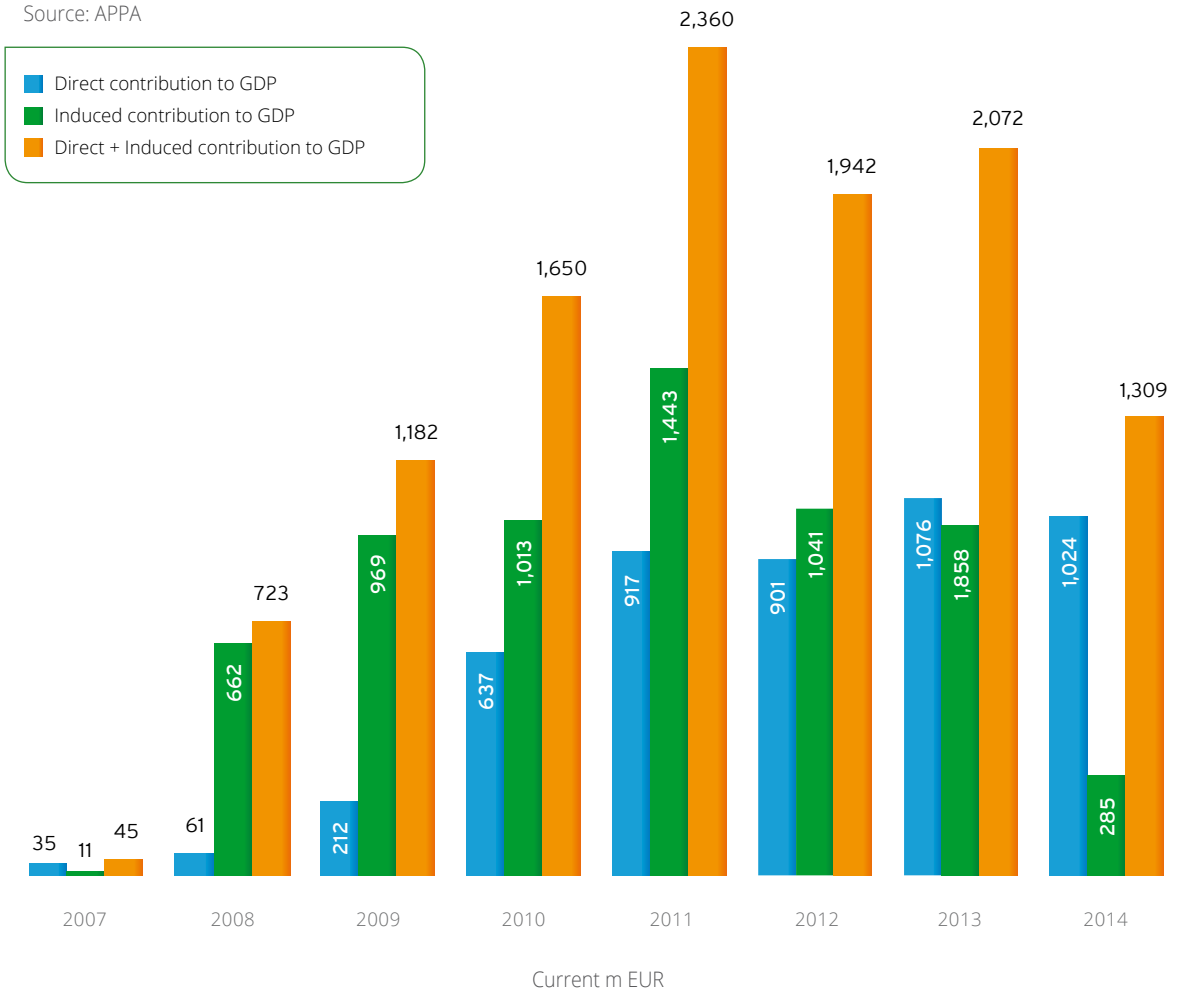

4.10

Chart 4.10.1

Contribution to GDP from the CSP sector

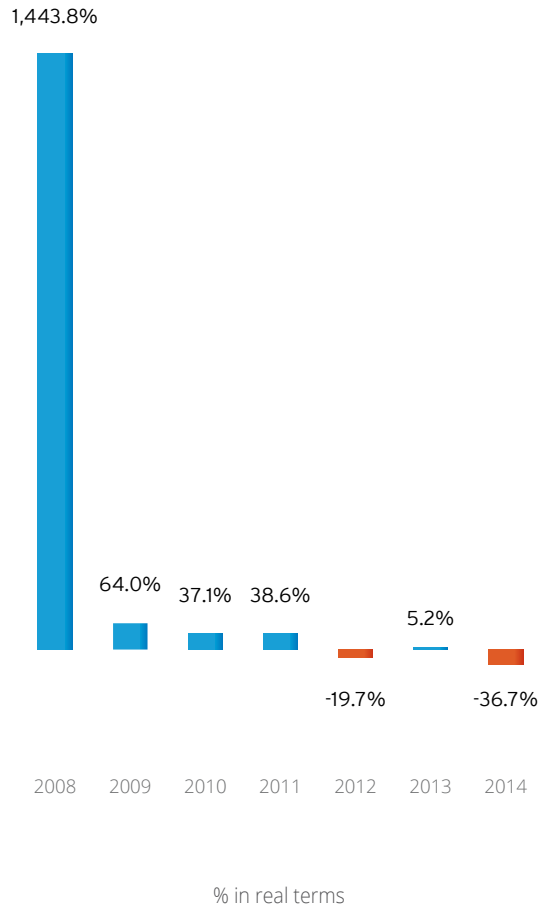


CSP (Concentrated Solar Power)

In 2014 CSP sector contributed 1,309 m EUR to Spain's GDP; 1,024 m EUR corresponded to the sector's direct contribution and 285 m EUR to its induced contribution. The sector recorded a decrease in their aggregate contribution of 763 million euros compared to the GDP of the previous year. The negative growth rate (36.7%) represents the biggest annual drop in the analysed series (see charts 4.10.1 and 4.10.2). It is the result of the completion of those power plants that were under construction

Chart 4.10.2 Growth rate in the CSP sector

Source: APPA

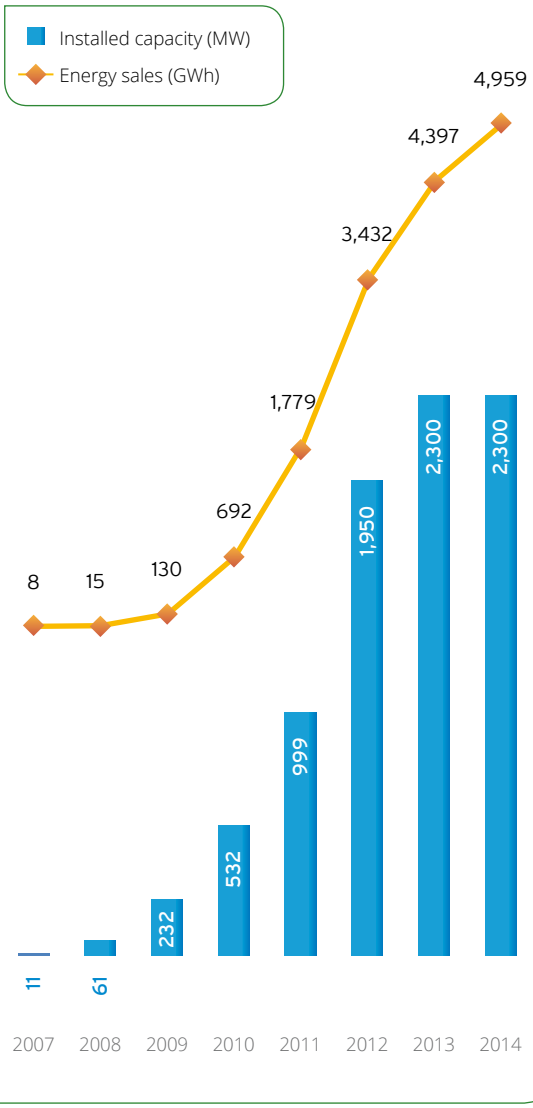


during 2013 and no new plants being started during 2014. The stagnation experienced by the installed capacity of this technology has reduced its induced contribution by more than 70%, resulting in the lowest aggregate contribution to GDP over the last five years.

After the reduction registered in 2012, the sole reduction in the annual series, the contribution from the CSP sector returned to positive growth rates, at 5.2%. This is basically due to the increase in installed capacity and to a larger production of electricity.

Chart 4.10.3 Evolution of installed capacity and energy sales in the CSP sector

Source: CNMC



The sector closed 2014 with an installed capacity of 2,300 MW, exactly the same capacity as by year-end 2013 (see Chart 4.10.3). Installed capacity in CSP is mostly located in six Autonomous Regions: Andalusia, 997 MW; Extremadura, 849 MW; Castilla-La Mancha, 349 MW; Valencia, 50 MW; Murcia, 31 MW, and Catalonia, 23 MW. (Chart 4.10.3).

The above mentioned installed capacity is distributed among the 50 plants operating by the end of 2014, 20 of which have storage systems while the remaining 30 do not.

In any case, plants without storage system have their manageability ensured through hybrid systems with natural gas or biomass.

Thermoelectric generation sector reached 4,959 GWh in 2014, covering 2% of the total electricity demand of the year. Thermoelectric generation increased 12.8% compared to 2013.

In 2014 the CSP sector produced 4,959 GWh to cover 2% of the total electricity demand in 2014 (see chart 4.10.3). Compared to 2013, the CSP sector increased its production by 12.8% in 2014 thanks to running the parks fully operational throughout the year, as well as improving the management of the facilities.

The month with the highest production recorded was August, when 833 GWh were produced. Its maximum contribution to the demand occurred on the 3rd of August at 6 pm, exceeding 8.5%. During the same month, daily contributions above 5% were achieved. All this with a production curve perfectly adjusted to demand, capable to meet afternoon peaks in demand, thanks to the management ability demonstrated by the plants, as most of them count with storage systems.

Thanks to the efforts deployed over the last years, Spanish companies still hold a worldwide leading position in CSP markets. Thus, out the 6,500 MW installed or under construction worldwide, 75% are Spain branded, either in the development, construction, engineering and/or component supply.

The technological evolution of CSP itself, storage capacity and its manageability are some of the reasons why in 2014 the International Energy Agency gave the leading role to CSP in those geographic areas with sufficient solar resources.

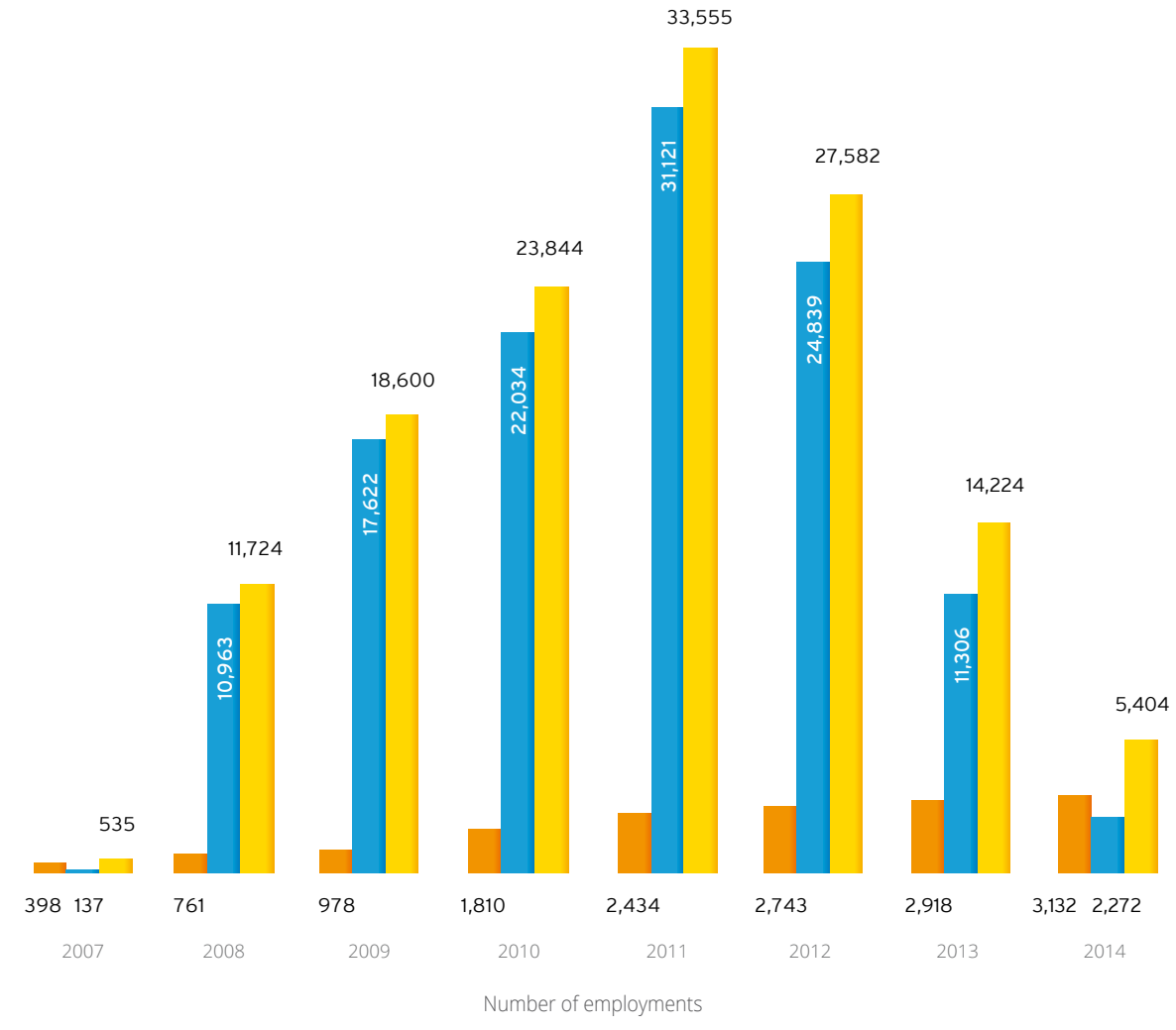
In 2014 the CSP sector generated an aggregate 5,404 employments, of which 3,132 were direct and 2,272 indirect employments. The sector registered an aggregate loss of 8,820 employments compared to 2013. This represents a loss of 62% of the employments in just one year, almost 80% of which were indirect employments. (Chart 4.10.4).

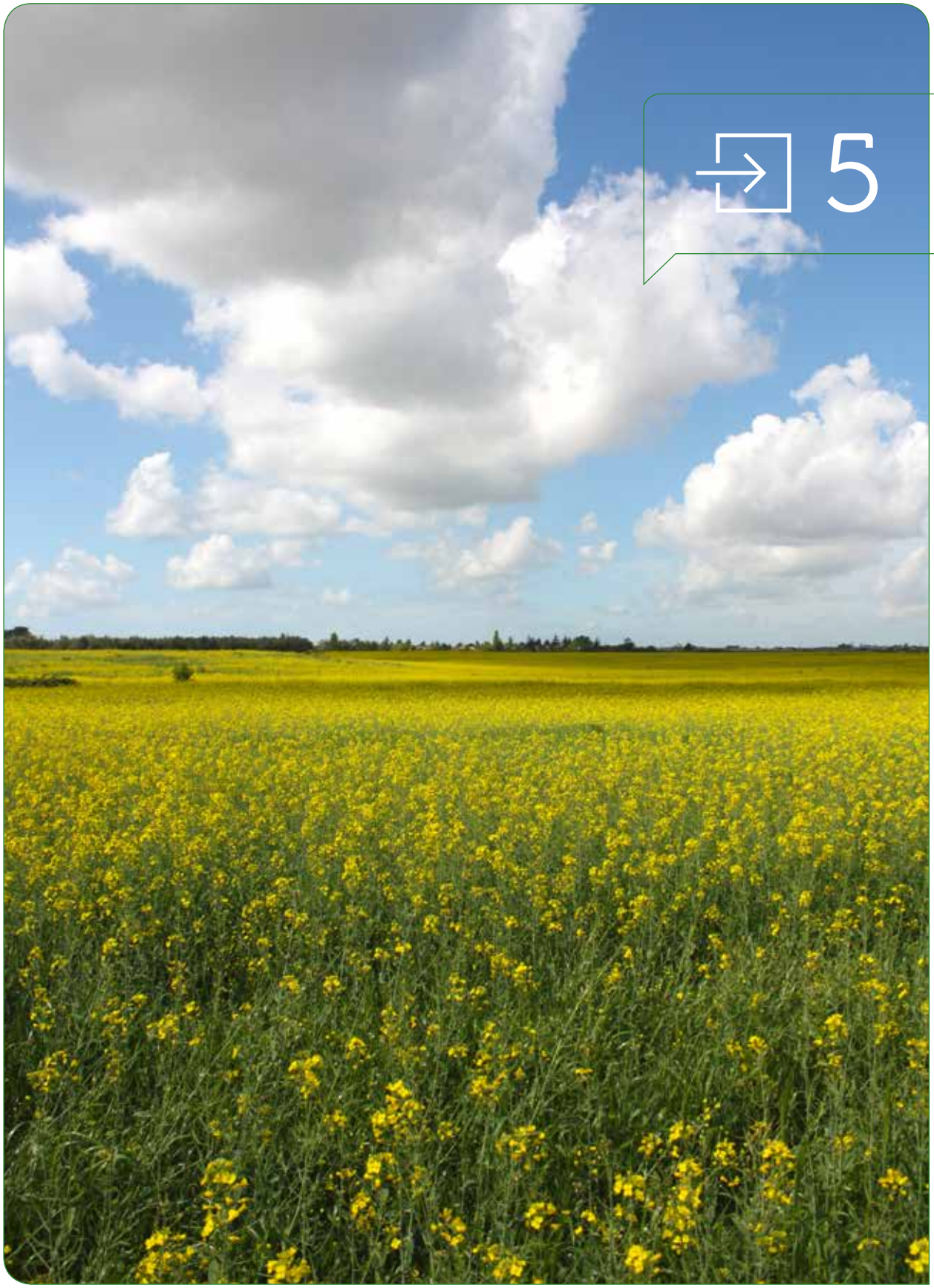
This is the third consecutive year, since the technology began to operate in Spain, in which aggregate employment in the sector has decreased. This trend will likely continue in the future if the construction of new solar thermal power plants, which is manpower-intensive, does not start again.

Chart 4.10.4

Direct and Indirect employment in the Termoelectric Solar power sector

Source: APPA




5

Impact of renewable energies on environment and energy dependence

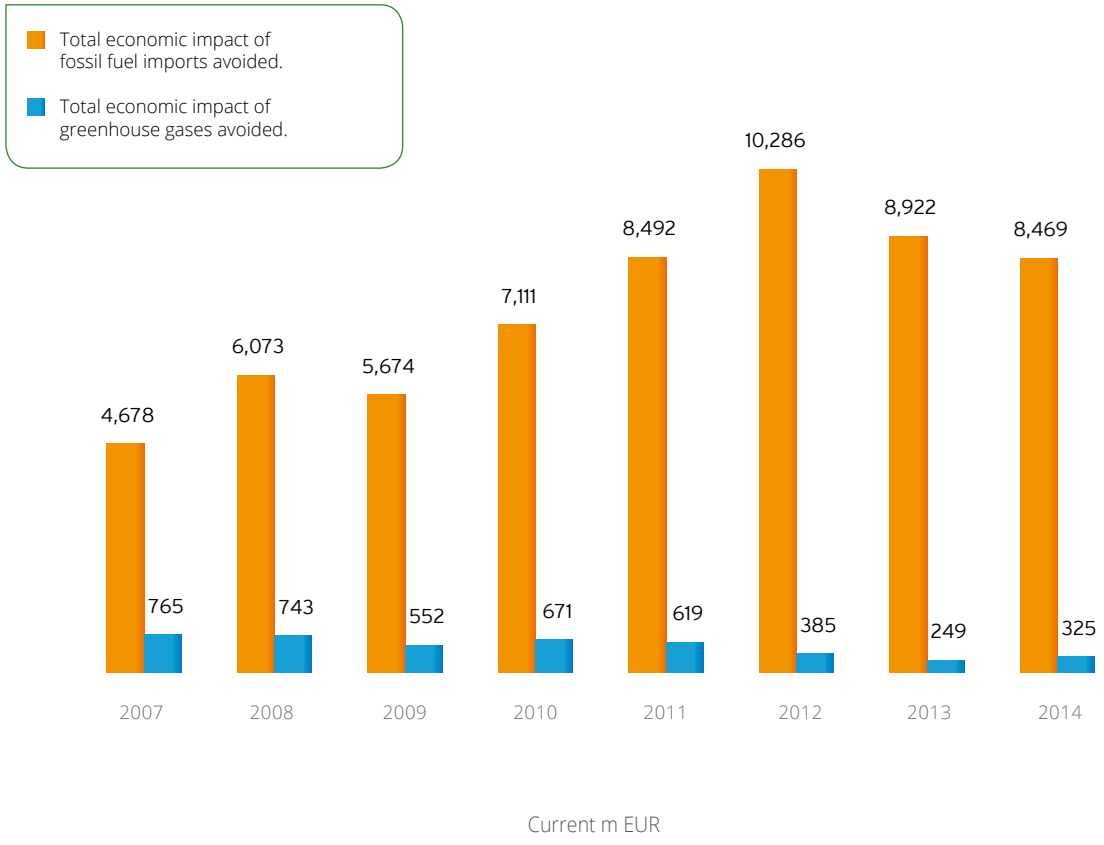
Renewable energies, unlike fossil fuels, do not produce CO_2 emissions. In fact, renewable energy production replaces fossil production sources and avoids pollution caused by CO_2 emissions. This entails a double economic saving: on the one hand, it makes it unnecessary to pay the cost of any externalities that should be paid in case contaminating fossil sources were used; and on the other hand, it becomes unnecessary to import those fossils that Spain does not own.

As it is shown in section 2 of the study herein, our economy had to pay a total of 38,071 m EUR in 2014 to import energy products such as oil, gas and coal, due to our high foreign energy dependence which exceeded 73% in 2014.

Chart 5.1

Savings produced by the use of renewable energies

Source: APPA



Electric, biofuel and thermal electric renewable production allowed the Renewable Energy Sector to avoid imports of 20,577,904 tonnes oil equivalent (toe) in fossil fuels, thereby generating economic savings of 8,469 m EUR. Similarly, the Sector avoided the emission of 54,433,800 CO_2 tonnes into the air, equivalent to 325 m EUR, a quantity that would have been paid by our country as externalities if renewable production would not exist. (Chart 5.1).

Impact on electricity production

By replacing the electricity produced from natural gas, coal and fuel-gas with electricity produced from renewable sources, energy dependence is reduced and important economic savings are achieved in the imports of those fuels. In 2014, electricity produced from renewable sources was of 74,907 GWh. (Chart

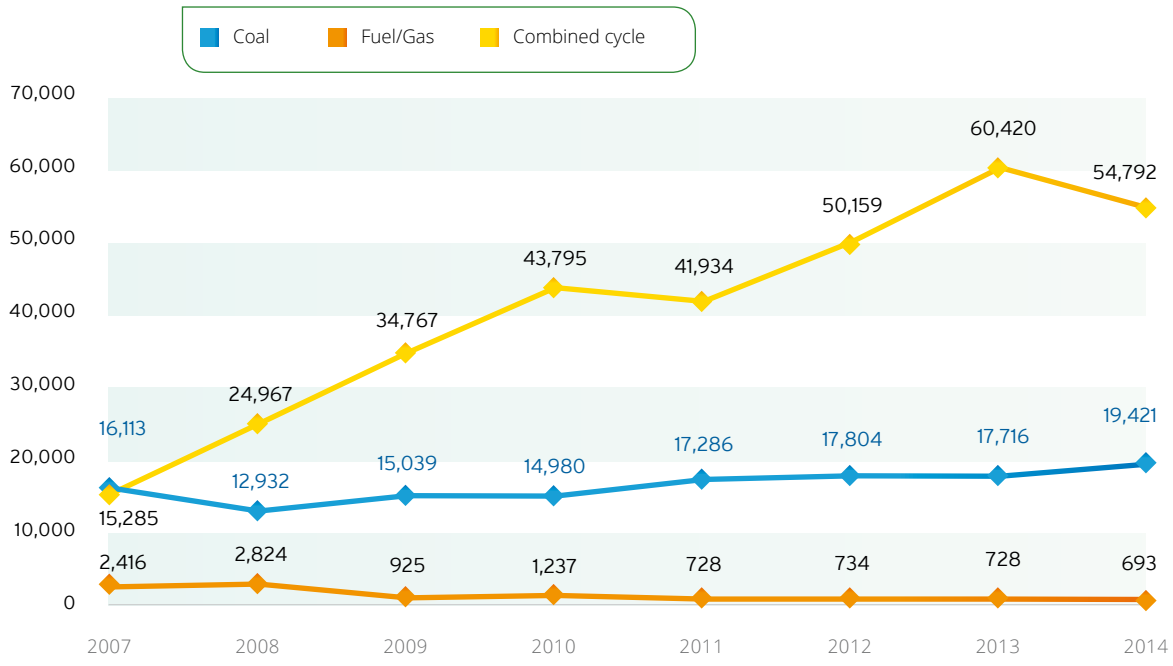
5.2). If this renewable production had not existed, it would have been necessary to produce this electricity with combined cycle gas, coal and fuel-gas plants, depending on the

Chart 5.2

Electricity from fossil fuels replaced by electricity from renewable sources

Source: APPA

GWh	2007	2008	2009	2010	2011	2012	2013	2014
Technology replaced								
Natural gas combined cycle	15,285	24,967	34,767	43,795	41,934	50,159	60,420	54,792
Coal	16,113	12,932	15,039	14,980	17,286	17,804	17,716	19,421
Fuel/Gas	2,416	2,824	925	1,237	728	734	728	693
Total	33,814	40,722	50,731	60,012	59,948	68,697	78,864	74,907

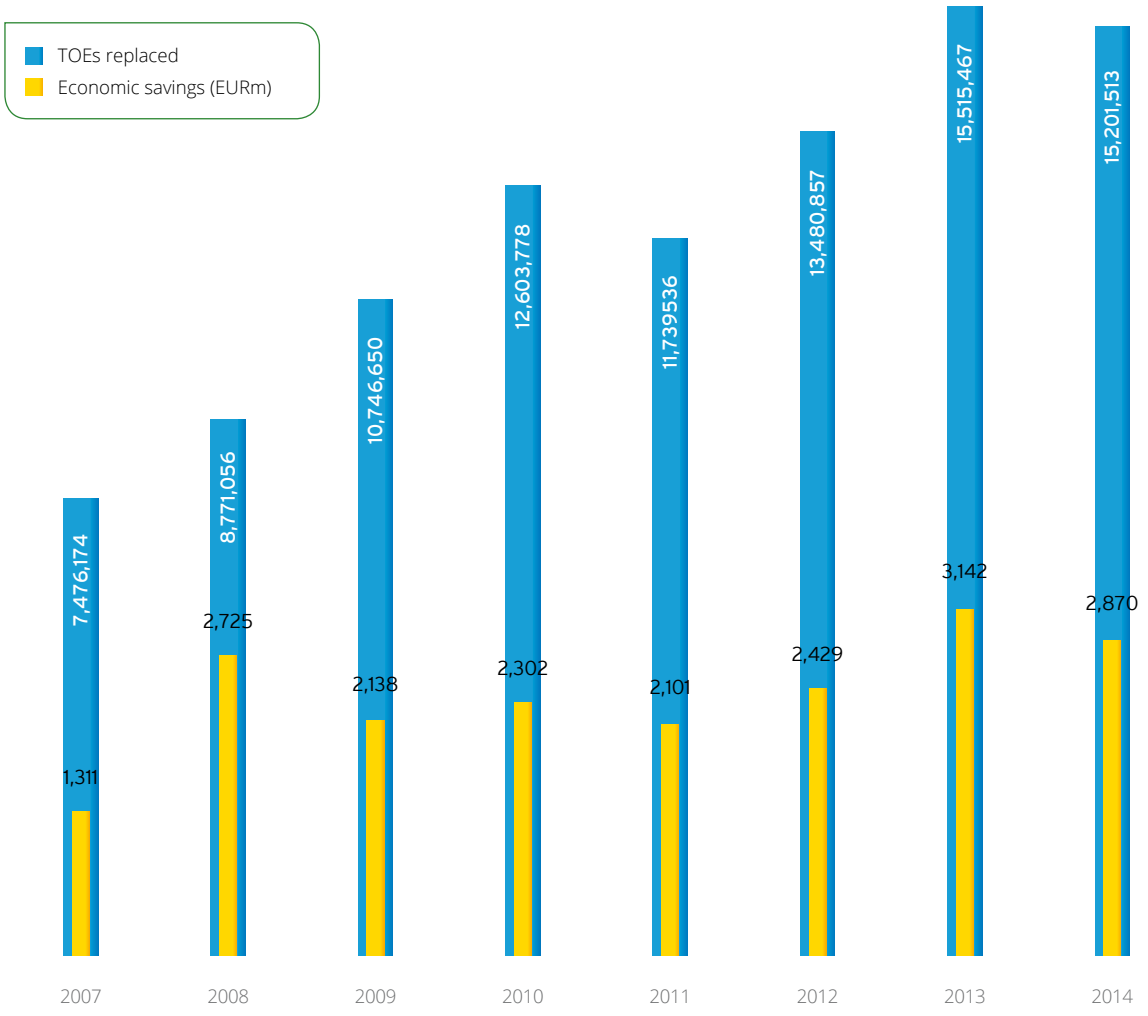


GWh - Technology replaced

Chart 5.3

Evolution of fossil fuels imports replaced by renewable energy generation

Source: APPA



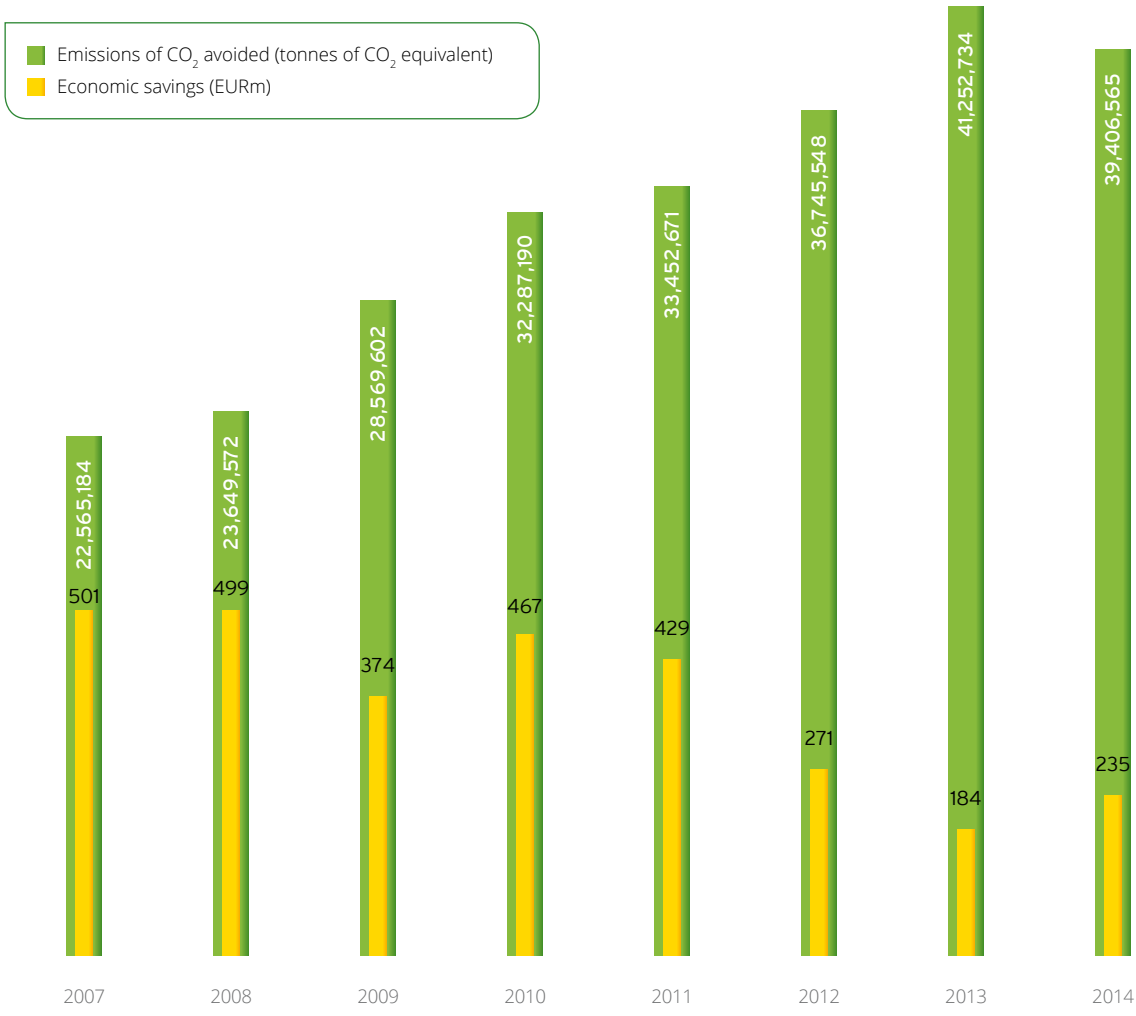
current energy mix. The Renewable Energy Sector saved the electricity system imports of 15,201, 513 toe of fossil fuels, with associated savings of 2,870 m EUR. (Chart 5.3).

Renewable energies avoided the emission of 39,406,565 tonnes of CO_2, resulting in economic savings to the amount of 235 m EUR. (Chart 5.4). While in 2013 the price of the CO_2 tonne was reduced from 7.37 to 4.45 euros, in 2014 this value increased to 5.96 euros for each tonne, and so, the produced economic savings increased even with the reduction of the avoided CO_2 emissions. It shall be noted that in 2007 the pri-

Chart 5.4

Emissions of CO_2 equivalent avoided and economic savings achieved by the production of renewable electricity

Source: APPA



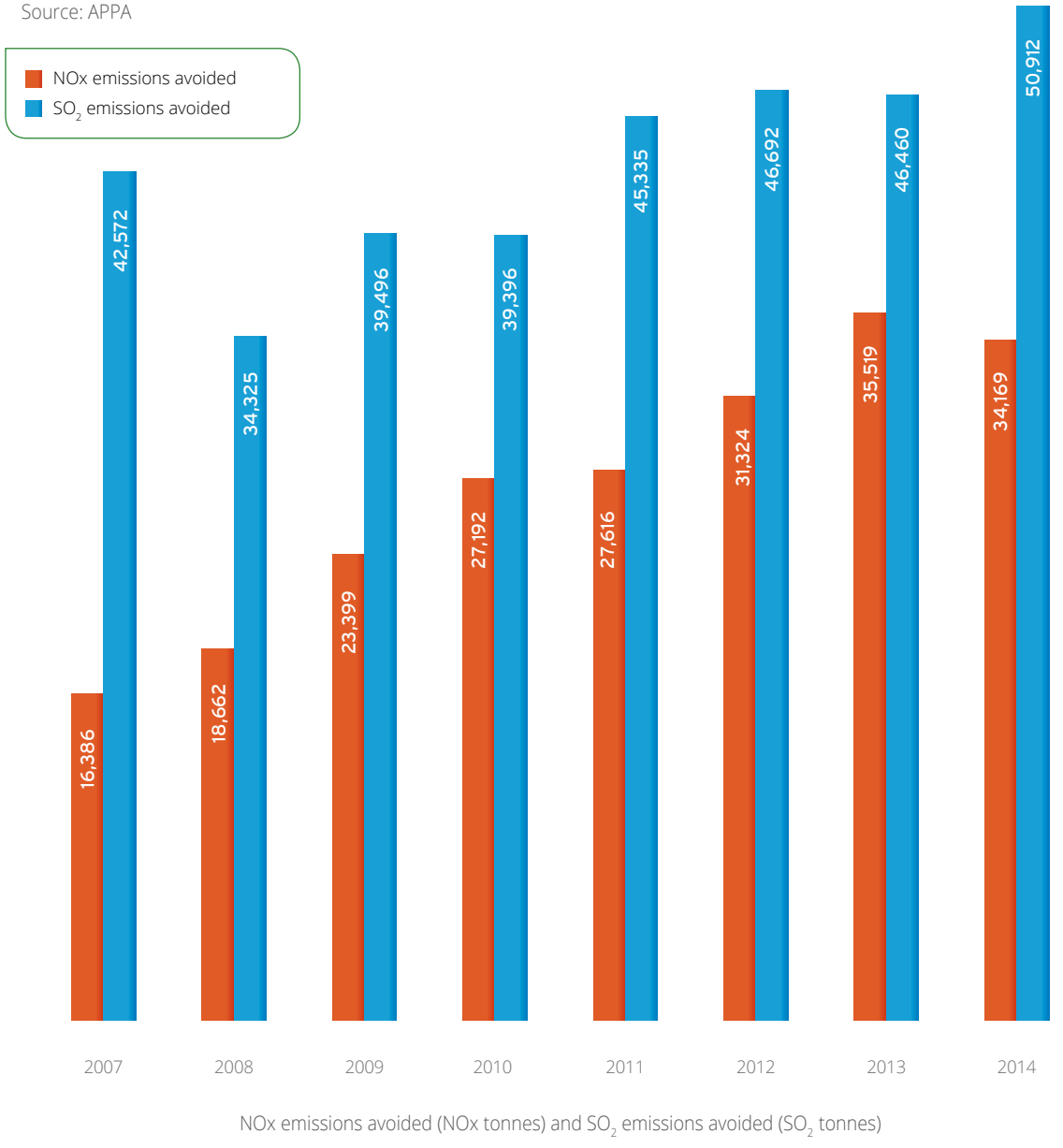
ce per emitted tonne reached 22,21 EUR, and consequently, the cost to pay for polluting the atmosphere was practically a quarter of what it used to be eight years ago. In the last ten years, renewable energies have avoided the emission of 296,203,202 CO_2 tonnes into the atmosphere. This 300 million of avoided CO_2 tonnes prevented the payment of 3,514 m EUR as externalities by the Spanish economy.

Though they do not have an own market, and so they do not produce direct economic savings, renewable energies also prevent other polluting (and harmful) gases from being

Chart 5.5

Evolution of NOx and SO_2 emissions avoided by producing electricity from renewable sources

Source: APPA



NOx emissions avoided (NOx tonnes) and SO_2 emissions avoided (SO_2 tonnes)

released into the air such as NOx and SO. Renewable production avoided the emission of 34,169 tonnes of NOx and 50,912 tonnes of SO_2 in 2014. Over the last decade the emission of 661,716 tonnes of these gases has been avoided. (Chart 5.5).

Impact on thermal production

The use of renewable energies, such as biomass, biogas, geothermal or solar also has a replacing effect which prevents the import of fossil fuels, such as natural gas, C diesel or heating and liquefied gases from oil, which would be necessary to consume if we could not use renewable technologies. In 2014 the thermal use of renewable energies avoided the import of 4,366,094 tonnes of toe, resulting in economic savings of 4,013 m EUR, see the Charts 5.6 and 5.7.

Chart 5.6 Evolution of fossil fuel imports replaced by thermal renewable production

Source: APPA

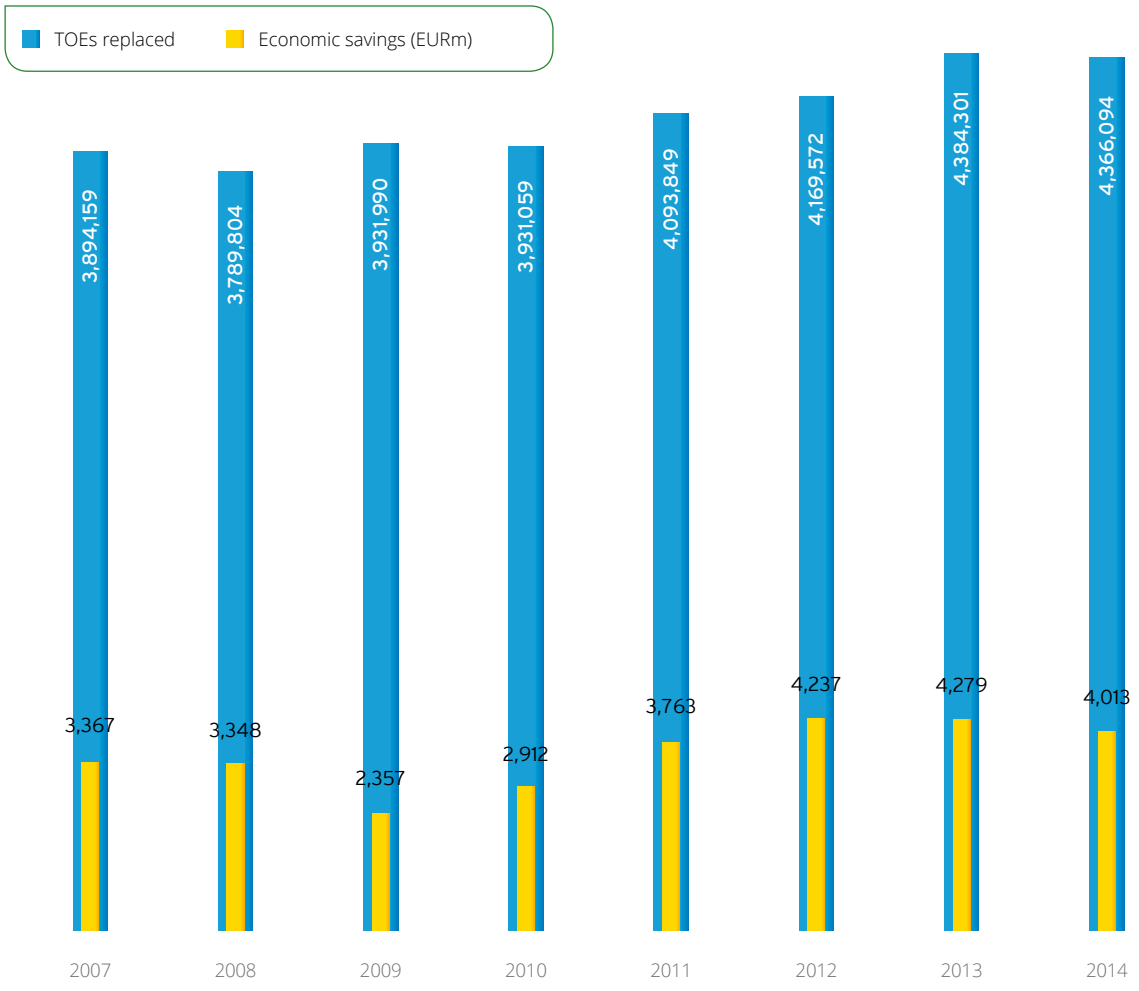


Chart 5.7

Energy from fossil fuels replaced by thermal production from renewable sources

Source: APPA

TOEs replaced	2007	2008	2009	2010	2011	2012	2013	2014
Technology replaced								
Diesel	3,823,898	3,695,513	3,813,746	3,787,686	3,931,885	3,993,061	4,188,287	4,155,222
Natural gas	53,329	71,242	91,372	114,031	130,778	142,914	161,223	174,064
LPG	16,932	23,048	26,872	29,343	31,186	33,597	34,792	36,808
Total	3,894,159	3,789,804	3,931,990	3,931,059	4,093,849	4,169,572	4,384,301	4,366,094
Economic savings	3,367	3,348	2,357	2,912	3,763	4,237	4,279	4,013

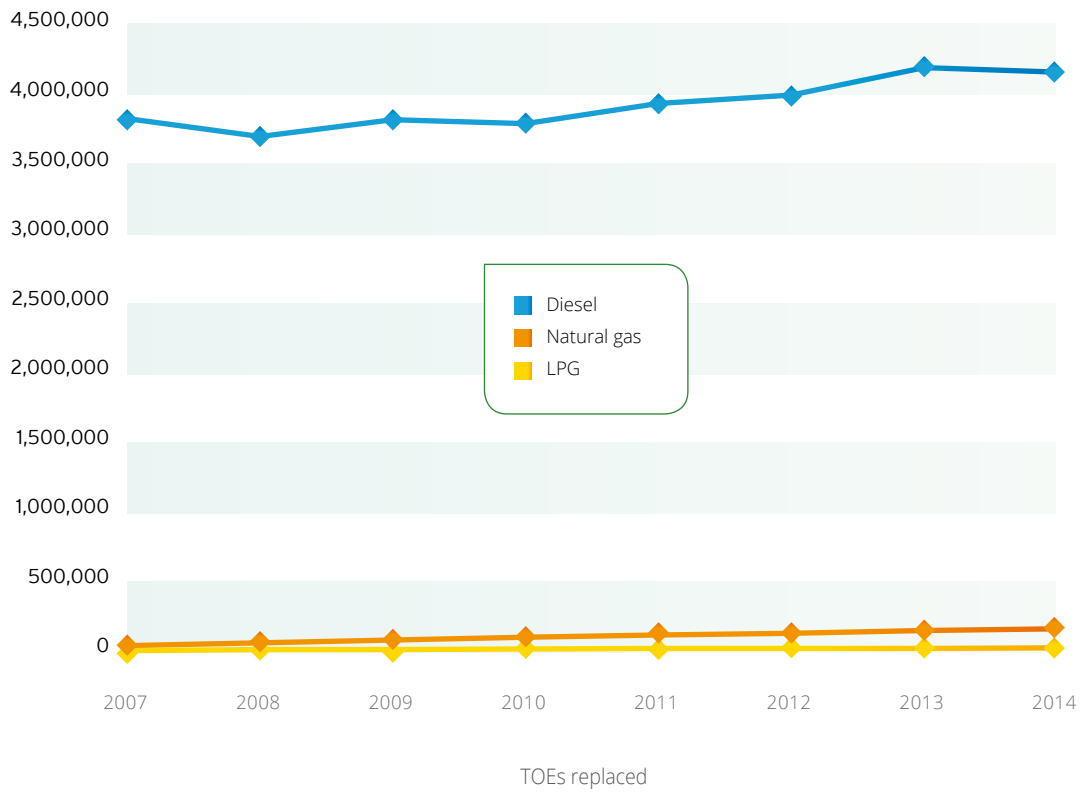
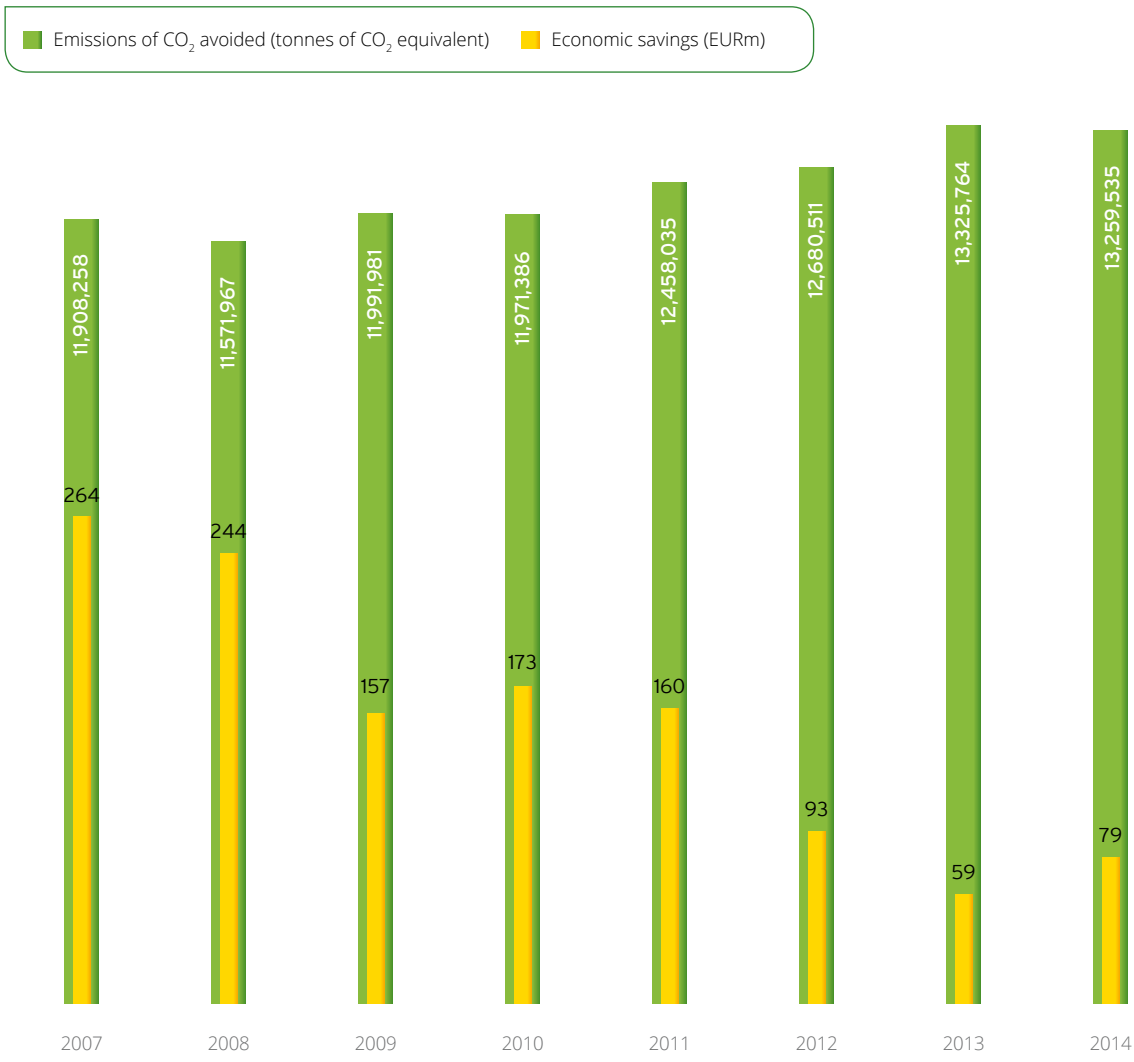


Chart 5.8

Emissions of CO_2 equivalent avoided and economic savings achieved from using renewable energies in thermal production

Source: APPA

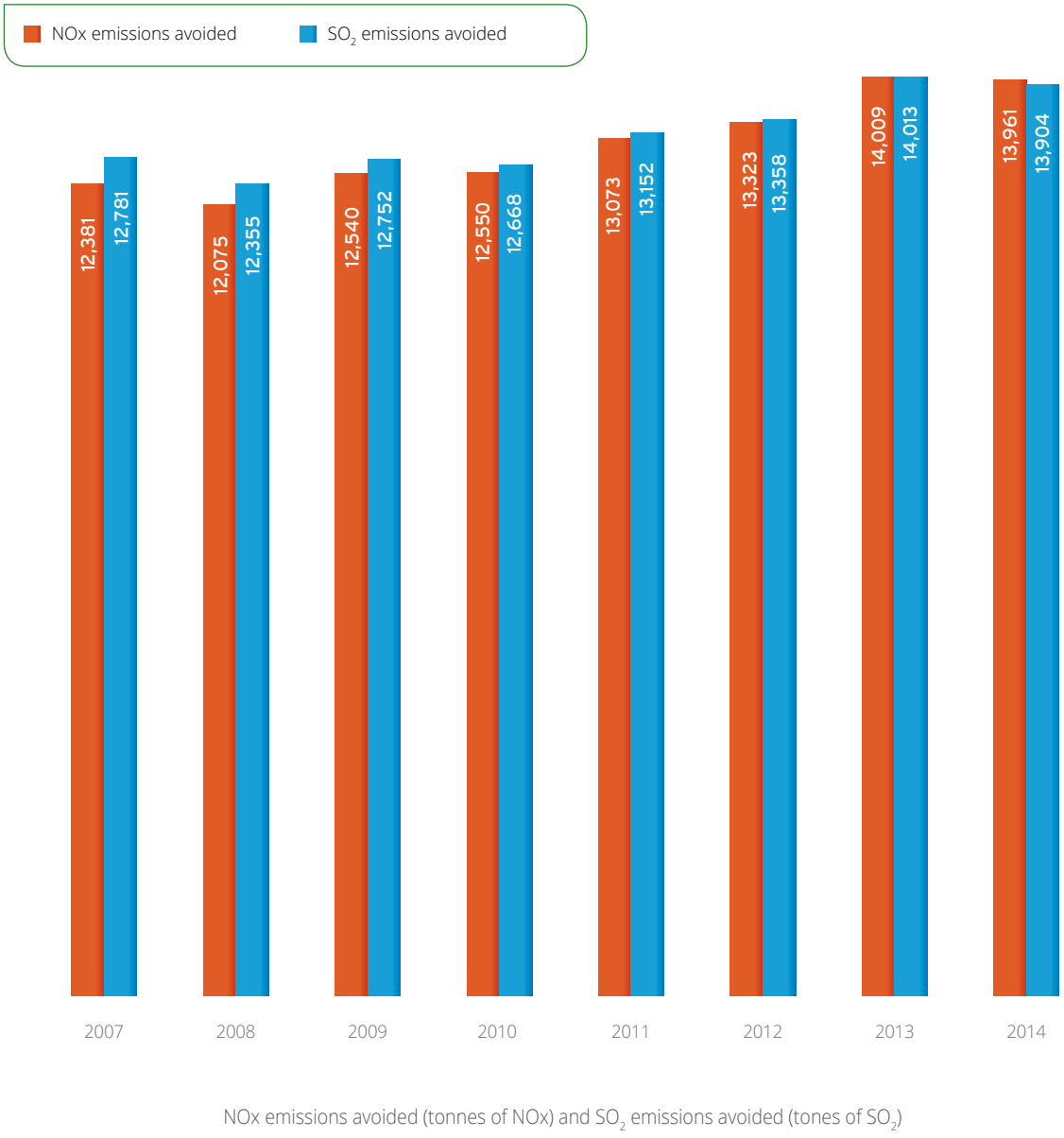


The thermal renewable production prevented the emission of 13,259,535 CO_2 tonnes with economic savings of 79 m EUR. (Chart 5.8). Despite the clear tendency to a reduction of the prices regarding CO_2 emission externalities over the past years, in 2014 the price tonne increased to 5.96 euros whereas in 2013 the price was 4.45 euros. This increase is reflected in the savings produced by the thermal use of renewable energies.

Chart 5.9

Evolution of NOx and SO_2 emissions avoided by using reneable thermal energies

Source: APPA



NOx emissions avoided (tonnes of NOx) and SO_2 emissions avoided (tones of SO_2)

Thermal renewable production avoided the emission of 13,961 tonnes of NOx and 13,904 tonnes of SO_2 during 2014. Over the last ten years the prevented emissions of these gases increased to 296,578 tonnes. (See the Chart 5.9).

Impact resulting from the use of biofuels

In 2014 biofuels consumed in Spain -1,169,978 tonnes of biodiesel, bioethanol and hydro-biodiesel- contributed to reducing greenhouse gases (GHG) emissions from transport, consequently preventing 1.7 million of CO_2

Chart 5.10

Emissions of CO_2 equivalent avoided by using biofuels in transport

Source: CNMC for 2009, 2010 and 2011; APPA estimates for 2012 and 2013; CNMC for 2014

Emissions of CO_2 equivalent avoided (tonnes)	2009	2010	2011	2012	2013	2014
Biodiesel and hydro-biodiesel	1,263,383	1,592,651	1,852,692	2,383,640	884,176	1,291,291
Bioethanol	346,172	567,111	522,613	464,829	390,958	476,410
Total	1,609,555	2,159,761	2,375,305	2,848,469	1,275,134	1,767,700
Economic savings	21	31	30	21	6	11

equivalent from being released into the air, with associated savings of 11 m EUR in externalities. (Chart 5.10).

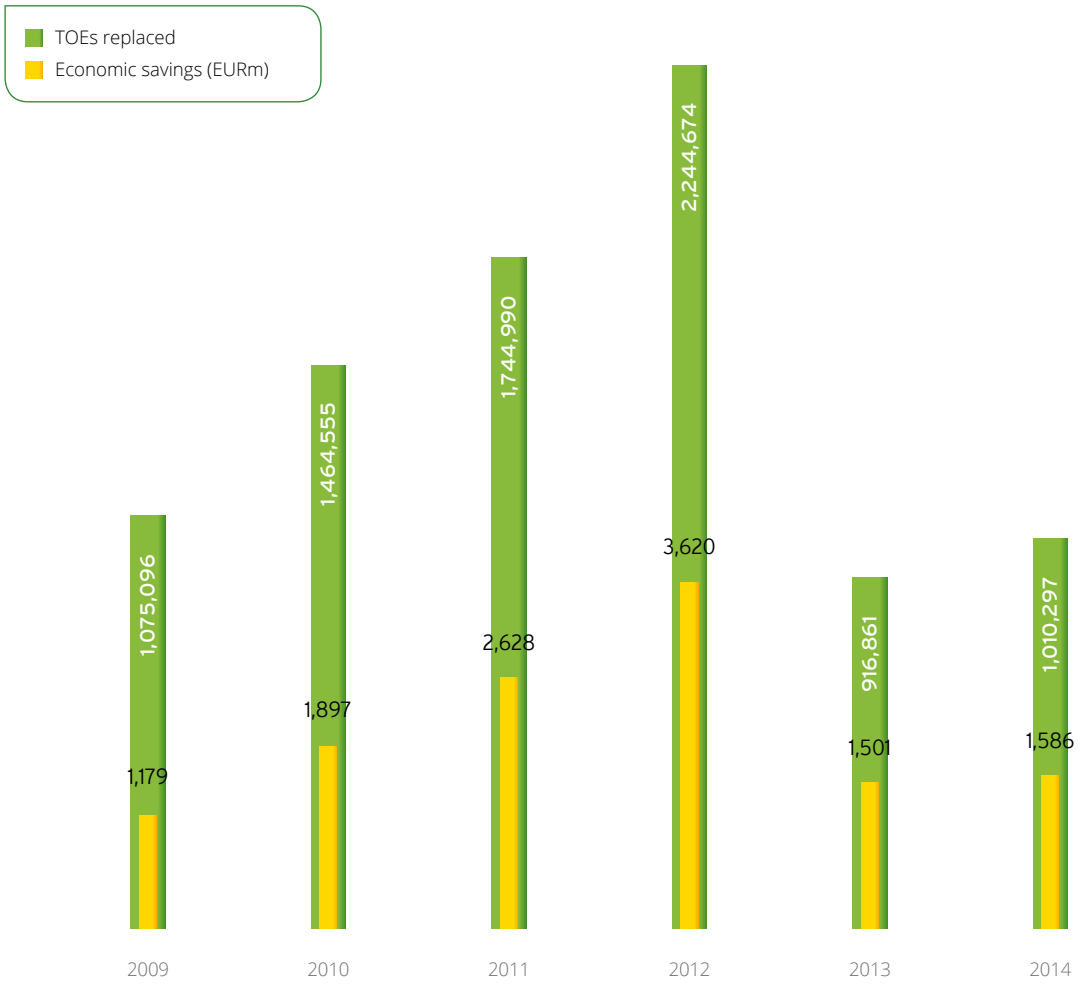
In addition to reducing GHG emissions as compared to fossil fuels, use of biofuels also enables the substitution of oil imports and consumption, there by contributing to the diversification of energy supplies and to the reduction of energy dependence from oil producing countries characterized in many cases by the political, social and economic instability. The avoided import of fossil fuels for transport exceeded one million of toe, with associated savings of 1,586 m EUR. (Chart 5.11). A greater market penetration from biofuels would enable to reduce the adverse effects on oil prices resulting from the above mentioned instability even more. Additionally, a larger biofuel domestic production would improve Spain's trade balance and would reduce its energy dependence on imports even more.

Chart 5.11

Estimates of fossil fuels for transport replaced by biofuels

Source: CNE and CNMC

Fossil fuels replaced (toe)	2009	2010	2011	2012	2013	2014
Diesel	923,303	1,226,853	1,519,301	2,043,939	748,027	824,289
Petrol	151,793	237,702	225,689	200,735	168,834	186,008
Total	1,075,096	1,464,555	1,744,990	2,244,674	916,861	1,010,297
Economic savings	**1,179**	**1,897**	**2,628**	**3,620**	**1,501**	**1,586**



6

Economic balance from renewable electricity production

In 2014, renewable energies reduced the price of the electricity market in 7,105 m EUR. That figure represented savings of EUR 26.30/MWh. Thus, the use of renewable energy as a source of electricity production, supposed an important reduction of the cost of electricity in the electric market.

In 2014 Feed-in Tariffs (FIT) received by renewable energies amounted to 5,238 m EUR, representing a reduction of 22.3% in relation to 2013. The difference between FITs and the benefits produced by renewable electricity technologies amounted to 4,972 m EUR, twice the value of the previous year.

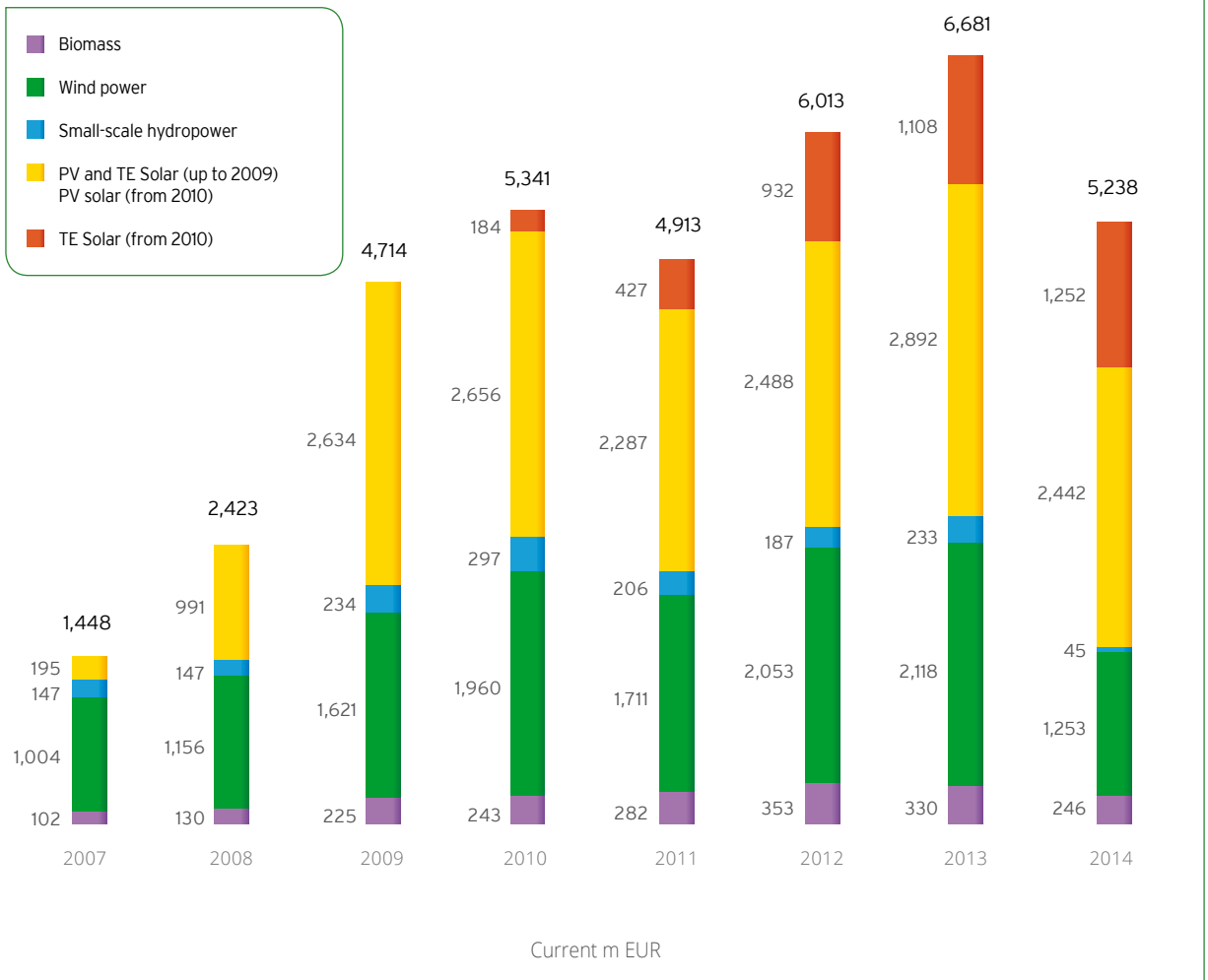
Feed-in Tariffs received by renewable energies for producing electricity

This significant reduction of renewable energies retribution is a consequence of the important cutbacks included in the misnamed energetic reform promoted by the Spanish Government in 2013 which started with RDL 8/2014. The cutbacks were confirmed after the publication of RDL 413/2014 and OM 1045/2014, which established the standard parameters. It is the second time a reduction of FITs happens after the one which took place in 2011 as a result of Royal-Decree Law 14/2010. Chart 6.1 shows the breakdown by technologies.

Chart 6.1

FITs received, by technology

Source: CNMC



Current m EUR

Economic impact on the electricity wholesale market

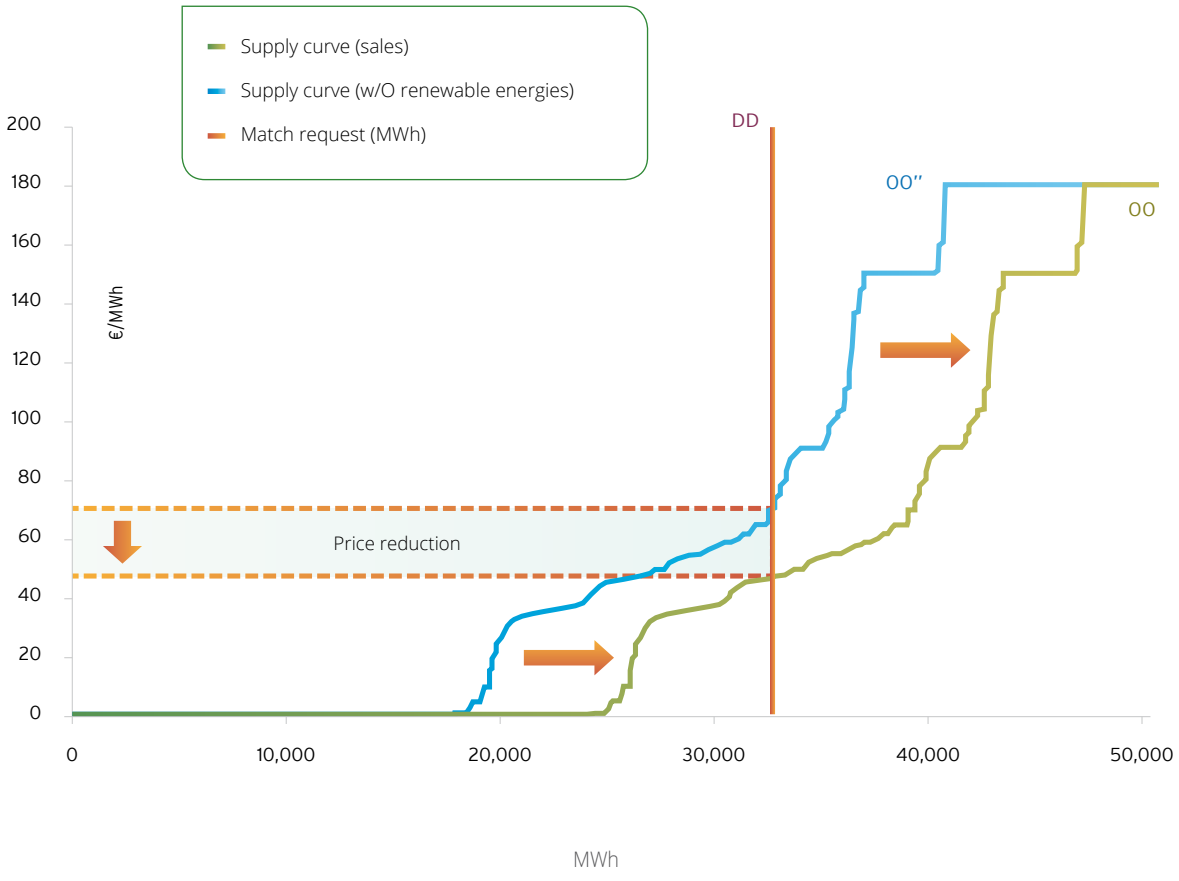
Renewable production under the Special Regime acted as price-taker in the electricity wholesale market, also known as "pool". This production, with a production marginal cost lower than units produced from fossil fuels, causes a downward market effect by establishing a marginal price lower than the price that could be achieved if renewable production did not exist. Renewable energies replace conventional generation units with higher marginal costs which would set a higher resulting market marginal price.

Given the marginal nature of the wholesale market (pool) (all production is paid at the price of the latest generation unit admitted to the market, i.e. at the highest price), the existen-

Chart 6.2

Methodology employed to compare hourly matches on the Daily Market with and without renewable energies

Source: APPA



ce of production from renewable sources that offer electricity at lower prices results in the establishment of lower marginal prices. Therefore, it is clear that renewable energies under the Special Regime do reduce the market price.

Chart 6.2 shows the assessment of the impact the above mentioned effects have on the aggregate cost of energy in OMIE Daily Market. For this purpose, a comparison has been made for the period 2005-2013 between the hourly match of production made by OMIE[1] on the daily market, including renewable production, and another one where this kind of production is excluded, and replaced by higher-price units.

The result of this exercise shows a reduction in the electricity acquisition price resulting from the downward renewable energies effect, and thus, a lower marginal price to be obtained from the wholesale market.

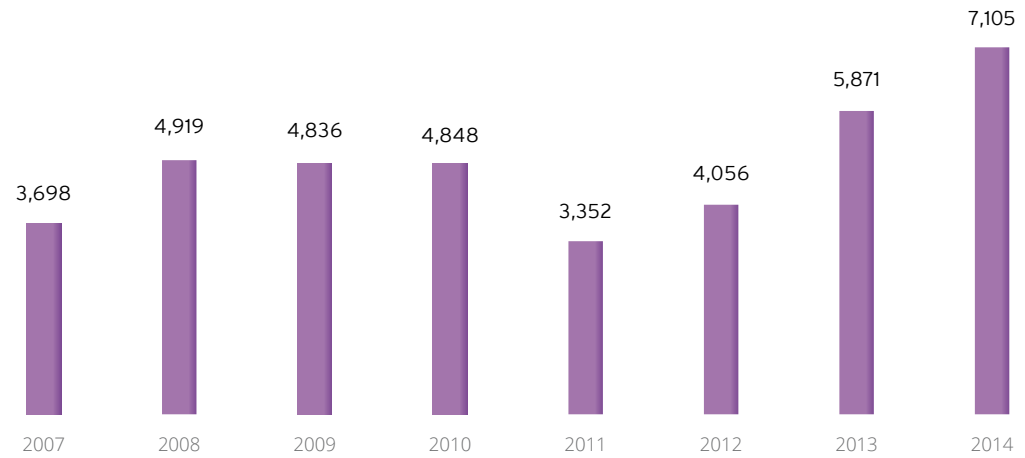
With this, in 2014, renewable energies reduced in 7,105 m EUR the price of the daily

[1] This comparison has been made by replacing renewable energies considered in every hourly match with the closest offers submitted by production units to OMIE and with the mechanism established in 2006 to prevent the cost of CO_2 emission rights to be transferred to all the electricity traded in the market (CO_2 reduction). Since the exercise has been conducted on the daily market, the effect of capacity payments and technical restrictions is excluded.

Chart 6.3

Reduction in the cost of acquiring energy in OMIE's Daily Market due to penetration of renewable energies

Source: APPA

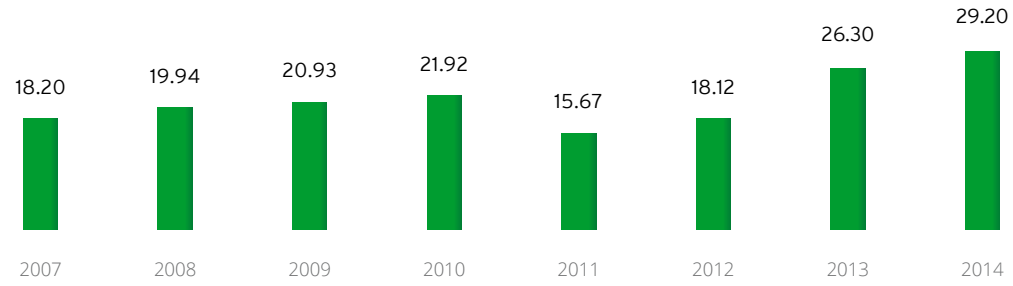


Current m EUR

Chart 6.4

Reduction of electricity cost in MW, on the wholesale market

Source: APPA

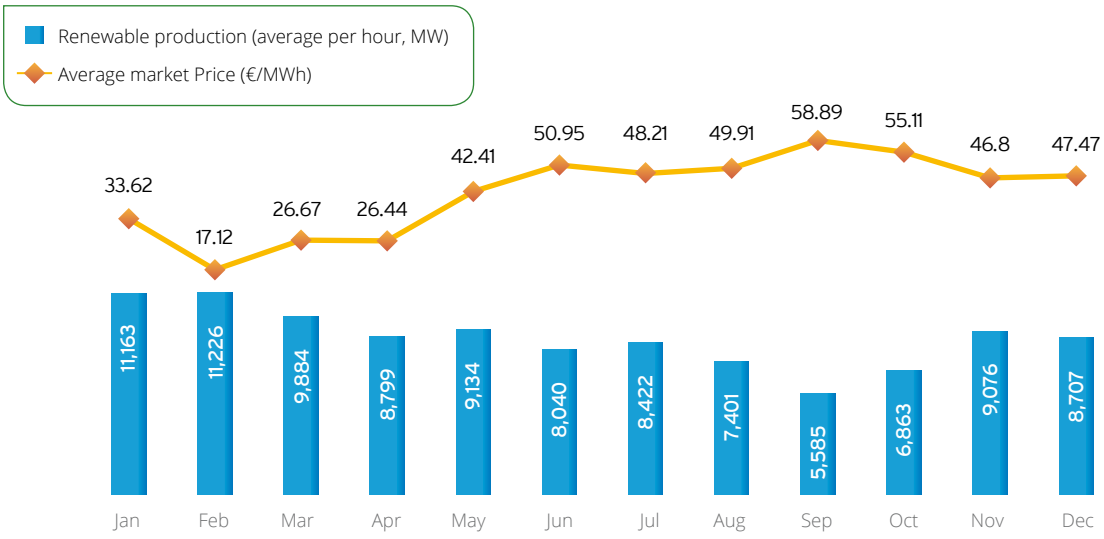


€/MWh

Chart 6.5

Renewable production in 2014 and average pool market price

Source: REE and OMIE



€/MWh

market. This figure represents savings of EUR 29.20 for each MW acquired on the pool. (Charts 6.3 and 6.4).

As is shown in chart 6.5, the higher the contribution to renewable energies is, the lower the match price in the market is.

It is clear that without the existence of renewable production, the average market price in 2014 would have been of 71.33 €/MW, far from the 42.13 €/MW resulting from the match in price.

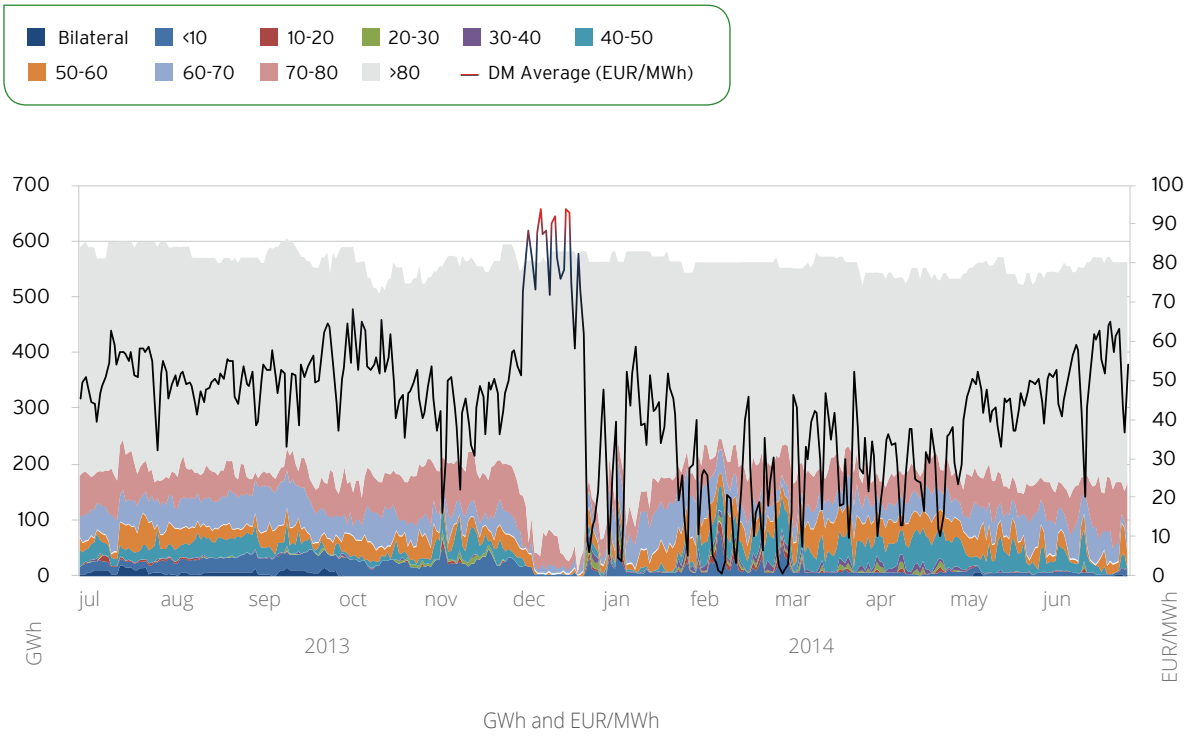
This difference between the real daily market price and the one that would have resulted from the match without renewable production is well justified by the high price of the following bid units, mainly the combined cycles of natural gas.

Chart 6.6 shows the cost of the offers of combined cycle plants during 2013 and the first semester of 2014 (when this study was being edited, CNMC had still not published the reports corresponding to the second semester of 2014).

Chart 6.6

Price range for electricity offered on the daily market and electricity bilateralised from combined cycle plants. July 2013 - june 2014

Source: (SGIME) CNMC



GWh and EUR/MWh

Chart 6.7

Comparative evolution of price reduction in OMIE's Daily Market, the economic impact of CO2 emissions avoided and reduced energy dependence, and FITs received by the Renwable Energy Sector

Source: APPA

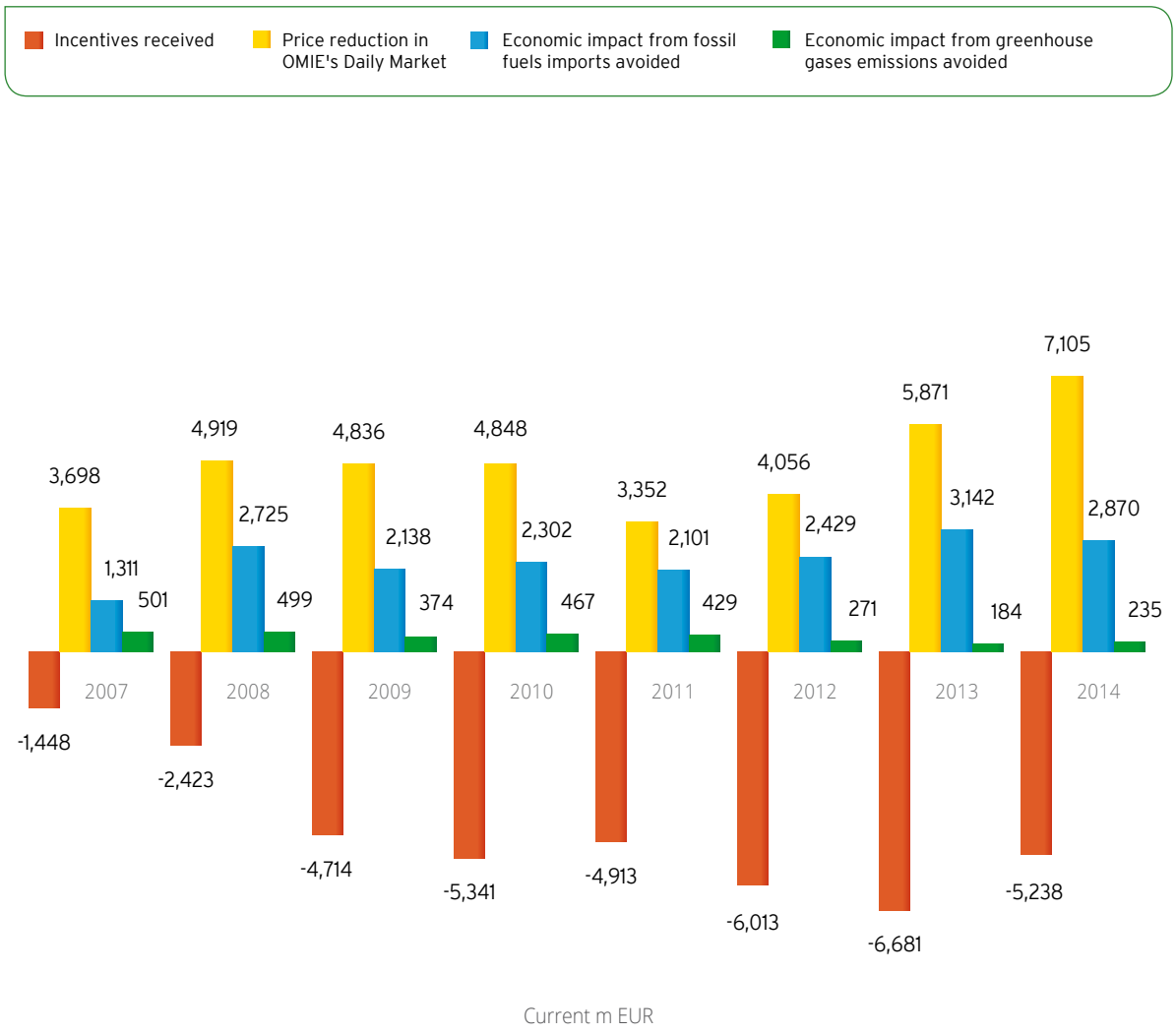


Chart 6.6 shows that most of the plants offer exceed EUR 80/MWh. However, if renewable production did not exist, offers should match between 60 and 80 €/MWh, something that would make the price much higher than the price finally registered during 2014.

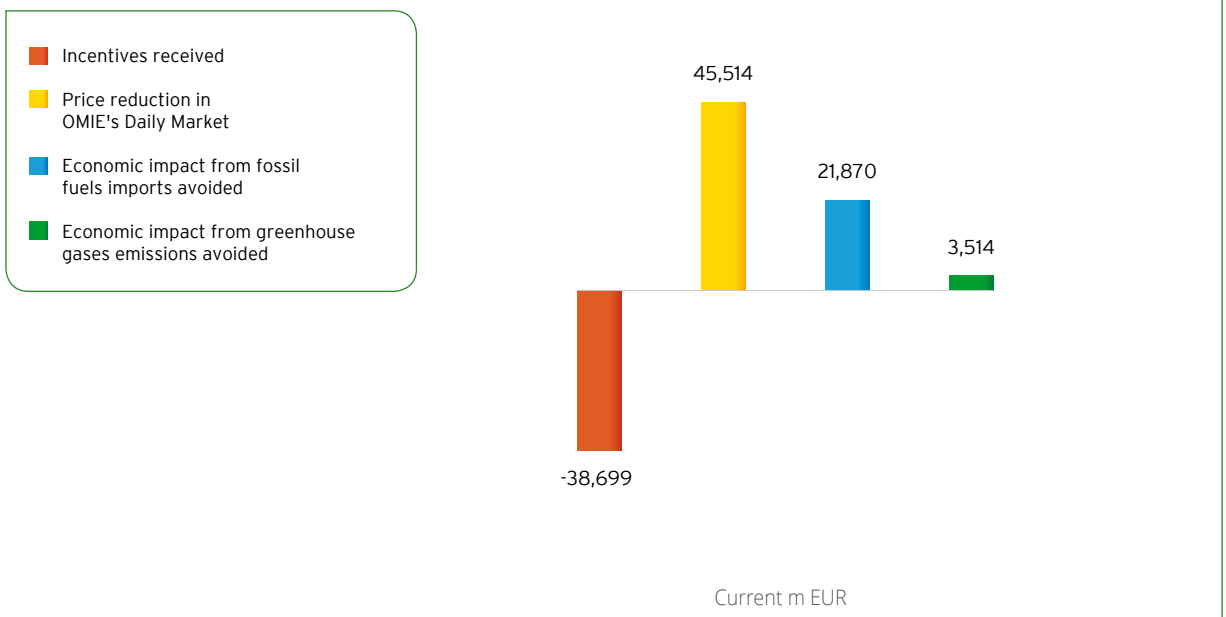
Difference between Feed-in Tariffs received and savings produced by renewable energies

Over the above sections, this Study has shown the savings produced by renewable energies

Chart 6.8

Comparison between accumulated values (2005-2014) of received bonuses, pool savings, import savings and CO_2-emission savings

Source: APPA



under the Special Regime as a result of reduced CO_2 emissions and of avoided fossil fuels imports, being the total emissions of greenhouse gases reduced. These savings are complemented by the ones produced in the OMIE's market are assessed in this chapter.

In 2014 the savings obtained by renewable electric technologies exceeded their FITs by 4,972 m EUR, as it can be observed in chart 6.7. This values practically doubles the 2,516 m EUR saved by the renewable energies in 2013. Considering the aggregate savings achieved in pool price, in CO_2 emissions and in fossil fuel imports, during the last ten years renewable energies have produced 70,898 m EUR in savings for the Spanish energy mix taken as a whole (see chart 6.8).

Tariff deficit and savings produced by renewable electricity sources

Renewable energy use not only produces significant savings directly from the electricity system by reducing the price in the electricity market pool but also by avoiding CO_2 emissions and imports of millions of tonnes of oil equivalent

(toe), with its corresponding economic savings which positively impact the trade balance in the purchase of externalities.

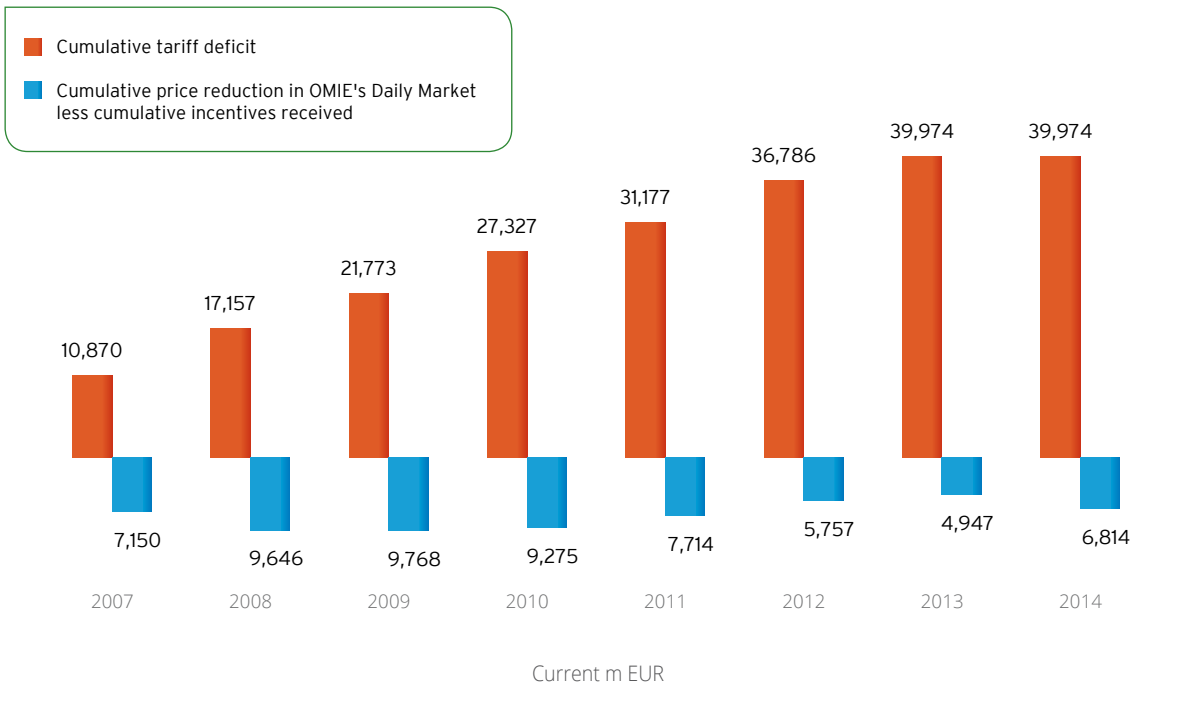
This Section compares the savings produced by renewable energy with FITs received and the evolution of tariff deficit. The comparison is presented between the aggregate tariff deficit and the net pool price reduction from renewable energies, previously called "bonuses".

Over the last ten years, savings achieved by the pool price reduction generated by renewable energies amounted to 45,514 m EUR, while the received aggregate FITs amounted to 38,699 m EUR, raising to 6,814 m EUR net cumulative savings from renewable energies until 2014.

The aggregate tariff deficit generated amounted to 39,974 m EUR, whereas the aggregate price reduction that renewable energies generated in the electric system was 6,814 m EUR. This means that the electric market would have probably reached higher levels without the presence of renewables, as these technologies do not generate tariff deficit. On the contrary: they reduce electricity costs. (Chart 6.9).

Chart 6.9 Cumulative tariff deficit vs. net cumulative savings from reduced prices in the electricity market

Source: APPA



7

The Electricity System in Spain

The Spanish electricity system registered an installed capacity of 107,954MW by the end of 2014. The production capacity increased by 39% during the last ten years, while electricity demand was reduced by 1% during the same period, resulting in an excess in capacity in Spain's electricity system.

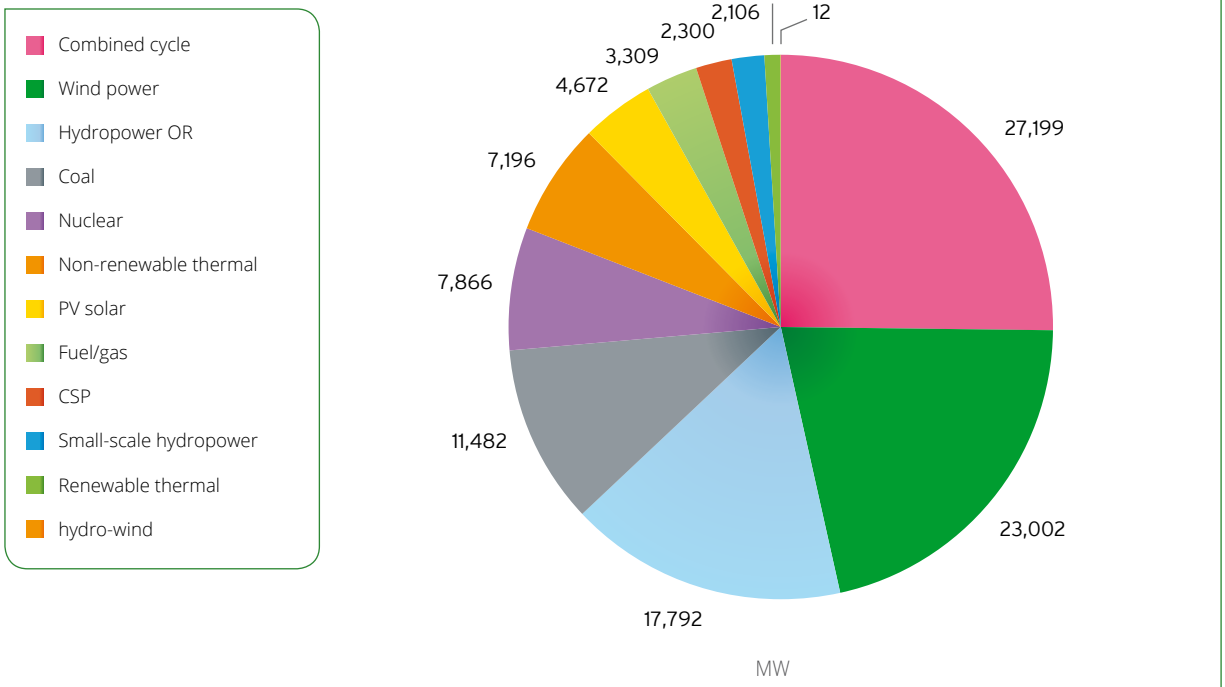
During 2014, the total costs of the electricity system amounted to 30,217 m EUR, of which 12,398 m EUR (41%) corresponded to the so-called liberalized energy costs and 17,819 m EUR (59%) to the regulated costs.

FITs of renewable energies decreased 22% in relation to 2014. However, some items were barely modified, such as adjustment services or distribution, which were reduced by 3% and 1% respectively. Others increased, such as transport, (4%).

Chart 7.1

Installed capacity in Spain by the end of 2014

Source: REE



Evolution of installed capacity and electricity demand

By the end of 2014, the Spanish electricity system had 107,954 MW in installed capacity. Natural gas combined cycle is the technology with more capacity with a 25.19% of the total (27,199 MW) followed by wind power with a 21.31% share (23,002 MW) and large hydropower with a 16.48% share (17,792 MW). Renewable energies as a whole represented 47% of the installed capacity with 50,902 MW, whereas renewable technologies from the old Special Regime, with 33,110 MW, reached a 31%. (Chart 7.1).

Even though not a single MW of it was installed in 2001, natural gas combined cycles experienced an increase in installed capacity during the last years, becoming the technology with the most installed capacity in our country. The development of the generation in ordinary regime, such as natural gas combined cycles is the result of the lack of regulation for the sector. A big part of the installed capacity of gas plants remains unused nowadays.

To the contrary, the development of renewable energy facilities was the result of an energy policy designed to meet, among others, the European environmental targets, based on directives marked in the sector's regulation (see chart 7.2).

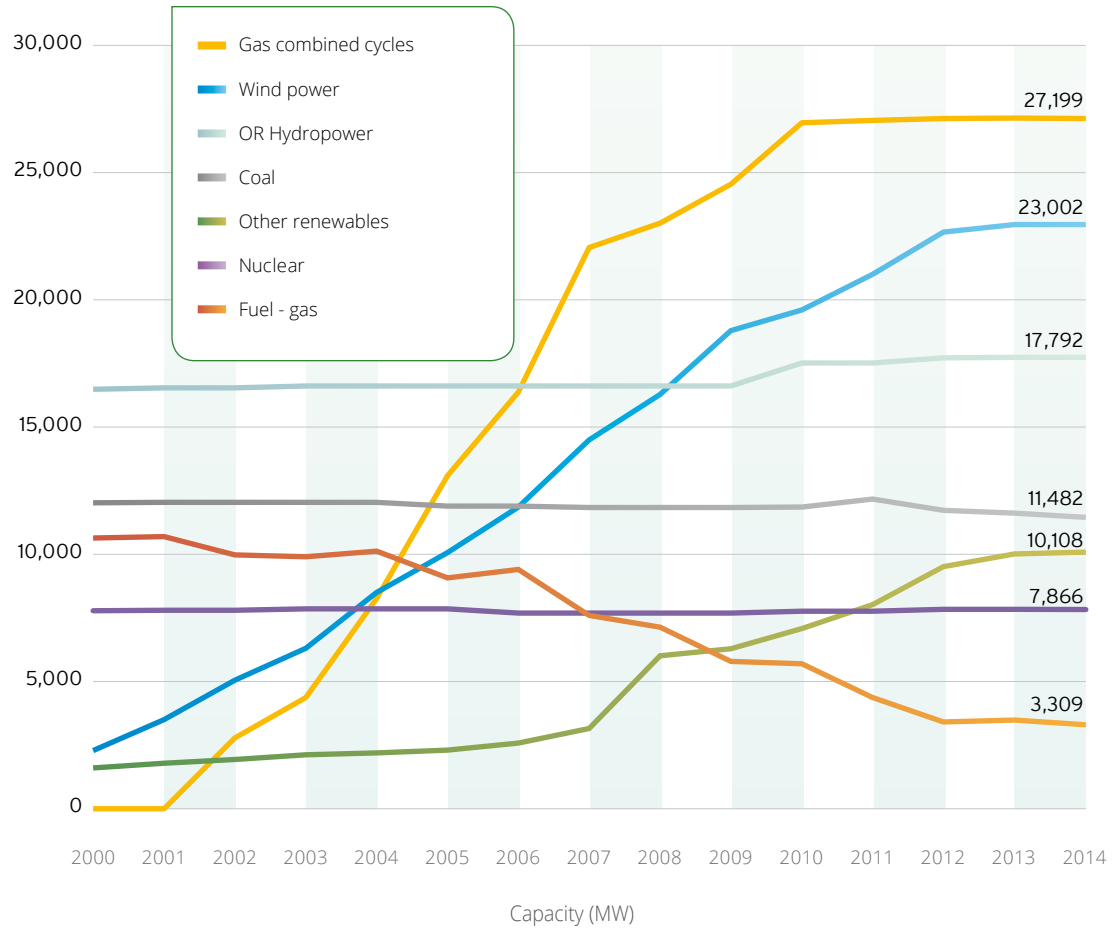
The standstill suffered by renewable energies is proved by the lower electricity generation in 2014 compared to 2013. A big part of this reduction of 4.8% in renewable electricity is a direct consequence of the disastrous regulation faced by the sector and the discriminatory measures taken against these technologies (see chart 7.3).

The Spanish electricity system has an excess of generation capacity today. If the last ten years the aggregate installed capacity increa-

Chart 7.2

Installed capacity in coal, gas combined cycles, fuel-gas and hydropower plants under ordinary regime, nuclear and other renewable energies

Source: CNMC and REE



sed by 38.2%, going from 78,086 MW in 2005 to 107,954 MW in 2014, the demand of electricity decreased, achieving in 2014 a lower value (258,117 GWh) than the value registered in 2005 (206,704 GWh). This difference between the increase of new production facilities and the decrease of the demand during the last years resulted in an electricity system with an excess of generation capacity, and thus, a non efficient system. (See chart 7.4).

Chart 7.3 Electricity production, renewables under Special regime and other technologies (2007-2014)

Source: CNMC and REE

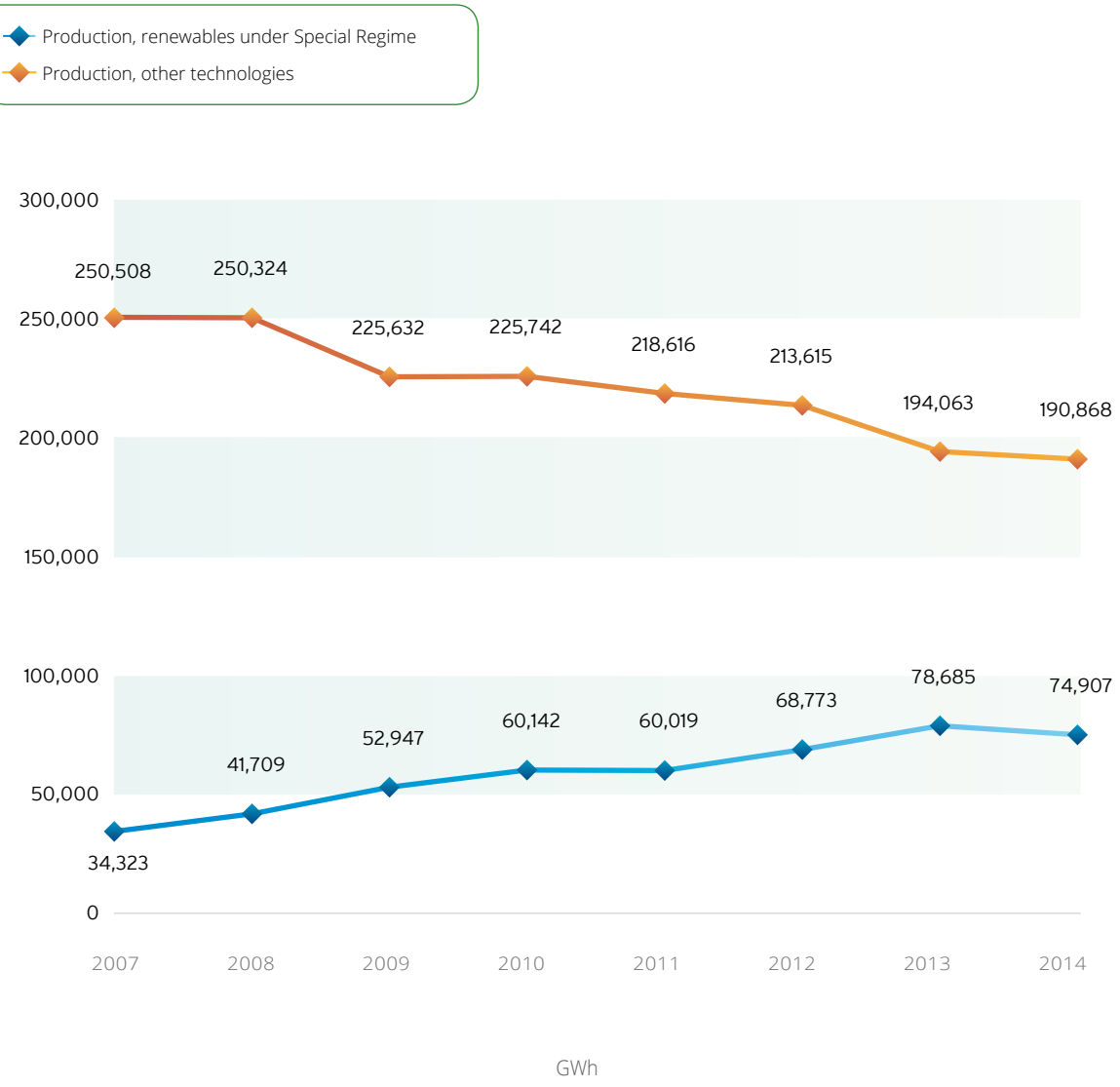
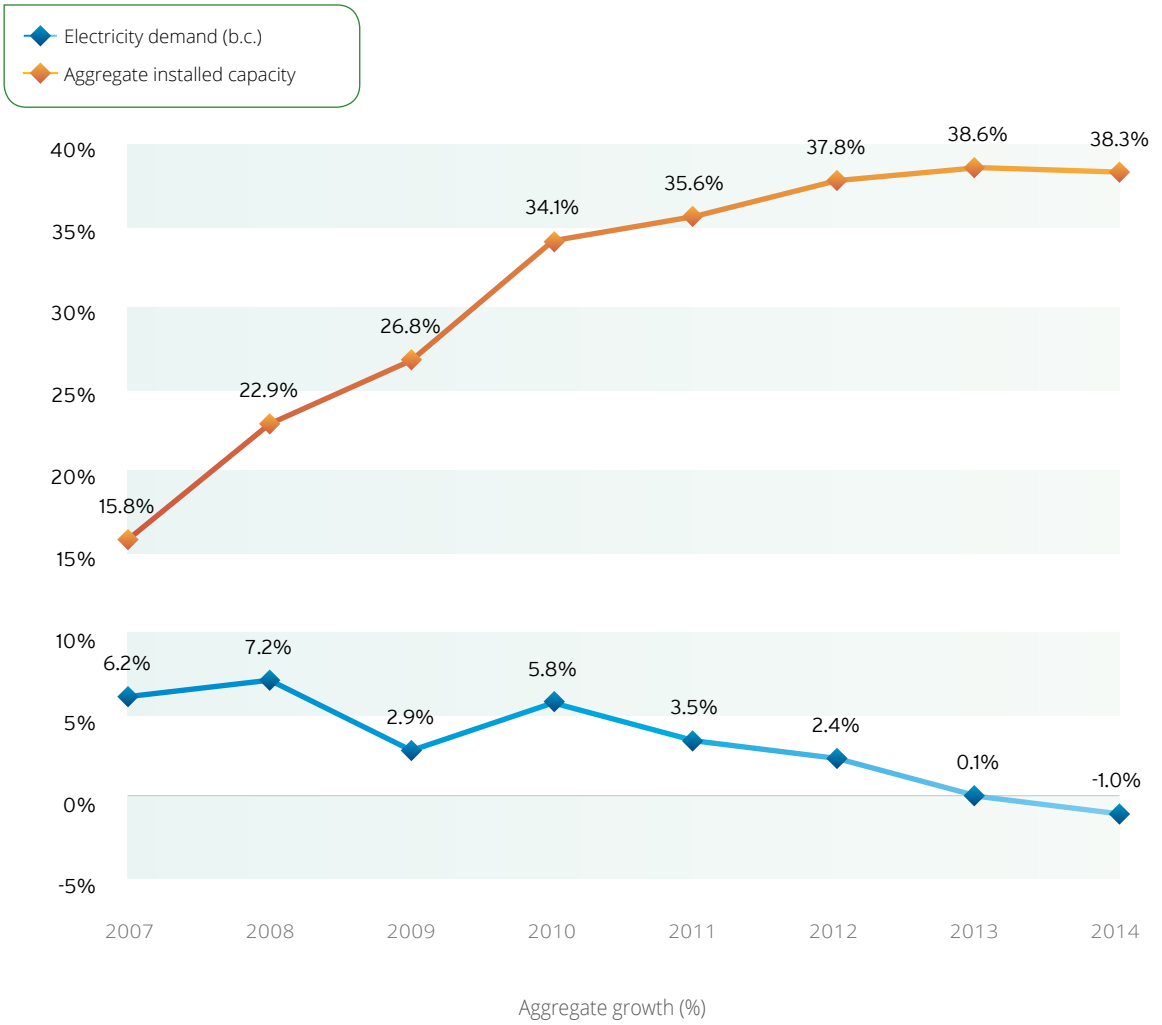


Chart 7.4

Aggregate growth in installed capacity vs. electricity demand

Source: REE



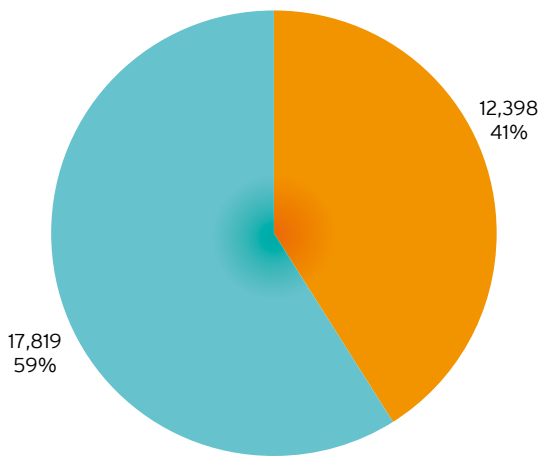
Electricity System Costs

In mid-2013, the Spanish Government sponsored the miscalled electricity reform, justifying it by the urgent necessity of putting an end to the so-called tariff deficit (difference between the system's income and the recognized costs of electricity). This reform has exclusively focused the reduction of the regulated costs of the system, and fundamentally, on FIT costs, being renewable energies the most damaged by this reform.

Since the end of 2013, with the implementation of Law 24/2013 of the Electricity Sector, the bonuses recognized by the old special regime have disappeared (renewable production was part of this regime), and have been replaced by an Specific Remuneration Regime which complements the incomes obtained by these technologies in the electricity market in order to recover their investment and operation costs.

Chart 7.5 Electricity system costs in Spain, 2014

Source: CNMC, REE and OMIE



Current m EUR - Percent

The electricity system costs consist of two tranches. One of them is the "liberalized tranche" which fundamentally includes the costs of the electricity market, also known as "pool". Other concepts set by the Government are also included in the liberalized tranche, such as payments for capacity or payments to domestic coal. Therefore, it is a mistake to call it liberalized costs, when part of these are set by the Government.

Secondly, we have the "regulated tranche" which includes, amongst others, the costs of electricity networks, FITs paid to renewable energies, tariff deficit related costs, etc. These costs are set by the Government in the different regulations of the electricity sector.

Both regulated and liberalized costs are directly transferred to electricity consumers' bills, and are subsequently increased by the electricity tax (4.86%) and the applicable VAT (21%).

This section shows the electricity system costs in 2014 and the evolution of its main components over the past few years based on data published by the Spanish National Commission for Markets and Competitiveness (CNMC), Red Eléctrica de España (REE) and the results from the OMIE electricity market.

In 2014 the aggregate costs of the electricity system amounted to 30,217 m EUR, 41% of which (12,398 m EUR) corresponded to the so-called liberalized energy costs, and 59%,

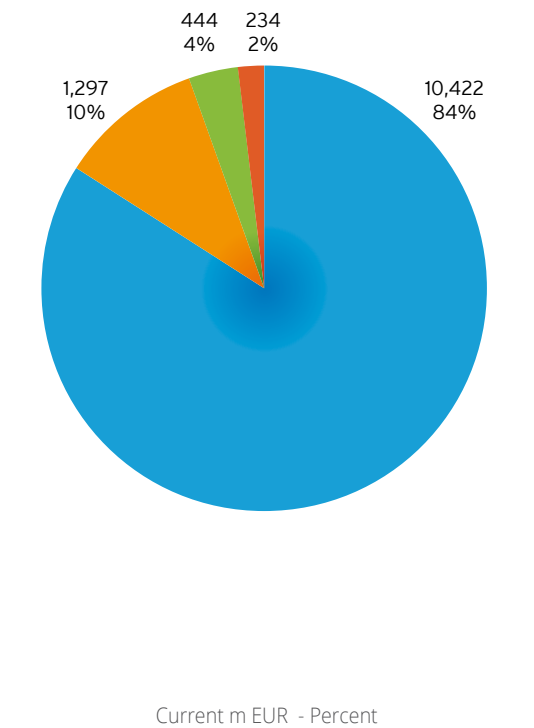
(17,819 m EUR) to the cost of regulated business (see Chart 7.5).

Liberalized energy costs include: the cost of OMIE daily electricity market price, amounting to 10,422 m EUR (84%); the system adjustment services[1], amounting to 1,297 m EUR (10%); capacity payments[2], amounting to 444 m EUR (4%); and the cost resulting from the supply guarantee restrictions process[3] (domestic coal aids), amounting to 234 m EUR (2%) (See chart 7.6).

As it has been explained in the previous section, in 2014 renewable energies produced direct savings amounting to 7,105 m EUR. Without the renewable output this amount would have been transferred to daily market costs. Accordingly, without the existence of renewable energies, daily market costs during 2014 would have been of 17,527 m EU, 68% more compared to what was registered during the year.

Chart 7.6 Energy system costs, 2014

Source: REE and OMIE



Current m EUR - Percent

On the other hand, costs of regulated business include, inter alia, FITs paid to renewable energies for the production of electricity, electricity transport and distribution costs, costs associated to tariff deficit, FITs paid to cogeneration and non-renewable waste and stranded costs in non-mainland generation. (See chart 7.7)

[1] REE definition: Services required ensuring the electricity supply under the necessary conditions of quality, reliability and security. The adjustment services can be of an obligatory or optional character. Resolution of restrictions due to guarantee of supply, resolution of technical restrictions of the system, ancillary services and deviation management are all considered adjustment services.

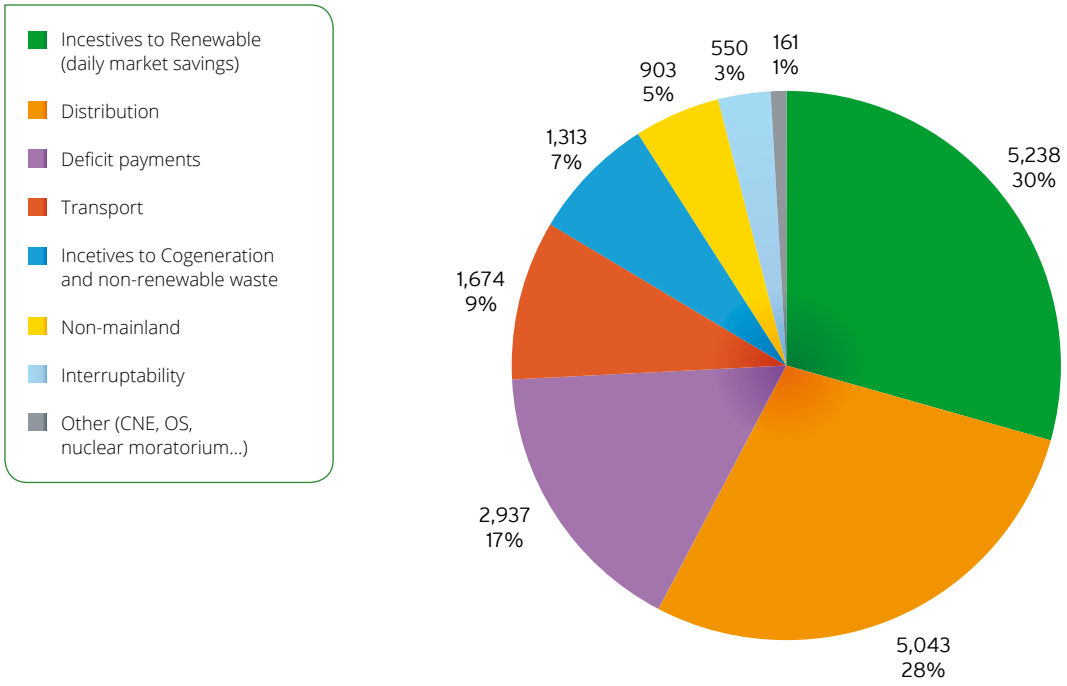
[2] REE definition: Regulated payment to finance the medium and long-term power capacity service, offered by the generation facilities to the electricity system.

[3] Royal Decree 134/2010 ensures market access to a certain amount of energy produced from domestic coal in thermal plants.

Chart 7.7

Cost of regulated business, 2014

Source: CNMC



Current m EUR - Percent

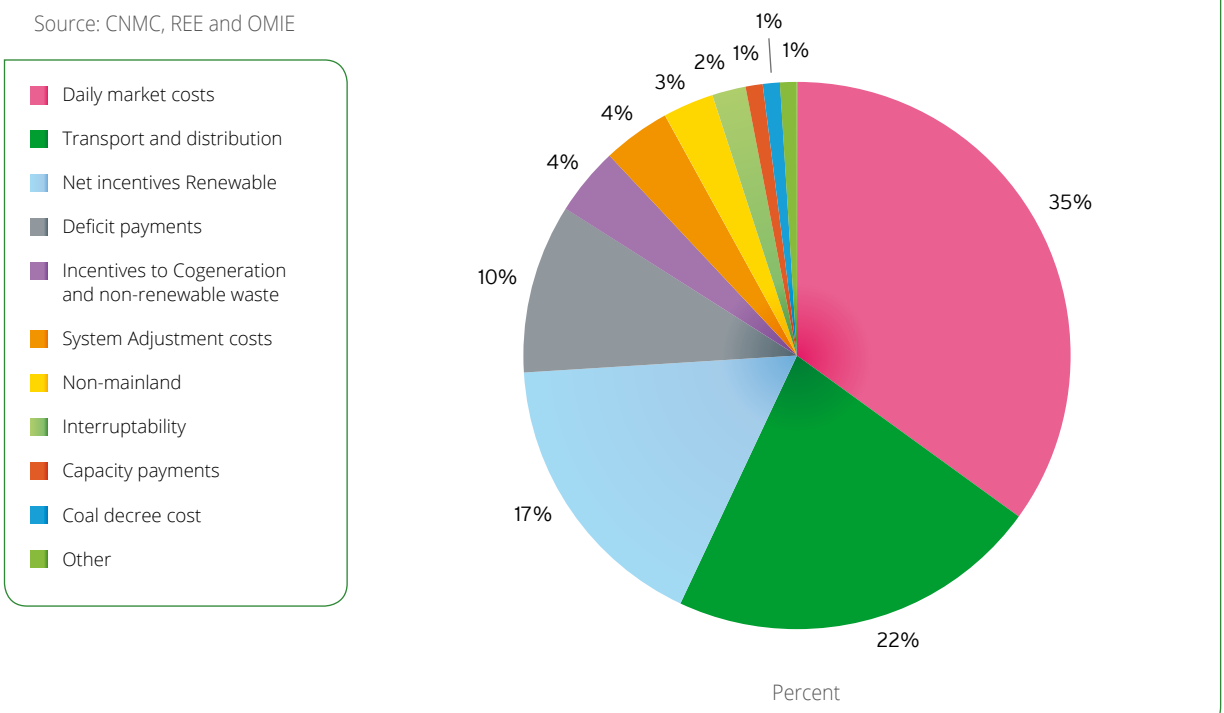
Regarding the aggregate costs of the electricity system, the cost of energy in the daily market price is the highest in percentage (35%), followed by transport and distribution costs (22%), and the cost of the FITs equivalent to renewable production (17%). (See chart 7.8).

If specific remuneration of renewable energies has supposed a 5,238 m EUR cost for the system, these energies reduce the cost in the daily market, which in 2014 had supposed savings of 7,105 m EUR. With this, and for the first time since the historical series are analyzed, the effect of renewables energies in the reduction of the pool has been 1,867 m EUR higher than the regulated remuneration cost of these clean energies.

The analysis of the electricity system in the last two years, 2013 and 2014, shows that

Chart 7.8 Aggregated costs of the lectricity system in Spain, 2014

Source: CNMC, REE and OMIE

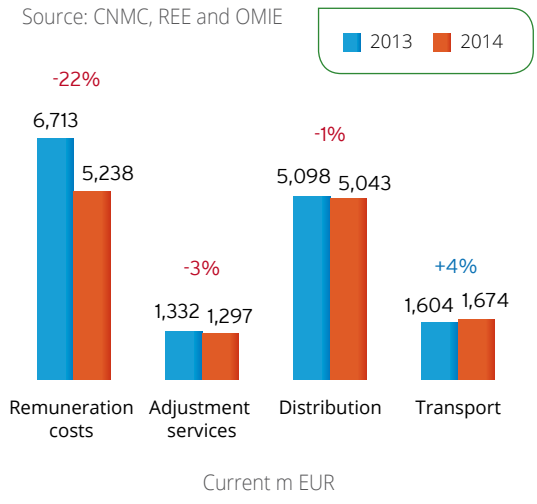


while the remuneration costs of renewable energies were reduced by 22% (6,713 compared to 5,238 m EUR), other regulated costs stayed invariable or even increased (Chart 7.9). In particular,

- System adjustment service costs decreased minimally (-3%).
- Energy distribution costs stayed practically invariables (-1%).
- Electricity transport costs increased by 4%.

Chart 7.9 Comparison of certain system costs, 2013-2014

Source: CNMC, REE and OMIE




8
ENERGY AND CLIMATE CHANGE PACKAGE
Ratified by the European Parliament on 17 December 2008
2020 targets
20% reduction in greenhouse gases compared to 1990
20% savings in European energy consumption
20% of energy consumption from renewable sources
Directive 2009/28/EC

Energy policy targets and renewable energies

The European Commission has warned the Spanish Government on several occasions that Spain will not meet its European 20% target for renewable energies set for 2020. Different studies and reports made by different organisms and institutions, such as the International Energy Agency or the European Environment Agency, agree with the Commission in reporting that with the current policy Spain will not achieve its mandatory environmental targets.

Even though the Government publicly insists in stating its support to renewable energies and affirms that our country will achieve its commitments, data show that this not the case. Even though it is true that over 2014 Spain achieved a 17.1% of the 20% target, this can be explained by the current scenario of low energy demand. Should there be a recovery in demand, with the situation in the Renewable Energy Sector Spain's energy targets would be seriously compromised.

According to the Planning proposal made by the Government, it would be necessary to install about 8,500 renewable MW before 2020 to achieve the targets. This would imply installing 1,400 MW every year from 2015 until 2020, thus it is important to remember that in 2014, 45 renewable MW were installed in Spain, a figure that will probably not be reached in 2015. In 2014 no renewable technology achieved the installed capacity targets enumerated in the PER 2011-2015.

European Directive on renewable energies

The European energetic policy sets the consumption of energy targets from renewable sources that Member States shall meet over the coming years, established in Directive 2009/28/EC of the European Parliament and the Council, 23 April 2009, on the promotion of the use of energy from renewable sources.

One of the overall targets set in the Directive is to encourage the use of renewable sources for energy production. The Directive states that at least 20% of gross final consumption of energy in the European Union shall come from renewable sources of energy by 2020 and at least 10% of energy consumption in the transport sector shall come from renewable sources.

The Directive uses as a starting point the part of energy coming from renewable energies in the gross final consumption of energy of every Member State in 2005 and establishes the targets for 2020. The targets set for Spain (20%) coincide with EU overall targets.

In order to facilitate Member States meeting their targets, the Directive provides a series of flexibility measures: statistical transfers, whereby Members States may make arrangements for the statistical transfer of a specified amount of energy from renewable sources from one Member State to another Member State; joint projects, whereby two or more Member States may cooperate on specific joint projects relating to the production of electricity from renewable energy sources. These joint projects may be located outside the European Union provided that the energy produced is consumed within the EU; and joint support schemes, whereby a joint feed-in-tariff or a joint market for certificates of electricity from renewable sources may be established.

Renewable Energies Plan 2011-2020

In compliance with Directive 2009/28/EC in 2010 Spain submitted to EU the National Action Plan for Renewable Energies (NREAP). The plan initially set a target of a 22.7% share of final gross energy consumption from renewable sources, compared with the 20% target set in the Directive.

As a consequence of the Social and Economic Pact, signed by the Spanish Government, employers, and trade unions in January 2011, the 22.7% target for consumption of final energy from renewable sources was finally cut down to 20.8%, as they took as a reference the target agreed by the Subcommission of Industry of the Congress, held in November of 2010.

The Council of Ministers held in November, 11th, 2011, passed the Renewable Energies Plan 2011-2020 (PER 2011-2020), prepared by IDEA. This plan defines a package of measures to be developed by the Government in order to meet the targets set in Directive 2009/28/EC, based on technical, economical and energetic scenarios.

The initial targets by sectors, defined in the Ministry of Industry, Tourism and Trade, in the NREAP sent to the European Commission in 2010, were reduced in the new Renewable Energies Plan 2011-2020. In December of 2011, the Spanish Government sent to the Commis-

sion an amendment of the NREAP to adapt it to the REP 2011-2020.

Afterwards, in November of 2014, the Ministry of Industry presented the draft document of the Energetic Planning 2015-2020, which continued in open process by November, 29th, 2012 through Order IET/2598/2012. This first draft proposal plans the development of the network of electric energy transport during the term 2014-2020. This change is due to the passing of Law 24/2013 by the end of 2013 and will become the reference document for the compliance of the European commitments.

Even though the REP 2011-2020 and its targets are still in force, this new planning document substantially modifies some of them. The targets for 2020 of renewable installed capacity for electric production are reduced by 15.9%,

Chart 8.1

2020 targets as established in the Renewable Energies Plan 2011-2020 and the Energy Plan draft version from the Ministry of Industry for the electricity sector

Source: IDAE and MINETUR

Technologies	REP 2011-2020	Energetic Planning
	MW	MW
On-shore wind power	35.000	29.479
Hydropower (included pump)	22.672	21.694
PV Solar	7.250	6.030
CSP	4.800	2.511
Biomass	1.950	1.293
Off-shore wind power	750	0
Hydrokinetic, wave and tidal energy	100	0
Geothermal	50	0
Total	72.572	61.007

as they change from the 72,572 MW included in the REP to 56,805 MW in the Planning draft. The marine wind power, oceanic energies and geothermal stay without installation targets, despite equaling 900 MW of target as a whole for 2020 in the REP. All technologies reduce their targets: solar thermoelectric by 44.7%; biomass, wastes and biogas by 33.7%; hydroelectric by 22.8%; photovoltaic solar by 16.8%; and land wind power by 15.8%. (Chart 8.1).

To achieve our targets in 2020 stated in the draft of Energetic Planning, without forgetting that those established in the REP are currently in force, wind power would have to install in the next six years 6,477 MW, at a rate of 1,080 MW each year, something quite unlikely if we consider the data of 2014. The same would happen with photovoltaic solar, which having installed 7 MW, would need to install 226 MW every year to achieve the proposed target. The solar thermoelectric, which did not increase its installed capacity during 2014, would have to install 211 new MW, 35 MW each year. Biomass, with 38 new MW installed, would need to install 46 MW each year and a total of 275 new MW until 2020. Also, the small hydro should install 199 new MW.

Chart 8.2 Difference between roadmap as of 2013 and REP 2011-2020 targets

Source: IDAE and REE

Technologies	REP targets for 2014		Situation as of 2014		Difference	
	GWh	MW	GWh	MW	% GWh	% MW
PV Solar	8,605	5,143	8,199	4,672	-4.7%	-9.2%
CSP	7,400	2,721	4,959	2,300	-33.0%	-15.5%
On-shore wind power	52,673	26,416	51,026	23,002	-3.1%	-12.9%
Off-shore wind power	36	22	0	0	-100.0%	-100.0%
Biomass, SUW, biogas	6,615	1,082	4,729	1,018	-28.5%	-5.9%
Geothermal	0	0	0	0	-	-
Hydrokinetic, wave and tidal energy	0	0	0	0	-	-

Electricity sector

REP 2011-2020 includes indicative targets referred to the share of renewable energy technologies towards complying with Spain's 20% overall target by 2020. In terms of installed capacity, by the end of 2014, none of the technologies had met the indicative targets included in REP 2011-2020. This information makes the standstill of the Sector evident, as a consequence of current regulatory instability. All the figures are clearly inferior to those obtained the previous year, due to the halt in the installation of new capacity and the increase of the annual targets stablished in the REP, and will follow the same path in the next years if Spain doesn't act imminently in favour of renewable energies. (Chart 8.2).

Thermal sector

REP 2011-2020 defines a final target of 5,357 ktoe for thermal renewable energies in Spain, 87% of which (4,653 ktoe) correspond to biomass, both solid and biogas. CSP and geothermal energies with 644 and 50 ktep respectively, should complete the thermal renewable targets.

Production of thermal energy from biomasses shall be achieved by using solid biomass and biogas. The 2020 targets are as follows: 4,553 ktoe for solid biomass and 100 ktoe for biogas. The pace foreseen in REP would allow the installation by 2020 of 753 ktoe, a conservative target given the Spain's tremendous biomass potential.

Chart 8.3

Difference between targets as established in the Renewable Energies Plan 2011-2020 for the Thermal Sector and 2014 achievements

Source: IDAE and MINETUR

Technologies	REP targets for 2020	REP targets for 2014	Situation as of 2014	Difference
Geothermal	50,0	25,0	19,7	-21.2%
CSP	644	266	258	-3.0%
Biomass	4,553	3,827	4,046	5.7%
Biogas	100	57	42	-26.3%

CSP target for 2020 is 644 ktoe, equivalent to a catchment area of 10,000 m2. Despite the slowdown caused by the real estate crisis, in the medium term this technology is expected to achieve a growing trend. Energy production will grow by an annual 4% during the first years and by 16% by the end of the period.

According to REP 2011-2020, geothermal energy's potential for thermal uses exceeds 50,000 MWth. The Plan foresees thermal energy from geothermal sources to be produced by heat pumps, with a partial target of 40.5 ktoe, and by heat usage with a target of 9.5 ktoe. (Chart 8.3).

Transport sector

REP 2011-2020 stablished a target for relative penetration of renewable energies in transport by 2020 of 11.3% and foresaw its compliance to be achieved mainly by the use of biofuels. Chart 8.4 shows the absolute biofuel targets defined in REP for years 2015 and 2020. (Chart 8.4).

The aggregate target for absolute biofuels consumption defined in the Plan for 2014 has not been met, consumption being 54.5% short of target despite the contribution from a biofuel —hydro-biodiesel— that was not included in the REP. Chart 8.5 shows that in 2014 consumption of bioethanol/bioETBE and biodiesel were 35.9% and 72.3% respectively below the estimates included in REP for this year. (Chart 8.5).

Chart 8.4 Targets for the transport industry (ktoe) defined in REP 2011-2020

Source: IDAE

Technologies	PER 2011-2020	
	2015	2020
Bioethanol BioETBE	301	400
Biodiesel	1,970	2,313
Electricity	229	503
Total (ktep)	2,500	3,216

Chart 8.5 Difference between roadmap as of 2014 and REP 2011-2020 biofuel targets

Source: IDAE and CNMC

Biofuels	REP 2014 targets (ktoe)	Situation as of 2014 (ktoe)	Difference (%)
Bioethanol BioETBE	290	186	-35.9%
Biodiesel	1,930	535	-72.3%
Hydro-biodiesel	0	289	-
Total	2,220	1,010	-54.5%

Target compliance for 2020

Chart 8.6 shows the target for 2020 the consumption of gross final energy from renewable sources set by Directive 2009/28/EC for each Member State and for the European Union as a whole. For Spain the target is 20%.

In 2014 the share of energy from renewable sources in gross final consumption of energy in Spain was 17.1%, above the 15.9% indicative target included in REP 2011-2020. The situation could be considered as temporary, due to the current scenario of low energy demand. Should there be a recovery in demand, given the situation in the Renewable Energy Sector Spain's energy targets would be seriously compromised. Similarly, an Ecofys report comissioned by the European Commission and edited in 2012 concluded that Spain would not achieve its mandatory targets of 20% for 2020.

According to the latest European data available, from 2013, from the part that renewable sources represent in the gross final consumption of energy, the percentage of compliance each State had achieved in the aforesaid year can be observed. In this regard, Spain was in the sixteenth position, with 77% of the target achieved. The 15.4% that the European Commission attributes to our country is slightly below the 16.6% informed by the Spanish Government as a degree of compliance for the same year. On the other hand, the KEEPONTRACK! report on fulfillment of the 2020 targets by Member States, presented to the European Commission, concluded that Spain will not meet its mandatory 20% target referred to the share of renewable energies in final demand.

This report basically considers two scenarios, depending on whether Member States will cooperate to achieve their respective targets for renewable energy by 2020. Both scenarios are based on each country current situation and policies. Thus, the scenario without cooperation refers to the share of renewable energy that each Member State will achieve by itself, i.e. without help from any other Member State. The cooperation scenario takes into account the flexibility measures established in the Directive to facilitate Member States the achievement of their respective targets such as the purchase or statistical transfer of renewable production among Member States.

It shall be noted that through statistical transfers, any Member State having exceeded in 2020 its minimum target for renewable energy could sell its surplus to any other Member State that had not achieved its target. Spain could sell renewable energy to other Members States that do not enjoy conditions as favourable as existing in our country. Unfortunately, this measure provided for in the Directive seems to be absent from Spain's national renewable energy strategy; consequently Spain will face significant trouble to meet its mandatory minimum target committed before Europe.

Chart 8.6

National overall targets for the share of energy from renewable sources in gross final consumption of energy in 2020 and compliance by 2013

Source: European Commission

Member State	Situation as of 2013	Target 2020	Compliance by 2013 (%)
Bulgaria	19.0%	16%	119%
Sweden	52.1%	49%	106%
Estonia	25.6%	25%	102%
Lithuania	23.0%	23%	100%
Romania	23.9%	24%	100%
Italy	16.7%	17%	98%
Finland	36.8%	38%	97%
Austria	32.6%	34%	96%
Czech Republic	12.4%	13%	95%
Latvia	37.1%	40%	93%
Denmark	27.2%	30%	91%
Croatia	18.0%	20%	90%
Slovenia	21.5%	25%	86%
Greece	15.0%	18%	83%
Portugal	25.7%	31%	83%
Spain	**15.4%**	**20%**	**77%**
Hungary	9.8%	13%	75%
Poland	11.3%	15%	75%
EU28	**15.0%**	**20%**	**75%**
Slovakia	9.8%	14%	70%
Germany	12.4%	18%	69%
Cyprus	8.1%	13%	62%
France	14.2%	23%	62%
Belgium	7.9%	13%	61%
Ireland	7.8%	16%	49%
Malta	3.8%	10%	38%
United Kingdom	5.1%	15%	34%
Luxembourg	3.6%	11%	33%
Netherlands	4.5%	14%	32%

Chart 8.7

Forecast for RES share on gross final consumption in 2020

Source: 2020 RES scenarios for Europe (KEEPONTRACK!)

Member State	Target 2020	Forecast (Current scenario without cooperation)	Forecast (Current scenario with cooperation)	Deviation according to scenario	
				Without cooperation	With cooperation
Germany	18%	17.3%	17.5%	-3.9%	-2.8%
Austria	34%	36.9%	34.0%	8.5%	0.0%
Belgium	13%	12.0%	12.3%	-7.8%	-5.4%
Bulgaria	16%	21.4%	16.0%	33.8%	0.0%
Cyprus	13%	13.5%	13.0%	3.8%	0.0%
Croatia	20%	23.0%	20.0%	15.0%	0.0%
Denmark	30%	30.4%	30.0%	1.3%	0.0%
Slovakia	14%	13.9%	14.0%	-0.7%	0.0%
Slovenia	25%	22.7%	23.5%	-9.2%	-6.0%
Spain	20%	14.7%	16.5%	-26.5%	-17.5%
Estonia	25%	31.0%	25.0%	24.0%	0.0%
Finland	38%	39.0%	38.0%	2.6%	0.0%
France	23%	18.6%	20.1%	-19.1%	-12.6%
Greece	18%	13.7%	15.1%	-23.9%	-16.1%
Hungary	13%	12.2%	12.5%	-6.2%	-3.8%
Ireland	16%	16.5%	16.0%	3.1%	0.0%
Italy	17%	20.8%	17.0%	22.4%	0.0%
Latvia	40%	34.6%	36.5%	-13.5%	-8.8%
Lithuania	23%	26.6%	23.0%	15.7%	0.0%
Luxembourg	11%	7.3%	8.5%	-33.6%	-22.7%
Malta	10%	2.9%	5.3%	-71.0%	-47.0%
Netherlands	14%	7.1%	9.4%	-49.3%	-32.9%
Poland	15%	13.7%	14.1%	-8.7%	-6.0%
Portugal	31%	27.7%	28.8%	-10.6%	-7.1%
United Kingdom	15%	8.9%	11.0%	-40.7%	-26.7%
Czech Republic	13%	12.2%	12.5%	-6.2%	-3.8%
Romania	24%	25.8%	24.0%	7.5%	0.0%
Sweden	49%	54.3%	49.0%	10.8%	0.0%
EU28	20%	18.4%	18.4%	-8.9%	-8.9%

This share, compared with the minimum mandatory target for each Member State, shows the level of target compliance, represented as a percentage deviation from the relevant target. Forecasts predict that Spain will fail to achieve its mandatory 20% target for 2020, falling short of target by 17.5%-26.5% (see chart 8.7). It shall be noted that, with its current policies, Spain would cover in the best of cases a 16.5% share of renewable energies in its final energy consumption and would be forced to purchase renewable production from other Member States. If the transfers between countries were not possible, the achieved percentage would be 14.7%.

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