4 _SUSTAINABLE ENERGY

COMMITTED TO SECURITY OF SUPPLY, EFFICIENT **MANAGEMENT AND INNOVATION**

GRI indicators reported on within this chapter:
EU4, EU6, EU7, EU8, EU10, EU23, EU28, EU29, EC9, SO5.

MOST RELEVANT ACTIONS IN 2013

QUALITY AND SECURITY OF THE ELECTRICITY SUPPLY

>> 564 million euros invested in grid strengthening and meshing.

>> 776 new km of line and 162 new substation bays.

>> 98.13% grid availability rate.

>> MAR Project: improvement of the quality of insular assets.

INTERNATIONAL INTERCONNECTIONS AND INTER-ISLAND LINKS

>> Important advancements in the interconnection with France scheduled for 2015.

>> Puebla de Guzmán – Portuguese border axis in the construction phase.

>> Northern interconnection (Galicia -Porto) in the administrative permitting process.

>> The new interconnection with France via the Bay of Biscay in the study phase.

INTEGRATION OF RENEWABLES

>> 42% of the electricity demand covered by renewable energies.

>> For the first time wind power energy is the technology that contributes most to demand coverage.

>> New records for wind power production are reached.

>> A 23% reduction in CO_2 emissions derived from electricity generation.

ENERGY EFFICIENCY

>> Promoting consumer involvement as a key part of the electricity system.

>> Commencement of the PRICE deployment project (intelligent demand-side management).

>> Commencement of the ALMACENA project (electrochemical energy storage).

>> Design of the consumer panel in the PERFILA project (profiling service improvement).

TECHNOLOGICAL INNOVATION

>> 14.23 million euros in investment with an increase of 86% compared to 2012.

>> 62 projects in the R&D portfolio.

>> Participation of 251 REE specialists (15% of the workforce).

>> More than 41,000 working hours, equivalent to 24 full-time personnel.

QUALITY AND SECURITY OF THE ELECTRICITY SUPPLY [-EU6-]

RED ELÉCTRICA, as transmission agent and system operator, is responsible for contributing to making the energy policy objectives viable with regard to a secure, efficient and sustainable electricity supply. Therefore, we are working on developing a transmission grid that is ever more meshed, robust and better interconnected with our neighbouring countries, so that it can provide greater transmission capacity and the highest level of quality of service to all consumers.

TRANSMISSION GRID PLANNING [-EU10,EU23-]

THE CURRENT ENERGY planing is reflected in the document 'Planning for the energy and gas sectors, 2008-2016. Development of the transmission grids', approved by the Council of Ministers in May, 2008; and in the annual programmes of November, 2010 (ITC Order 2906/2010) and of January 2013 (the resolution of 27 December 2012). In this context, the Royal Decree Law 13/2012 led to the suspension of the granting of new administrative authorisations of the facilities contemplated within the 'Planning 2008-2016' which made it necessary for a new transmission grid planning to be drafted, taking as a basis the likely macroeconomic scenario and the evolution of the forecasted demand. Subsequently, the IET/18/2013 Order, January 2013, approved a list of facilities considered critical to the electricity system and therefore Red Eléctrica can move forward with them.

In December 2012, a new planning process began for the 2014-2020 horizon for which Red Eléctrica has drafted the 'Initial proposal for the development of the transmission grid for the 2014-2020 horizon', which was sent to the Ministry of Industry in September 2013, and re-submitted in December 2013 with the modifications required by the Ministry. Moreover, Red Eléctrica has developed a new Annual Programme proposal which was sent to the Ministry in June 2013 and incorporates actions that aim to mesh the extra-peninsular systems with the Spanish Peninsula (both the Balearic Islands and Ceuta) and facilitates the integration of Canary Island wind power into the system. [-SO5-]

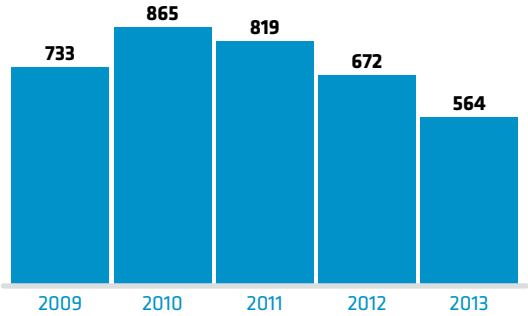
GRID DEVELOPMENT [-EU4-]

IN 2013, INVESTMENT in the transmission grid basically responded to the need to increase the capacity and meshing of the grid to support distribution in various parts of the country as well as the implementation of international interconnection projects.

In this fiscal year, 776 km of new lines and 162 new bays in substations (16 of which replace existing bays), have been put into operation and the transformer capacity has increased by 2,525 MVA, which represents a joint investment in the transmission grid of 564 million euros.

INVESTMENT IN THE TRANSMISSION GRID

(MILLIONS OF EUROS)



FOCUS OF THE KEY ACTIONS REGARDING GRID DEVELOPMENT

>> Improved transmission grid meshing.
>> Development of inter-island links.
>> Strengthen international interconnections.
>> Favour the evacuation of new installed generation.
>> Facilitate the powering of the High Speed Train routes.

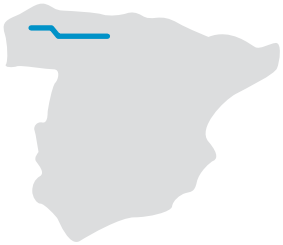
MAIN TRANSMISSION GRID DEVELOPMENTS IN 2013 (LARGE AXES)

ASTURIAS-GALICIA LINK

Status: under construction
Total investment: 218 million euros
Investment to date: 14.7 million euros
Construction: 2008-2017

General objective: guaranteeing the security and quality of supply throughout the whole northern axis, creating a 400 kV transmission infrastructure, through the incorporation of 361 km of line, 46 substation bays and 3 transformers. A large part of the axis was commissioned before 2011. The Boimente-Pesoz line and Gozón substation are currently being constructed.
Specific objectives: to connect northern Galicia with the west of Asturias to meet the consumption forecasts for this area and facilitate the evacuation of planned new generation. The aim is to close the Cantabrian axis linking up with the Soto-Penagos line, so that high demand areas such as Galicia and Asturias can evacuate its energy to regions with a lack of supply. It is also aimed at strengthening the 400/220 kV transformer capacity in Asturias and in the future to enable the powering of the Cantabrian High Speed Train.
Key socio-environmental measures

>> Performing specific environmental studies for the design of accesses. Restoration of the aforementioned accesses at the end of works via the introduction of topsoil, seeding and planting of trees native to the area.
>> Performing a comprehensive inventory of the pruning and felling of flora and continuous monitoring to avoid any unnecessary effects being caused.
>> Hanging lines by helicopter to avoid affecting the land and flora (more than 20% of line hung using this method).
>> Hoisting via the use of a boom crane in steep areas and those with native flora.
>> Over elevation of towers to reduce the opening up of safety corridors.
>> Intensive archaeological monitoring. Protection and cataloguing items found including: Celtic hillfort remains, Roman mining channels, lime kilns and civil war trenches.
>> Amicable agreements with landowners used in 96% of the cases.



Summary 2013

>> Commissioning of the Grado substation and two lines associated with this substation: Grado-Salas line and the Grado substation.

Forecast for 2014

>> Construction of the Boimente-Pesoz line.

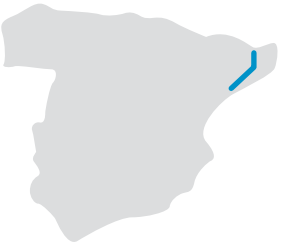
BESCANÓ-RAMIS-SANTA LLOGAIA AXIS

Status: under construction
Total investment: 91 million euros
Investment to date: 33 million euros
Construction: 2013-2016

General objective: to give continuity to the interconnection with France and improve the electricity supply to Gerona.
Specific objectives: to strengthen the meshing of the 400 kV grid in Catalonia and to support the Barcelona-French border section of the High Speed Train. The axis consists of 164 km of line, 24 bays in substation and two transformer units.

Key socio-environmental measures

>> Design of the lines, in parallel to the existing 220 and 132 kV and the subsequent dismantling of sections of the indicated lines.
>> Renovation of the corridors of the dismantled lines.
>> Marking with bird-flight diverter devices on a high percentage of the line.
>> Biological stoppage of works.
>> Amicable agreements with landowners used in 96% of the cases.



Summary 2013

>> Commencement of civil works of the section of the Santa Llogaia line and the substation.

Forecast for 2014

>> Commissioning of the Santa LLogaia substation and line.

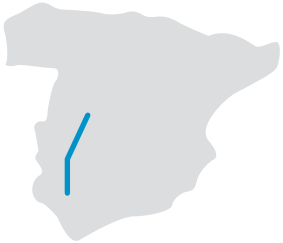
MAIN TRANSMISSION GRID DEVELOPMENTS IN 2013 (LARGE AXES)

ALMARAZ-GUILLENA AXIS

Status: under construction
Total investment: 189 million euros
Investment to date: 36.4 million euros
Construction: 2012-2014
General objective: to ensure the quality of supply for the forecasted demand in the autonomous communities of Extremadura and Andalusia via the connection of the central and southern areas of the Spanish peninsula through an axis of 400 kV, consisting of 705 km of line, 37 bays and two transformers.
Specific objectives: the axis will link up the Almaraz, San Serván, Brovales and Guillena substations, joining an area with a generation deficit from north to south, and will serve as support for the expansion of the interconnection with Portugal, as well as the distribution of the area allowing the evacuation of new renewable generation.

Key socio-environmental measures
Given the characteristics of the area of action, the principal challenge was the design of the route and the location of the towers so as to have the minimal effect on the protected natural areas, pasture lands and other areas rich in biodiversity, especially bird life, for which the following actions were carried out:

>> Drafting of specific reports regarding the effects on Red Natura and the establishment of specific measures for the protection of priority habitats.
>> Over-elevation of towers to avoid the need for opening up of safety corridors.
>> Assembly and hoisting with boom cranes in all sensitive areas.
>> Installation of bird-flight diverter devices (spirals and blades) in SPAs and breeding areas of the major water courses (more than 85% of the axis).
>> Biological stoppages of works in 78 towers during various periods from 1 January to 23 August.



>> Establishment of numerous accompanying measures of various characteristics aimed at improving habitats.
>> Amicable agreements with landowners used in 90% of the cases.

Summary 2013

>> Commissioning of the following lines: Almaraz-San Serván, San Serván-Brovales y Brovales-Balboa, as well as the Brovales, San Serván, Guillena and Almaraz substations.

Forecast for 2014

>> Commissioning of the Brovales-Guillena and Mérida-San Serván lines, so that the axis will be fully operational.

GUILLENA-PUEBLA DE GUZMÁN AXIS

Status: under construction
Total investment: 19.2 million euros
Investment to date: 0.7 million euros
Construction: 2012-2014

General objective: To complete the connection with the Puebla de Guzmán-Portuguese border line and facilitate the evacuation of new renewable generation in the area, especially wind power.

Specific objectives: the axis, consisting of 11 substation bays and 4.2 km of line and a transformer will allow the existing 220 kV line to be used in the future as a 400 kV line.

>> Installation of bird-flight diverter devices on the incoming lines to the substations.
>> Dismantling of the old 220 kV towers.
>> Amicable agreements with landowners used in 99% of the cases.

Summary 2013

Commencement of the assembly and hoisting of line towers, and the commissioning of the Guillena and Puebla de Guzmán substations.

Forecast for 2014

Commissioning of the Guillena-Puebla de Guzmán line, leaving the axis fully operational.

MAIN TRANSMISSION GRID DEVELOPMENTS IN 2013 (LARGE AXES)

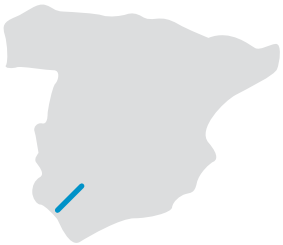
ALJARAFE-ROCÍO LINE

Status: in service
Investment: 23.4 million euros
Construction: 2009-2013

General objective: strengthening of the transmission grid meshing to provide greater reliability and security for the electricity system and improve the quality of supply, especially in the area of Almonte, whose capacity to meet present and future demands is insufficient.
Specific objectives: the axis consists of 118 km of line and two substation bays that strengthen the distribution network in the Almonte area as it provides a second 220 kV supply to the Rocío substation, and simultaneously, will allow an increased evacuation of renewable energy in the area.

Key socio-environmental measures

>> Design of the route meeting socio-environmental criteria, the result of the development of a comprehensive environmental inventory which has allowed the most sensitive areas to be avoided and reduce the risks associated with the new installation (passing through the Doñana National Park has been avoided and it only crosses a SCI for a 1,900 m stretch which contains eucalyptus).
>> As an accompanying measure the signing of a collaboration agreement is expected with the Government of Andalusia to promote the development of the Iberian Imperial Eagle in the Doñana Natural Area and other measures aimed at promoting biodiversity within the project.
>> Amicable agreements with landowners used in 98% of the cases.



Summary 2013

>> Commissioning of the Aljarafe-Rocío line.

OTHER IMPORTANT GRID DEVELOPMENTS IN 2013

>> As part of the facilities commissioned in 2013, in addition to the Almaraz-San Serván (285 km), San Serván-Brovales (132 km) and the Aljarafe-Rocío (116 km) lines, reflected in the key axes, also noteworthy are the Vilanova-Valldigna-Gandía (50 km) and the Costa de la Luz-Onuba (40 km) lines, amongst others, as well as various 400 and 220 kV substations.

>> Moreover, additionally noteworthy are the actions carried out in several facilities under construction such as the Tordesillas-San Sebastián de los Reyes axis, the axis to power the Lleida –Barcelona High Speed Train and the 'Plan Madrid Sur' axis.

GRID MAINTENANCE

RED ELÉCTRICA'S mission is to guarantee that the facilities of the transmission grid are always in optimum condition in terms of availability and reliability; this is accomplished through the establishment of an annual programme that sets out all the activities and resources necessary to ensure the continuity of the electricity supply.

During 2013 the following actions were noteworthy:

>> Replacement of a total of 154 towers, spread across the Peninsula (65), Balearic Islands (43) and Canary Islands (46), replacing them with more modern ones, in order to increase the reliability and quality of the installations.
>> Annual inspection of 100% of the underground lines, to ensure that there are no negative impacts on the environment.
>> Due to the specific and differentiated behaviour of the insulation, a long term plan of installation / replacement of composite insulation of the overhead lines was drafted for the period 2014-2030.
>> Maintenance of a total of 616 switches, so as to ensure the availability of the facilities.
>> Thermographic inspections at all facilities as well as monthly visual inspections to ensure the good condition of the substations.
>> In addition to scheduled maintenance, there has been significant investment to provide anti-corrosion coating for 94 substation bays, the reconditioning of various transformer units and actions to improve the tele-control equipment and protection systems.

Similarly, various innovative projects have been carried out that ensure the continual improvement of the maintenance activity, amongst which noteworthy are:

>> Installation of remote devices for the control of fires near to the electricity lines and a device to dissuade birds from nesting via the use of ultrasound.
>> Monitoring of the parameters for the preventive maintenance and control of the aging of the various elements of the transmission lines.

PENINSULAR AND EXTRA-PENINSULAR TRANSMISSION GRIDS [-2.8, EU4-]

	2008	2009	2010	2011	2012	2013
Km of 400 kV circuit	17,727	18,019	18,792	19,671	20,109	20,641
Km of 220 kV circuit	16,600	16,732	17,565	18,412	18,834	19,078
Km of 150-132-110 kV circuit	52	52	257	272	272	272
Km of <110 kV circuit	23	23	2,014	2,014	2,017	2,017
Total km of circuit	**34,402**	**34,825**	**38,629**	**40,369**	**41,232**	**42,008**
Substation bays of 400 kV	1,057	1,118	1,189	1,253	1,319	1,374
Substation bays of 220 kV	2,113	2,280	2,662	2,819	2,942	3,047
Substation bays of 150-132-110 kV	4	4	47	52	52	52
Substation bays of <110 kV	0	0	723	741	741	743
Total substation bays	**3,174**	**3,402**	**4,621**	**4,865**	**5,054**	**5,216**
Transformer capacity (MVA)	**62,772**	**65,547**	**71,170**	**73,220**	**78,170**	**80,695**

2013	Peninsula	Balearic Island	Canary Island	Total
Overhead lines (km)	38,566	1,061	1,023	40,649
Submarine cable (km)	265	306	30	601
Underground cable (km)	369	149	240	758
Total	**39,200**	**1,515**	**1,293**	**42,008**

SERVICE QUALITY

THE SERVICE QUALITY INDICATORS highlight for yet another year the highest level of security and quality of supply provided by Red Eléctrica's facilities, being well within the benchmark established in the current legislation, which is 15 minutes / year average interruption time.

In 2013, there was an increase in the Energy Not Supplied (ENS) and Average Interruption Time (AIT) compared to previous years, which is due mainly to three incidents that resulted in supply disruptions to consumers directly connected to the transmission grid in the areas of Andalusia, Galicia and Cantabria. These incidents represent 96% of the total ENS recorded in the peninsular system, all of them in insufficiently meshed nodes, whose particular topological situation involves maintaining one supply circuits related to a single line.

SERVICE QUALITY INDICATORS [-EU28, EU29-]

	2009	2010	2011	2012	2013
Grid availability (%)	98.04	97.93	97.72	97.78	98.13
Energy Not Supplied (ENS) (MWh)	437	1,552	259	113	1,126
Average Interruption Time (AIT) (minutes)	0.910	3.135	0.535	0.238	2.404

MAR PROJECT (Grid Asset Improvement)

Within the maintenance activity, Red Eléctrica is carrying out a significant programme of integration of the assets acquired from the electricity companies, especially in insular systems, raising them to the quality standards established by the Company. The programme, being carried out in the period 2011-2015, is contributing to a significant improvement in the levels of service quality in the two archipelagos. In 2013, the grid availability rate stood at 97.96% in the Balearic Islands and 98.32% in the Canary Islands, similar to values obtained on the Peninsula.

TRANSMISSION GRID ACCESS

DURING 2013, Red Eléctrica continued to manage the procedures for access and connection to the transmission grid (and to assess the acceptability of access to the distribution grid), with transparency and equality for the agents that plan to incorporate their facilities into the electricity system, not only for generators but also for distributors or consumers.

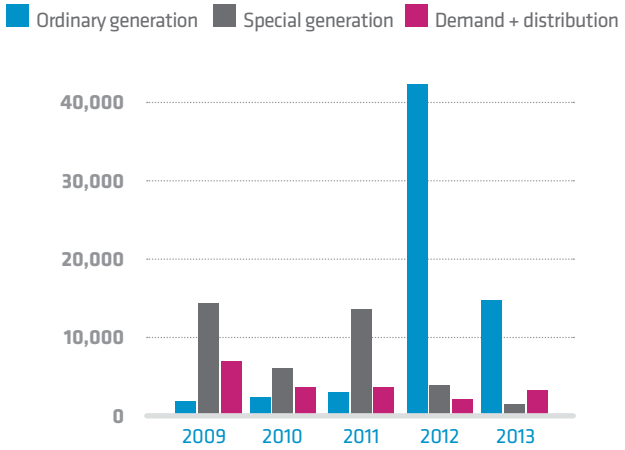
Throughout 2013, the volume of overall management decreased, particularly that of new requests, while the management associated to the updating of processes due to the modification of project conditions has remained at similar levels.

IN THE FIELD of ordinary regime, a large number of requests has again be registered, primarily associated with new projects of large photovoltaic plants, although less than the exceptionally high quota of 2012.

The following graph shows the evolution of access requests received, that are expected to connect to the transmission grid over the next few years.

REQUESTS RECEIVED FOR TRANSMISSION GRID ACCESS

(MW/MVA)



INTERNATIONAL INTERCONECTIONS AND INTER-ISLAND LINKS

FOR AN EFFECTIVE operation of the electricity system, it is essential to strengthen international interconnections. To have an increased electricity exchange capacity with neighbouring countries provides greater security of supply and a better use of renewable energies.

In the case of Spain, the need for investment in strengthening interconnections is highly relevant because we have an extremely limited level of interconnection with Europe. In this regard, strengthening interconnections, specifically the new interconnection line with France, is the number one priority in the development of the transmission grid.

Moreover, Red Eléctrica has set out a major investment plan to improve the security and reliability of the electricity systems on the Balearic Islands and the Canary Islands. In this regard, one of the most outstanding projects from the point of view of security of supply and the structuring of the territory is the submarine interconnection between Majorca and Ibiza, which will connect the two currently existing electricity subsystems in the Balearic Islands: Majorca-Menorca and Ibiza-Formentera.

INTERCONNECTION CAPACITY

(MW)

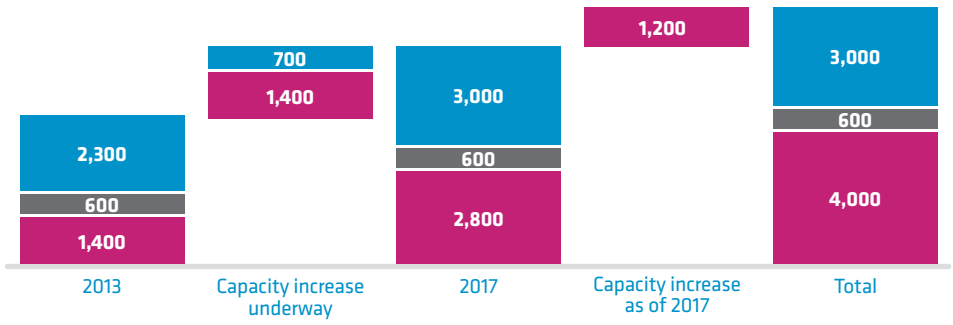
Portugal
Morocco
France

France

>> Eastern interconnection through the Pyrenees (Sta. Llogaia-Baixas) - 2015
>> Western interconnection (Basque Country-Aquitania) - 2020

Portugal

>> Southern interconnection (Andalusia-Algarve)-2013/2014
>> Interconexión Norte (Galicia-Oporto)-2015/2016



INTERCONNECTION WITH FRANCE

THE NEW INTERCONNECTION AXIS with France consists of a 400 kV direct current line of 65 km in length, which will be completely underground. Moreover, at each end of the line two converter substations are being built: Santa Llogaia (Spain) and Baixas (France), through which the transformation from alternating current to direct current and vice versa will take place. A tunnel (8.5 km long and 3.5 metres in diameter) will house the cables in the stretch that crosses the Pyrenees.

This new line, whose commissioning is scheduled for 2015, represents a total investment of 700 million euros, co-financed with the neighbouring country through the company INELFE (50% owned by Red Eléctrica and 50% by RTE). During 2013, work on the tunnel was almost completed and progress was made on digging the trenches where the line goes underground, in addition the manufacturing of the cable has been completed. As for the converter stations, civil works and the installation of transformers were completed. The work in progress on the axis totals 255 million euros.

THIS INFRASTRUCTURE will double the current electricity exchange capacity between Spain and France to 2,800 MW, but is still insufficient to meet the minimum level of 10% interconnection capacity recommended by the European Union. Therefore, the study of a new interconnection is underway, for the 2020 horizon, via the Bay of Biscay.

INTERCONNECTION WITH PORTUGAL

THE OBJECTIVE of the Puebla de Guzmán-Portuguese border interconnection is to increase the interconnection capacity between Spain and Portugal and provide it with greater operational security, for which the 400 kV grid of the Spanish and Portuguese systems will be meshed between the substations of Puebla de Guzmán (Spain) and Tavira (Portugal).

This infrastructure has an investment of 9.1 million euros, which includes the enlargement of three bays in the Puebla de Guzmán substation that was commissioned in 2013, and the construction of the Puebla de Guzmán-Portuguese border line, 25 km in length, whose commissioning is scheduled for 2014. The current work in progress totals 8.2 million euros. Moreover, the administrative permitting process of the new northern interconnection (Galicia -Porto) will continue. With these interconnections the objective of reaching a commercial exchange capacity of 3,000 MW with Portugal shall be maintained.

More information in the 'Unique projects' section of the corporate website.

MAJORCA-IBIZA INTERCONNECTION

THIS NEW LINK will strengthen the electricity integration process of the Balearic Islands and the Spanish peninsula and is essential to ensure the reliability of supply in the archipelago. The main objective of the Majorca-Ibiza interconnection, with an investment of 210 million euros, is to end the current electrical isolation of Ibiza, in addition to saving costs for the system and promoting competition in energy generation on the islands.

INTEGRATION OF RENEWABLES

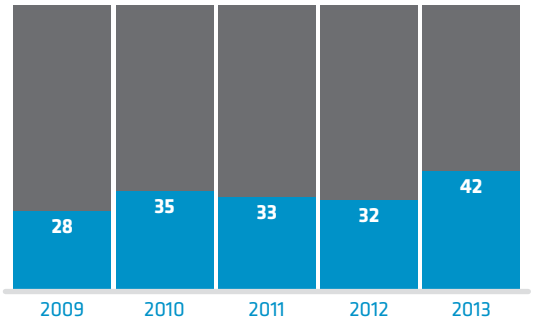
PENINSULAR DEMAND for electricity in 2013 reached 246,166 GWh, 2.2% less than in 2012. After having factored in the seasonal and working patterns the decrease was 2.1%. Regarding demand coverage, noteworthy was that 42% was covered by renewable energy sources. For yet another year, the important role played by wind power production stood out, whose contribution to the annual energy production reached 21%, ranking it for the first time as the technology that contributed most to demand coverage, a similar level to that of nuclear generation.

WIND POWER PRODUCTION in 2013 exceeded the previous records set. Thus, 25 December, 2013 at 2:56 am, its contribution represented 68.5% of the demand coverage, and on 6 February at 3:49 pm, the instantaneous wind production reached 17,056 MW. In this regard, to enable the operation of an electricity system with such a high penetration of renewable energy, without compromising security, the control and monitoring work carried out from CECRE (Control Centre of Renewable Energies) is key. Therefore, CECRE remains a pioneering control centre and is of reference worldwide.

MOREOVER, we must emphasise the special operational circumstances within the peninsular electricity system that occurred during Easter 2013, in which values of extremely low demand, high production of hydroelectricity with dumping in some basins, and a high producible wind power were recorded. Given this scenario, to ensure system security it was necessary to give orders to reduce production to a level not seen to date. These reductions affected, amongst others, nuclear production an exceptional fact and unprecedented since 1997.

RENEWABLE ENERGY IN DEMAND COVERAGE (%)

THE GREATER WEIGHT OF RENEWABLE ENERGY IN DEMAND COVERAGE, WITH RESPECT TO THE PREVIOUS YEAR, HAS REDUCED CO2 EMISSIONS OF THE PENINSULAR ELECTRICITY SYSTEM TO 61.4 MILLION TONNES, 23.1% LOWER THAN IN 2012.



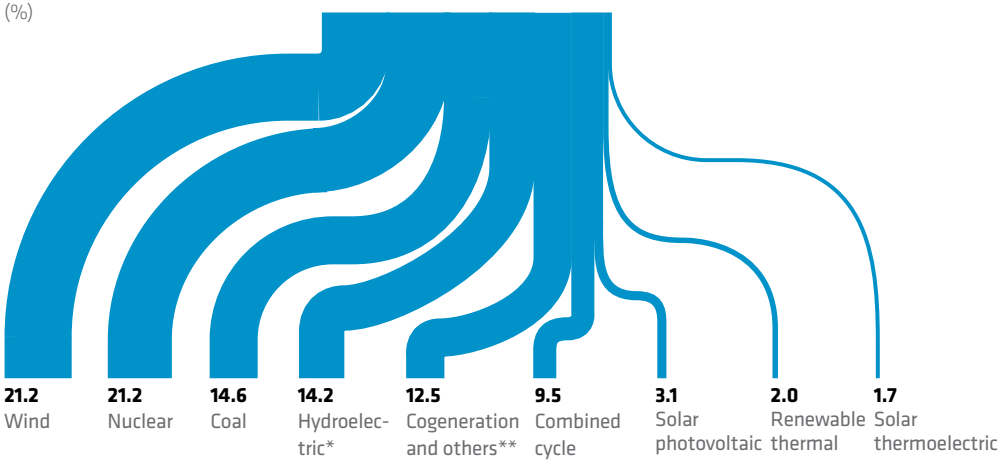
IN THE BALEARIC ISLANDS in 2013, the positive effects of the Spanish peninsula-Balearic Islands' link being operational have become apparent. This facility has led to a substantial improvement in regard to the quality and security of the electricity supply on the islands of Majorca and Menorca, given that their rapid response has avoided both frequency deviations outside of specific limits and power outages caused by generating losses.

In addition, the energy transferred from the Peninsula has covered 22% of the demand on the Balearic Islands, reaching peaks of 35% of the hourly consumption. This has resulted in a saving of 18% on the cost of coverage of the Balearic Islands' electricity system and avoided the emission of approximately 250,000 tonnes of CO_2 into the atmosphere.

IN THE CANARY ISLANDS, generation from renewable sources (wind and photovoltaic) represented 7% of the total generation in 2013, registering on occasions 30% in Tenerife and 32% in La Palma de Gran Canaria throughout the year, particularly challenging values in small isolated electricity systems.

PENINSULAR ELECTRICITY DEMAND COVERAGE IN 2013

(%)



* Includes hydroelectric from ordinary and special regime. Excludes pumped storage generation.
** Includes fuel/gas and non-renewable thermal.

ENERGY EFFICIENCY [-EU7-]

RED ELÉCTRICA continues to actively work on the promotion of demand-side management initiatives that seek to contribute to maintaining the guarantee and security of supply and achieve a greater efficiency for the electricity system as a whole.

Amongst these initiatives, noteworthy on one hand are those measures aimed at achieving a more balanced consumption profile, and on the other those that are aimed at providing system operation with a greater flexibility.

INTERRUPTIBILITY SERVICE

During 2013, Red Eléctrica continued its commitment to continual improvement of the management of and the relationship with the industrial consumers who are interruptibility service providers. These, fulfilling the requirements of the regulations, have in place a contract agreed with the system operator, so that, when requested to do so, they reduce their consumption to certain default values for system needs.

In this context, in October 2013 the Order IET/2013 was approved that introduces the challenge of a new mechanism for assigning this interruptibility demand-side management service based on an auction procedure.

To do this, Red Eléctrica is preparing the implementation of this new competitive mechanism with which the resource allocation is managed.

ACTIVE CONSUMER

THE ELECTRICITY SYSTEM is in a transition phase towards a new more dynamic energy model in which the role of the citizen, as a key part of system operation, is becoming increasingly noteworthy. For this reason, Red Eléctrica promotes the implication of consumers by providing information on the status of the system, or by disseminating recommendations on best practices regarding efficient consumption.

THE PROCESS of the progressive electrification of our society, due to the increasing weight of electricity in our lives, requires these types of initiatives that enable citizens to understand the operation of the electricity system easily, helping them to change their consumption habits and make a more efficient and responsible use of energy.

More information in the 'Red21' section of the corporate website.

INITIATIVES FOR AN EFFICIENT MANAGEMENT OF THE SYSTEM

In 2013, Red Eléctrica continued to develop various initiatives geared towards achieving a more efficient management of the electricity system in the areas of smart grids, energy storage, or the incorporation of the electric vehicle. Amongst these actions noteworthy are:

DEPLOYMENT PROJECT

THE 'PRICE' DEPLOYMENT PROJECT (Smart Grid Project in the Corredor del Henares area of the Community of Madrid) is the first in which the technological challenges associated with demand-side management mechanisms are tackled in a deployment scope and not through conceptual testing.

Thanks to the implementation of smart meters within the sphere of residential demand, the demonstration phase of the project will develop the knowledge and technology necessary for an intelligent demand-side management, and will incorporate new mechanisms to keep citizens informed about the state of the electricity system.

PROFILING SERVICE

THE 'PERFILA' PROJECT seeks to improve the current profiling service and have more knowledge available about both household hourly consumption and that of an important part of small businesses and services.

The initiative, with the involvement of the major distribution companies, is based on the analysis of the hourly information coming from a panel of consumers who already have smart meters. During 2013, the panel was defined and the 20,000 members or so have been identified. As of January 2014, the first sets of data are beginning to be collected from the panel.

In the first edition of the Enertic Awards 2013, the PERFILA project was awarded for its innovative research and character.

Proyecto almacena

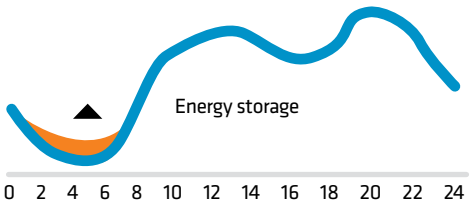
More information in the video of the 'Almacena' project.

ENERGY STORAGE

'ALMACENA' IS A TECHNOLOGICAL PROJECT to analyse and assess the challenges and capabilities associated with an energy storage battery connected to the transmission grid. Specifically, a prismatic lithium-ion battery, with a power of about 1 MW and a capacity of at least 3 MWh, which has been installed in the Carmona substation (Seville).

The development of energy storage systems will help improve the sustainability of the system by allowing a greater integration of renewable energy and improve the flexibility and efficiency of the electricity system, flattening the demand curve whilst maintaining security of supply.

FILLING VALLEY HOURS IN THE DEMAND CURVE



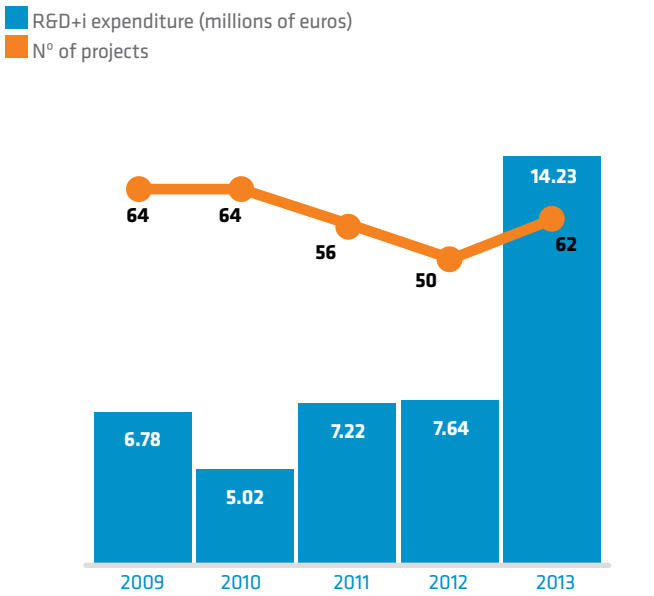
TECHNOLOGICAL INNOVATION [-EU8,EC9-]

RED ELÉCTRICA invested 14.23 million euros in a portfolio of 62 R&D+i projects during 2013. This investment represents an increase of 86% compared to 2012 and is encompassed by the Technological Innovation and Development Plan designed by the Company for the 2012-2016 horizon. Of this total, Red Eléctrica recovers about 24% through subsidies from various national and European programmes to promote R&D+i projects and tax breaks associated with innovation.

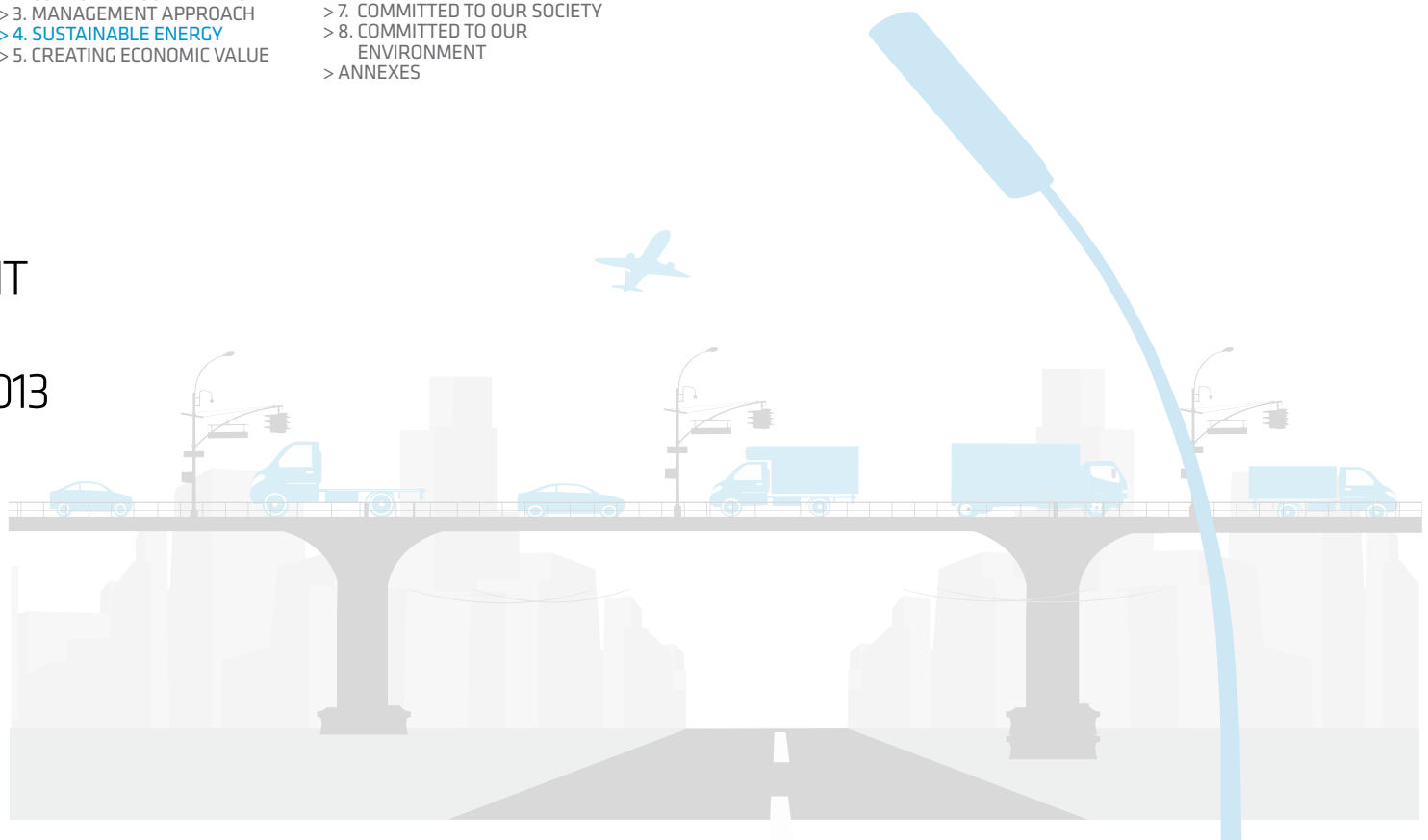
Throughout 2013, several projects were carried out both nationally and in Europe geared towards the incorporation of more efficient technologies into the transmission grid and the promotion of new operating resources, to make the system more sustainable. All projects reflect the Company's commitment to innovation as a driver for growth and efficiency, and as a key element to improve the competitiveness of the industrial fabric.

DURING 2013 a total of 251 specialists worked on 62 R&D+i projects, 15% of the workforce. Of these, 39 were women (15.5%). 41,210 hours were dedicated by our own personnel, the equivalent of 24.2 full-time people.

R&D+I EXPENDITURE



MOST IMPORTANT R&D+I PROJECTS COMPLETED IN 2013



TWENTIES
Transmitting Wind

ETHIS EUROPE-WIDE PROJECT is aimed at advancing the development of new technologies that will enable the massive incorporation of wind power into the European electricity system and thereby contribute to the achievement of the objectives of the Union European regarding energy matters for 2020.

CENIT VERDE

THIS NATION-WIDE PROJECT is focused on the design and implementation of a prototype electric car and the management and control systems necessary for its efficient integration into the electricity system. It is supported by the Ministry of Economy and Competitiveness and has the collaboration of 16 companies and 14 government agencies.

AGREGA

THE OBJECTIVE of this project was to analyse the provision of the demand-side management service through the aggregation of consumption in the small and medium-sized businesses in the area of the Basque Country.

TRAFO MÓVIL

THIS PROJECT consisted of the design and construction of a mobile transformer that can be moved to Red Eléctrica substations in emergency situations with minimal permits, or a generic permit reducing the administrative process, in order to quickly replace units that may have suffered sudden breakdowns.

BIRD COLLISION DETECTOR

THE DESIGNING OF A DEVICE to detect bird collisions with grounding wires of the towers of the overhead electricity lines has been the main objective of this project.

MOST IMPORTANT R&D+I PROJECTS CURRENTLY UNDERWAY

NATIONAL

ALMACENA (electrochemical energy storage connected to the transmission grid).

FLYWHEEL (energy storage system using a rotating mass).

REDIRECTION OF POWER FLOWS (high voltage equipment to control the flow of electrical current through an electricity line).

PERFILA (improvement of the energy profiling system for consumers who do not have hourly measuring).

TEMPERATURE MONITORING (measuring the temperature of a buried power cable via fibre optic technology, allowing the transmission capacity to be optimised).

POSIDONIA OCEÁNICA (study of the use of seeds for the recovery of the meadows of this underwater plant).

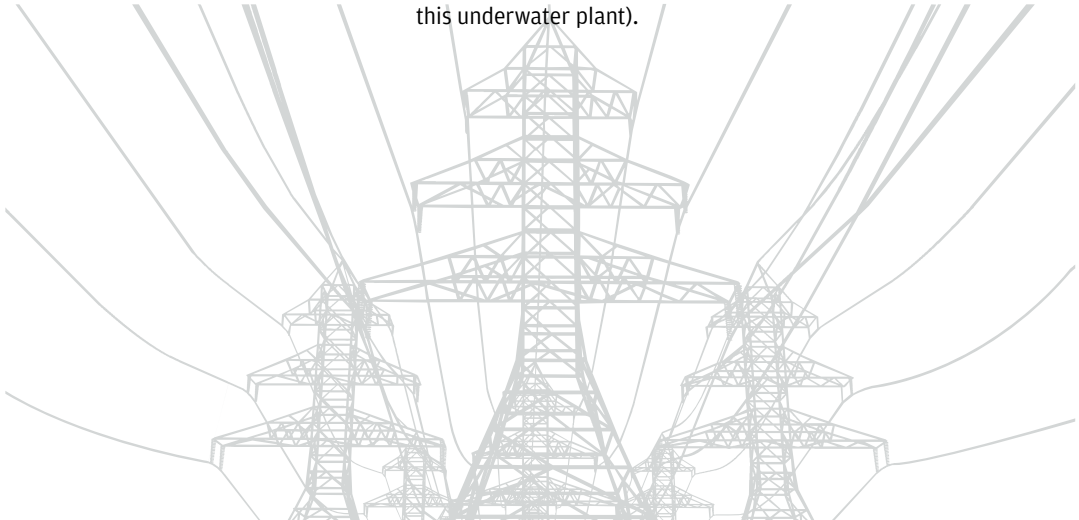
EUROPEAN

e-HIGHWAY 2050 (long-term optimal planning of the pan-European transmission system - 2050).

GRID+ (coordinated design of a roadmap for joint R&D+i projects between TSOs and DSOs).

BEST PATHS (BEyond the State-of-the-art Technologies for re-Powering Ac corridors & multi-Terminal Hvdc Systems).

More information in the 'Red21/R&D+i' section of the corporate website.



CARS PROJECT (SAFE, RESPONSIBLE AND AGILE DRIVING)

The proper maintenance of the transmission grid involves a large number of trips throughout Spain, both for scheduled work and to respond to emergency situations. The CARS Project (Conducción Ágil, Responsible y Segura), one of those noteworthy in the field of corporate responsibility, is the development of a specific navigation system and real-time monitoring for the Red Eléctrica fleet of vehicles, with the aim of improving driving conditions based on three aspects:

>> **Agile driving:** reduce travel times to the transmission grid facilities, efficiently selecting the best route from the starting point.

>> **Responsible driving:** to minimise the impact on the environment by reducing fuel consumption and CO_2 emissions. This is achieved by choosing the best route and monitoring the actual fuel consumption and driving style to improve energy efficiency, in addition to creating responsible driving habits.

>> **Safe driving:** improve safety of the displaced technicians/specialists, monitoring real-time enforcement of speed limits and correcting behaviours that involve risks and unnecessary costs.

The prototype has been tested in 12 Red Eléctrica vehicles, which has made it possible to check how it works and quantify the savings in time, fuel and CO_2 emissions, compared to standard practice.

The results have been entirely satisfactory and it has been proposed to implement the system throughout the whole fleet.