



ANDALUSIAN SUSTAINABLE ENERGY PLAN

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For a new energy model



European Union
European Regional Development Fund



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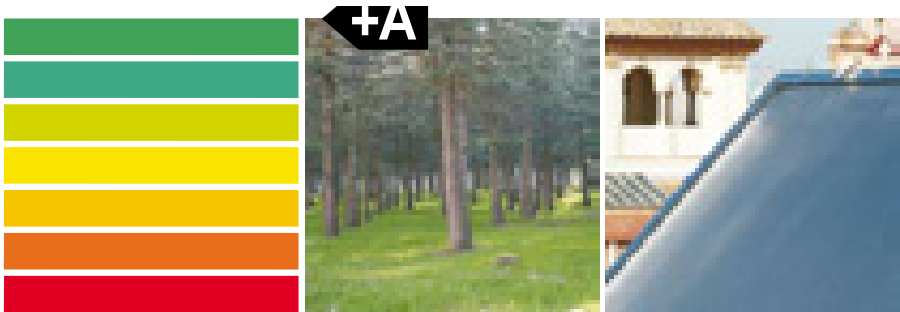
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Presentation



During the last few decades, energy has become the essential driving force of world economic development. However, the progressive increase in energy demand by all activity sectors, without taking into account the finite nature of the energy sources we have - basically fossil fuels-, the undeniable impact on the planet due to climate change and international conflicts that lead to an insecurity of energy supply, are among others, evident signs of the exhaustion of the current model.

This makes it essential to build a new energy model based on generation sources that are cleaner, more efficient and longer lasting, which will substitute traditional fossil fuels, will allow us to diversify our energy supply and reduce greenhouse gas emissions, contributing to being able to reach the environmental sustainability commitments made at Kyoto a decade ago. The commitment to renewable energy is therefore today, throughout the Western world as well as in emerging economies, an inescapable need and now occupies an essential position in the new energy paradigm.

The generalised use of renewable energy is going to allow us in Andalusia to value our autochthonous resources (sun, wind, water, biomass, etc), which are given to us free and are never-ending, substantially reducing our energy dependence from abroad and contributing to the sustainable development of our territory, as well as favouring the creation of new jobs and greater competitiveness.

Presently, when a new period of energy planning is starting in our region, the Andalusian Community faces up to building this new energy model not only as an environmental and economic need, but as a great industrial and technological opportunity. Our wind power, solar and biomass potential is very important in Europe and we are ready to exploit it to obtain scientific and industrial leadership and thus become an international reference in the development of technologies relating to the generation and exploitation of renewable energy.

We are aware that the change towards a new energy model cannot be postponed, due to the responsibility we have with future generations and with environmental conservation, and we are convinced that by acting in a determined and effective manner, this will bring important benefits to the Andalusian industrial network. There are many opportunities from this scientific, technological and industrial development afforded by this energy context and our ambition is to be and remain at the forefront of this quick expanding field.

Pronounced in clear agreement with European and State strategies, the Andalusian Sustainable Energy Plan 2007-2013 (PASENER) pursues to respond to energy supply needs without generating territorial, environmental, economic and social imbalances, in a sustainable development context that ensures not only the welfare of current Andalusian society, but also that of future generations.

It is an ambitious yet rigorous forward-looking planning document, which transcends traditional energy planning focused until now on analysing how to satisfy a demand without evaluating the criteria of sufficiency and solidarity. For this, it sets out as pillars in the new energy framework, demand management, energy diversification, maximum use of autochthonous resources and the promotion of high levels of self-sufficiency in consumer centres.

It is an innovative plan with regards to its structure, with programmes aimed at citizens, economic and social agents and the Public Administrations. We all share a leading role and responsibility at the same time and without the determined involvement of all the Andalusian people, this change towards a new energy model cannot be made.

Therefore, from this plan there is a call for the creation of a collective consciousness, for a new energy culture that will value energy as a valuable and limited asset and that will act in harmony with it.

The PASENER is Andalusia's strategic commitment to the energy sector, to address one of the major challenges that our society faces today, changing the energy model. Andalusia has the ability to transform this challenge into opportunities and make renewable energy a new industrial resource, which is already resulting in the creation of new companies, in strengthening an innovative business sector which has great technological content, in new jobs and finally in a new opportunity for growth, social cohesion and progress in our region.

Francisco Vallejo Serrano

Minister for Innovation, Science and Business

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Introduction

Energy planning in Andalusia faces a historic cycle change marked by the need to urgently and decisively tackle on a world scale the problem that addresses having a quality, safe and sufficient energy supply without creating imbalances in the global ecosystem, especially those associated with the great challenge caused by climate change.

Until now energy planning studies had been focused on anticipating the energy demand that society would need over a certain period, with the aim of covering this demand with an approach that considered energy as an infinite resource. However, the demonstrated effect that this system together with the current energy system has on the environment, with its important contribution to global warming, means we need an urgent solution to change the energy model.

The Andalusian Energy Plan 2003-2006 meant a first step towards this change, with the Governing Council approving very ambitious objectives in the field of renewable energy and energy savings and efficiency.

This new Plan elaborates on this path, chasing its aim to get closer to a new energy model that can respond to Andalusian society's energy needs without causing environmental, economic or social imbalances, within a sustainable development context for Andalusia.

This desire is based on a solid foundation consisting of a legal framework in line with the changes that are being pursued and by the specific commitments of different transversal policies.

The Reform for the Statute of Autonomy thus sets out the competence framework for the Autonomous Community, which explicitly recognises these policies based on the definition of shared energy competencies in production, distribution and transport installations, in the promotion and management of renewable energy and in energy efficiency.

Among the Autonomous Community's basic aims are setting out an industrial and technological development based on energy sufficiency, and among its guiding principles it examines the promotion and development of renewable energy, energy savings and efficiency. For this it urges the Andalusian government to promote clean renewable energy,

Planning
faces an energy
model change that
contributes to the
sustainable
development of Andalusia

and undertake policies that will favour the sustainable use of energy resources, energy sufficiency and savings so as to prevent climate change.

Likewise, the general economic planning document for the period 2007-2013, called "Strategy for Andalusian competitiveness" determines the basic strategic directions for regional economic development, and is considered to be the essential reference for the development of sector planning. This document, which devotes one of its sections, specifically Section 4 "Territorial balance, accessibility and energy," to the energy theme, has been used as the basis to draft this plan.


The consistency of planning in energy matters is fundamental to direct the current model towards sustainable social patterns. Hence the assumptions taken on in this area are set out in the community's environmental planning, specifically the Andalusian Environmental Plan 2004-2010.

On the other hand, and framed in the Autonomic Strategy for Climate Change adopted in 2002 by the Agreement of the Governing Council, the Andalusian Plan for Climate Action 2007-2012: Mitigation Program, includes among its action areas two structural lines of energy policy from the Autonomous Community of Andalusia: the promotion of energy saving and efficiency and promotion of renewable energy sources.

We should point out that, as a plan with an impact on spatial planning, PASENER has taken as a basis for its drafting what is set out in Art.17 of Law1/1994, on Spatial Planning in the Autonomous Community of Andalusia, as indicated in the Third Provision of the Agreement dated 13th July 2006, which approves its formulation.

On the other hand, the approval of the Technical Building Code through Royal Decree 314/2006, the new remuneration framework for renewable energy set out in Royal Decree 661/2007, the Law 2/2007 for the Development of Renewable Energy and Energy Savings and Efficiency of Andalusia and the consolidation of the Andalusian Energy Agency as an instrument to achieve the objective to be optimised, in economic and environmental terms, which is the energy supply of Andalusia, form a robust framework on which to base the main pillars of the Andalusian Autonomous Community's energy policy over the coming years.



An aerial photograph of a dense forest. The trees are mostly deciduous, with many showing vibrant autumn colors of yellow, orange, and red. There are also several dark green coniferous trees scattered throughout the landscape. A winding road or path is visible in the upper left portion of the image. A large, stylized white number '2' with a black outline is superimposed on the right side of the image.

2



Global energy context

The use of energy is a constant in all activities carried out by man. From the supply of food to the different forms of leisure, going through the development of working activities, health, education or transport, they require a vast shot of energy to carry them out. The demand of energy increases proportionately when society develops. Energy is the force that makes the world progress.

Ever since the time that man began to use energy to carry out the most basic activities, such as warming himself or cooking, until now, humanity has come a long way and has led it to exploit fossil energy resources without considering their finite nature, given the planet's limited capacity to renew these resources, or the possible effects on the environment or health. The great leap forward by Western urban society occurred from exploiting the enormous energy potential accumulated in fossil fuels; first with coal and then with an explosive growth, using oil.

The palpable improvement experienced in the 20th century by society with regards to population survival rates and welfare levels achieved are related to the great opportunities for producing goods and services that have triggered the exploitation of fossil fuels.

The improvements derived from this development have been unevenly distributed in the world, although demographic progress and the increase in capacity to be able to feed the global population experienced by the planet is undeniable. Whilst one part of the world has enough energy to meet not only its basic needs but also the new demands that have come about from the way of life of so-called developed countries, more than a third of humanity does not have an electric power supply or liquid and gaseous fuels. The tension generated by these inequalities and the pressure on resources resulting from the aspiration of all countries warns us about the limits of the current economic and social development model, which bases sustained growth in energy demand as a factor that links it to the degree of development.

Until the end of the last century energy crises were caused by conflicts to control resources or by temporary difficulties in the production/distribution system. However, now the focus is not so much on current specific problems but on long-term issues related primarily to the scarcity of the sources the current model is based on, which result in international conflicts based on strategic positions in areas with the greatest production.

Climate change and future energy supply problems mean an urgent solution to change the current energy model is needed



But it is also true that social welfare, economic growth and business competitiveness in regions are threatened by the **model's high vulnerability when facing future energy supply problems**. Over the last few years a new variable has been introduced that has undoubtedly been the driving force which is causing the rush to change the world's view on the energy issue, **climate change caused by emissions of greenhouse gases**.

This has decisively influenced energy policies adopted globally and **particularly in the national and European energy framework**, which is progressively adapting to the new requirements by introducing new aspects related to energy and with the formulation of important commitments to address the new conditions introduced in the energy context over recent years.

The technological, innovation and research aspect will be especially relevant, key points in developing strategic action areas and reaching objectives, mainly in the field of renewable energy.



2.1. CLIMATE CHANGE, THE SERIOUS CONSEQUENCES OF A MODEL IN CRISIS

The objective that underlies all current policy is the pursuit to improve the living conditions of the society to which it is addressed dealing with economic, social and environmental criteria. However, if we hope that this improvement is maintained or grows with time, is made more widely known to all people and does not compromise the welfare of future generations, the actions and measures that are taken for this must be coordinated and analysed together to simultaneously deal with the three areas: social, economic and environmental, which is the way to achieve a development that can be identified as sustainable.

The term sustainable development was defined in the so-called Brundtland report (1987) from the United Nations as that which allows *"to satisfy our current needs without compromising the ability of future generations being able to satisfy theirs."*

Gradually and more sharply in recent years, sustainability has begun to be introduced into the political agenda of developed countries, in such a way that today we cannot imagine development that does not incorporate this premise in its foundations and does not take on the challenges posed by effectively achieving it.

Energy is an essential nexus between the three basic aspects of sustainability, given that its transversal character establishes deep relationships with all of them. It is essential for economic growth, to guarantee services to society and it has an indisputable effect and interaction with the environment. But energy has also given rise to the greatest imbalances, making the development achieved thanks to sustainability.

The global warming seen on the planet, which until recently was thought to be just suppositions and "background noises in a wide time scale," has gone on to be endorsed by the evolution it has had and the credibility of the different indicators that have been presented regarding this. And future forecasts are not exactly reassuring.

The third General Report from the Intergovernmental Panel on Climate Change (IPCC) of the United Nations warned that already more than half of the effects from climate change are caused by human activity rather than the effects of natural climate variability. This report indicates that, on average, temperature has increased approximately 0.6 °C in the 20th century and that the average increase of the temperature on earth could vary between 1.4 °C and 5.8 °C in 100 years, which would cause a considerable rise in sea levels due to the expansion of the oceans, which would be increasingly warmer, altering weather

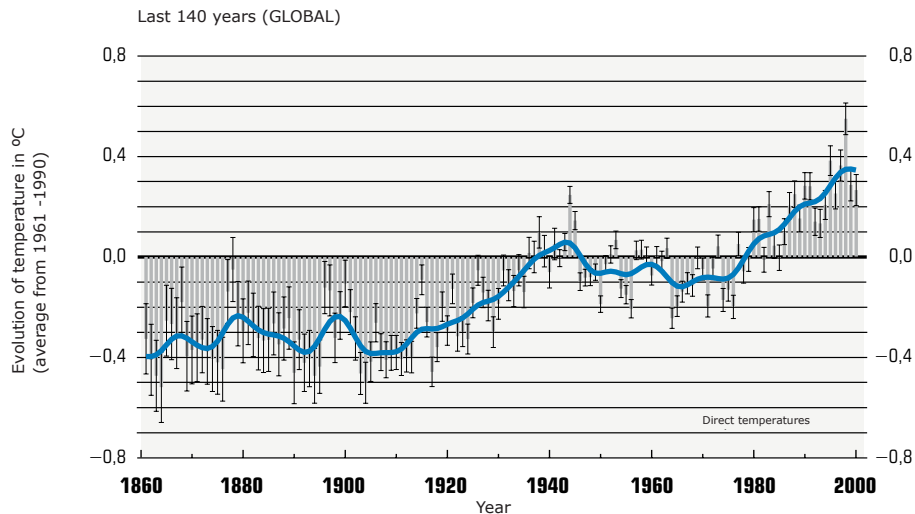
There is an important consensus in the scientific community about the truth of climate change and predictable seriousness of its consequences

patterns and would increase the number and intensity of extreme events, droughts or floods, as features of the future climate.

The fourth IPCC report was made public in February 2007. At first sight it seems that it only adds some variations to the estimates of the increase in the planet's average temperature due to greenhouse gas emissions, which this century would be about between 1.8 °C and 4 °C, with an initial rise of 0.2 °C per decade in the next 20 years, with later rises of 0.1 °C per decade. The situation could even be worse with a range of 1.1 °C to 6.4 °C if the world's population increases and drastic measures are not taken to change the development model. On this occasion we can affirm that the anthropogenic effect is

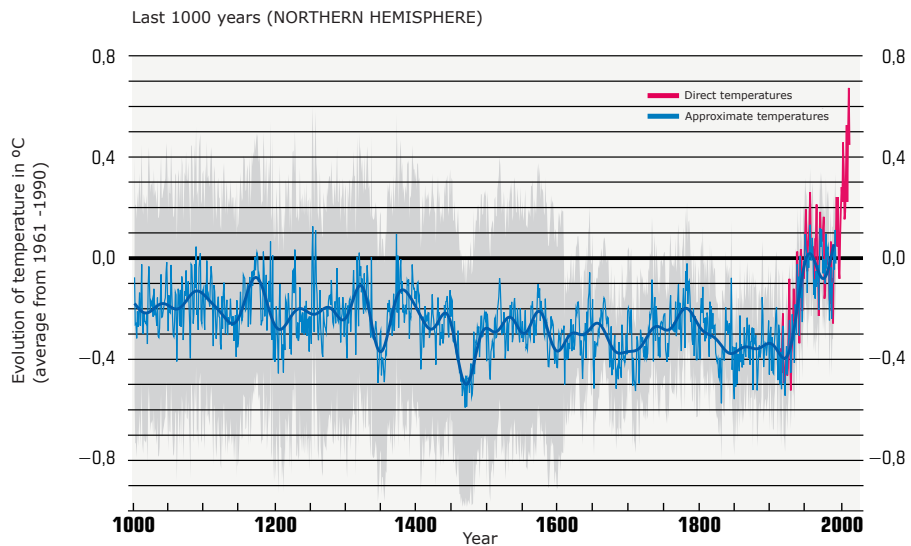
Graph 1
Variation of Global
Temperature

SOURCE:
IPCC



Graph 2
Variation of Global
Temperature

SOURCE:
IPCC





the cause, with a 90% probability, of the increase in temperature of the earth's atmosphere due to the effect from the emission of greenhouse gases due to burning fossil fuels.

But what is particularly relevant about this report is the "unanimity" in the scientific basis that considers warming "unequivocal": Among the most dramatic statements in the report is that **climate change on earth is irreversible.**

This is why, right now, we cannot tackle an energy policy on any scale without considering the global warming seen on earth as derived from the proven link between human activities and climate change. Moreover, issues related to climate change have placed the energy matter onto all the agendas and speeches of world politics.

The challenge created by climate change is mobilising the global energy sector, due to the priority treatment that governments are giving it and that end up in commitments that have a direct bearing on the energy policies adopted.

At the 2005 Summit of the most industrialised countries of the world, held at Glenables (Scotland), the group of leading industrialised countries discussed the challenges that climate change and ensuring clean energy have in the context of sustainable development, agreeing to take urgent and decisive action. A series of strategies for action on energy matters were set out for this, encompassed in an Action Plan for whose implementation the International Energy Agency plays a major role. In June 2007, and under the motto "Growth and Responsibility in the World Economy", the G8 Summit in Heiligendamm (Germany) ratified this commitment to climate protection and to promoting the most important areas for this, energy efficiency in buildings, new engines and alternative fuels in transport, carbon capture and storage, renewable energy, etc.

In order to establish a strategy for sustainable, competitive and safe energy, the European Union in 2006 set out in its Green Paper the need to adopt a new energy policy for Europe, able to confront the change in the energy scene needed to work towards the sustainable development of Europe based on balanced economic growth and price stability, in a highly competitive social market economy, aiming at full employment and social progress, and with a high level of protection and improvement in the quality of the environment.

In Spain, and aimed at integrating and reviewing all these studies and updating the state of existing knowledge, the Spanish Climate Change Office promoted during 2003 and 2004 the undertaking of the project called ECCE (Effects of Climate Change in Spain), with the support of more than 400 Spanish and international experts, scientists and tech-

nicians, whose final report was published in 2005 (General Preliminary Assessment of the Impacts in Spain due to the Effects of Climate Change).

Although these documents stress the complexity of applying the models as predictive tools locally, it is presumed that its latitudinal position, its climatic, orographic peculiarities and socio-economic development plan, make Andalusia a region that is vulnerable to the syndrome of effects that would be caused by a change in the climate.

The most prominent effects included in this report are the following and in line with the results published by the IPCC:

- Variation of the temperature range veering towards extremes, with increases in average temperature and in the frequency of extreme temperatures.
- Increasing episodes of drought and conditions in the availability of water for urban, agricultural and livestock use, loss of rainfall and changes in river ecosystems through the continued loss of ecological flow.
- Desertification of land.
- Losses in agricultural yield.
- Conditions in the tourism sector through changes in climate comfort conditions.
- Changes in the coastline.
- Conditions in the volume of catches in fishing and in marine ecosystems.
- Increase of fire risk in woodlands.
- Loss of genetic regional assets through the decrease in biodiversity and changes in the composition of ecosystems.
- Effect on human health and quality of life with increases in respiratory diseases (allergies, asthma, ..), added to the health problems caused by the loss of air quality in urban and neighbouring areas.
- increased spending to repair damage caused by climate catastrophes.

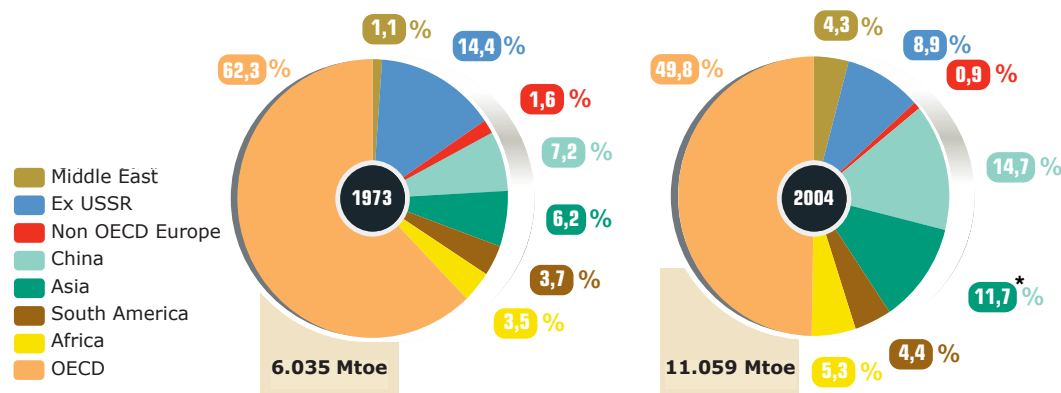
2.2. A VULNERABLE AND DEPENDENT ENERGY SYSTEM

Besides climate imbalance, social welfare, economic growth and business competitiveness of the regions, they are threatened with the **high vulnerability of the model when faced with future energy supply problems.**

As cited by the European Commission Green Paper on *European strategy for sustainable, competitive and safe energy [COM (2006) 105 final]*, the European Union's current energy needs are met with 50% of imported products, a dependence that could rise to 70% in the next twenty or thirty years if a greater competitiveness in domestic energy is not achieved. The leading role will continue to be held by oil and natural gas derivatives, whose imports will grow from 82% and 57% respectively today to 93% and 84% in 2030.¹

But not only developed countries require huge amounts of energy. The pattern for economic and social development is followed by those countries who aspire to attain the quality of life enjoyed by these societies, with a consequent increase in energy demand worldwide.

The dependence on fossil fuels: a determining factor for economic development and the environment



According to estimates from the World Business Council for Sustainable Development, by the middle of the century energy demand could have doubled and even tripled, keeping pace with population growth and expansion of today's emerging economies. And non-renewable energy sources will continue having a major stake in meeting this demand.

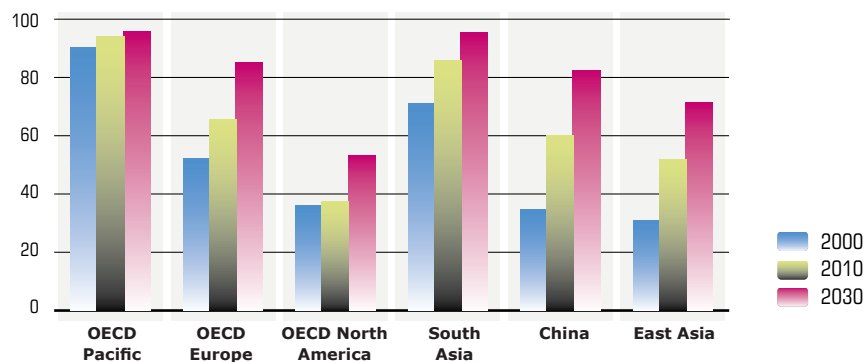
¹ Communication from the Commission to the Council and European Parliament, *An Energy Policy for Europe 2007*



Thus, countries like China and India which account for the bulk of the increase in global energy demand may have to import around 70% of energy to meet their needs by the middle of the century.

There is already a lot of evidence on the problem; escalating crude oil prices driven by the growing world demand for oil, the inability of supply to keep up with the pace of growth and the existing global shortfall in refining capacity. There are many who predict that early in the next decade there will be what is called "peak-oil" or peak in production which will begin to fall after passing this peak. And the first to suffer the consequences will be those who are most dependent on oil.

Graph 4
Evolution of foreign
dependence on oil
(% over total demand)



SOURCE:
30 Key Energy Trends in the IEA and
Worldwide.
International Energy Agency



2.3. EUROPEAN AND NATIONAL ENERGY POLICIES

The environmental impact caused from the extraction of energy sources to using them, high energy prices, supply problems to meet growing demand, and unequal access to energy, among others, are the basis of world energy problems and consequently affects the policies on energy that are developed at a European and national level.

These policies make up the reference framework when undertaking Andalusian energy planning.

In recent years and as a consequence of the new conditions introduced in the energy context that come from the unsustainability of the current energy supply and consumption model, the European Union has started to define its strategy to achieve an energy system that ensures safety in an energy supply, which is competitive, efficient and a catalyst for economic development, which creates jobs and protects human health and the environment.

For this the following strategic objectives for action have been set out:

- To promote electricity generated from renewable energy sources, in compliance with the provisions laid down in Directive 2001/77/EC of the European Parliament and Council, of 27th September 2001 regarding the promotion of electricity from renewable energy sources in the internal electricity market. It sets out as its target that by 2010 22.1% of the total electricity consumption in the European Union should be covered by electricity generated from renewable sources.
- To promote the use of biofuels or other renewable fuels as substitutes for diesel or petrol for transport purposes, Directive 2003/30/EC from the European Parliament and Council, of 8th May 2003, setting out as a reference that by 2010 a percentage rate in biofuel consumption of 5.75%, measured on the basis of the energy content of all petrol and diesel sold in the European Union markets for transport purposes, should be reached.
- To reduce emissions of greenhouse gases for the period 2008-2012 by 8% compared to 1990 levels in agreement with the Kyoto Protocol of the United Nations Framework Convention on Climate Change. (Council Decision 2002/358/EC concerning the approval, on behalf of the European Community, of the Kyoto Protocol of the United Nations Framework Convention on Climate Change and the joint compliance of commitments incurred thereunder).



The European Union proposes ever more ambitious objectives to develop policies to promote renewable energy and energy savings and efficiency

To act immediately on greenhouse gas emissions associated with energy (80% of greenhouse gas emissions in the European Union) means addressing the other challenges that threaten the system's sustainability; reducing emissions will lead to using less energy and using it more efficiently, with greater role for renewable energy sources produced locally, promoting the development of clean and low-emission energy technologies.

Thus, to combat climate change would mean limiting the vulnerability that the European Union has as a result of high oil imports and thus limit its exposure to the price volatility of these, providing a more competitive energy market, which encourages innovation and employment.

Despite the efforts that are being carried out, meeting the targets taken on by the European Union, especially as far as renewable energy is concerned, are still very far from being met. According to the communication from the Commission to the European Council and Parliament², the progress made by renewable energy sources contributing to the primary consumption structure are not enough and if we carry on like this means it is unlikely that a contribution of more than 10 % will be reached.³

However, the European Union continues to suggest increasingly ambitious objectives framed in its policy to promote renewable energy and energy savings and efficiency.

Taking into account the important role of a sustainable energy policy to achieve the objectives on climate, in the Spring Summit of 2007 the European Council adopted the *Action Plan of the European Council (2007-2009)*. *Energy policy for Europe* based on the three principles of safe supply, efficiency and environmental compatibility. At this Summit the following binding commitments were adopted:

1. 20% reduction in the use of global primary energy by 2020.

2. Increase in the percentage of renewable energy, in the primary energy structure, to 20% by 2020.

3. Reduction of greenhouse gas emissions in the European Union by a minimum of 20%, in 2020 compared to 1990.

² Working programme for renewable energy. Renewable energy in the 21st century: building a more sustainable future. COM (2006) 848 final.

³ The quota for renewable energy in primary energy consumption in the EU25 in 2005 stood at 6.38%, according to the 6th State Report on renewable energy in Europe carried out by Obser'ER: OBSERVATORY FOR RENEWABLE ENERGY.

Additionally, there was a voluntary agreement on the need for international commitment for a further **reduction in emissions until reaching a target of 30%**, subject to this same agreement being adopted by other industrialised nations, given that global greenhouse gas emissions should be reduced by at least 50% compared to those of 1990 in 2050 and this would mean reductions in industrialised countries of 60%-80% for that year.

The Action Plan also includes clear references to energy solidarity among Member States, responsibility for shaping national energy mixes, safety of supplies, international energy policy and R & D in new energy technologies. The savings targets in innovation will be reinforced by decisions on gas and electricity markets including the de-linking between generation and network operators.

The chart below summarises the objectives that the EU are committed to within the framework of an ambitious integrated European policy on climate and energy:

Renewable energy	Percentage of renewable energy in the primary energy consumption structure	12% in 2010
		20% in 2020
	Percentage of renewable energy in primary energy production	22% in 2010
	Percentage of biofuels over consumption of automotive fuels	5.75% in 2010
10% in 2020		
Energy savings and efficiency	Reduction of primary energy consumption	20% in 2020
	Reduction of energy intensity	1% per year until 2010
Emissions	Reduction in greenhouse gas emissions in the EU group with regards to 1990	8% in 2012
		20% in 2020
		30% if there is agreement with other industrialised nations

Chart 1
Main goals in the European Union's energy policy

The process of change that is occurring in the global and EU community energy sector, aimed at establishing new energy system guidelines, moves into the **national Spanish sector** where in recent years many strategic, normative and regulatory documents have come into being, aimed at achieving their own targets as well as the commitments undertaken by the European Union.

Among the initiatives started up in Spain are those that include setting up a regulatory framework aimed at establishing the progressive liberalisation of electricity and gas markets, in order to ensure safety and quality of supply, combining it with effectively protecting the environment. Thus, from the 1st January 2003 all consumers can choose their

Renewable energy,
energy savings and
efficiency and
technology innovation
are key to confront
climate change

supplier, in this way bringing forward the European calendar that sets out this date for July 2007.

Moreover, Spain has made a commitment to limit the growth of greenhouse gas emissions by 15% over emissions corresponding to the year 1990 by 2012, under the Kyoto Protocol. The National Allocation Plans approved to date, corresponding to the periods 2005-2007 and 2008-2012, mark out the map to follow to reach this target. The Spanish Strategy on Climate Change, which listed a series of policies and measures that will allow the effects of climate change to be mitigated and help the international commitments acquired by Spain to be met, was presented in February 2007.

Renewable energy, energy savings and efficiency and innovation in technologies and processes are key to meet the challenge that arises from climate change and the high dependence on foreign energy from fossil fuels. The national energy policy has taken on as priority objectives those set by the European Union, as listed in the Spanish Renewable Energy Plan 2005-2010 or the 2005-2007 Action Plan for Energy Saving and Efficiency Strategies in Spain 2004-2012, among others.

The cornerstone of this policy is to set up a steady system to remunerate generation, which will ensure the promotion of electricity production using clean technologies by offering an attractive return to the production activity under a special regime. This is the objective of the new Royal Decree 661/2007 that replaces the previous Royal Decree 436/2004 and adds improvements for remuneration of technologies to therefore be able to achieve the objectives of the 2005-2010 Renewable Energy Plan, as well as the commitments made by Spain at a community level. By developing these technologies, renewable energy in Spain will cover 12% of the energy consumption in 2010.

Energy policy and climate protection in Europe has resulted in the three strategic objectives set out in the new European Energy Action Plan, approved by the European Council: safe supply, efficiency and environmental compatibility. To reach them we must act in the priority areas of energy generation and consumption, as well as on emissions, taking on adaptation commitments (2020: 20% reduction in consumption, introduction of 20% of renewable energy, cutting back on greenhouse gas emissions by 20%). Spain follows suit, adopting a whole range of legal tools, guidelines and planning to lead the transformation process required to implement these commitments.



2.4. TECHNOLOGICAL FORESIGHT

Both European and national policies point at technological development and eco-innovations as one of the pillars to respond to the serious energy problems that have been revealed. The technology factor and the leeway this gives to public actions, becomes a critical point of the energy policy. Innovations are focused in two areas: renewable generation and applying hydrogen technology to generation, storage and transport. As for the possible implementation of renewable technologies, the following are highlighted:

Solar thermoelectric power plants: tower technology and distributed solar collector technology, with a wide range of sizes that give great versatility to the applications. Reduction of costs, development of storage systems and the direct production of steam in the collector, are the current technological challenges that research and innovation will have to solve.

Low temperature solar thermal energy: the future of low temperature solar thermal energy will occur in warm regions like ours due to the massive application in the refrigeration for climatization of areas using a thermal evaporation and absorption process, instead of the traditional compression system. Although there are many different types of intermediary systems such as absorption, adsorption, drying and steam injection, the system that best meets the characteristics for cooling buildings is absorption and is most commonly known as the absorption machine. The improvements come from increases in the coefficient of performance (COP) linked to the temperature reached in the collectors. Solar refrigeration through absorption is by using high performance technology such as vacuum tubes but this system must become more popular for it to become cheaper.

Photovoltaic: the trend that is emerging is aimed at developing new materials to ensure high performance, together with the integration of photovoltaic systems so that they become part of the buildings. Research in the field of new materials and new manufacturing methods will reduce the costs and increase the performance of current photovoltaic systems based on silicon.

Concentrated photovoltaic systems which allow the area of the solar cell to be reduced or the development of technologies, which today are experimental, based on the use of organic materials which under certain conditions become electric current conductors, with the traditional mechanical properties of plastic such as transparency and flexibility, could be directly applied in the construction sector, and even in the manufacture of fabrics and materials.

New processes for obtaining traditional semiconductors cheapen the current cost. In the short term ionic liquids will make the production of photovoltaic panels built with traditional semiconductors, Si, Ge, more feasible, but with much cheaper manufacturing processes.

Ionic liquids, organic composites, organic-inorganic composites, nanocrystal semiconductors such as CdSe or CdTe or inorganic hetero-junctions: solar cells made integrally with two different inorganic nanocrystals, CdTe and CdSe, stand out as future lines of developments in solar photovoltaic energy.

Wind energy: advances in R + D + i in wind farms should focus on both the physical components in control systems and the need to make this technology more manageable for it to better adapt to the electrical system. Among the specific aspects which should be innovated, we should mention: three-bladed wind turbines, with direct drive, varia-



ble-speed operation, individual pitch control for each blade, start-up at low speeds, etc. Another aspect to be considered concerns large power wind turbines suitable for areas that have less wind potential, and another field of great technological development would be off-shore wind farms, which could share their infrastructures with tidal power.

Biomass: innovation efforts in this renewable source should focus on developing specific crops, densification systems for lignocellulosic biomass, transport logistics, specialised agricultural machinery and technologies suitable for harvesting them (energy crops, agricultural residues, forest residues, etc.) and in energy conversion systems. Within the latter, gasification and pyrolysis technology should also be properly developed, together with gas cleaning systems that allow the correct functioning of the installations.

Additionally, within thermal power generation, we need a significant effort in innovation to integrate boiler systems and biofuel storage in buildings. Another important aspect is the use of biomass in local hot-cold power stations, which require appropriate development of both the energy conversion technology with biomass as well as absorption machines of various sizes and end uses. On the other hand, the co-firing of biomass with other fuels (for example coal), requires the adaptation and development of new technology.

Biogas: a significant effort is needed to develop anaerobic digestion technology, as well as control processes to enable the use of a large number of residues, boosting the emergence of co-digestion systems.

Biofuels: innovation efforts should focus on the development of second-generation technologies, thus providing a more extensive and indiscriminate use of biomass to produce biofuels, a lower production cost and a more positive energy-environmental balance than we have today.

Geothermal: the future development of this technology will be through lower costs of drilling with new drilling techniques. Among the options being considered, Hot Dry Rock (HDR) with an injection of n-pentane pressure is considered the most suitable.

Energy from the sea: there are different types of energy exploitations under this concept; tidal energy or changes in the level of the tides, marine current energy, wave energy on the sea surface or from those crashing against the shore, osmotic power through salinity differences and Ocean Thermal Energy Conversion (OTEC) using the Rankine cycle. The technological development of machines must go through the process of adapting the wave period to the optimal optimisation of the machine.

Combinations among the different technologies: the need to produce cleaner electricity has encouraged the investigation of combinations of natural gas with biomass, which reduces the risk of dependency and fuel supply.

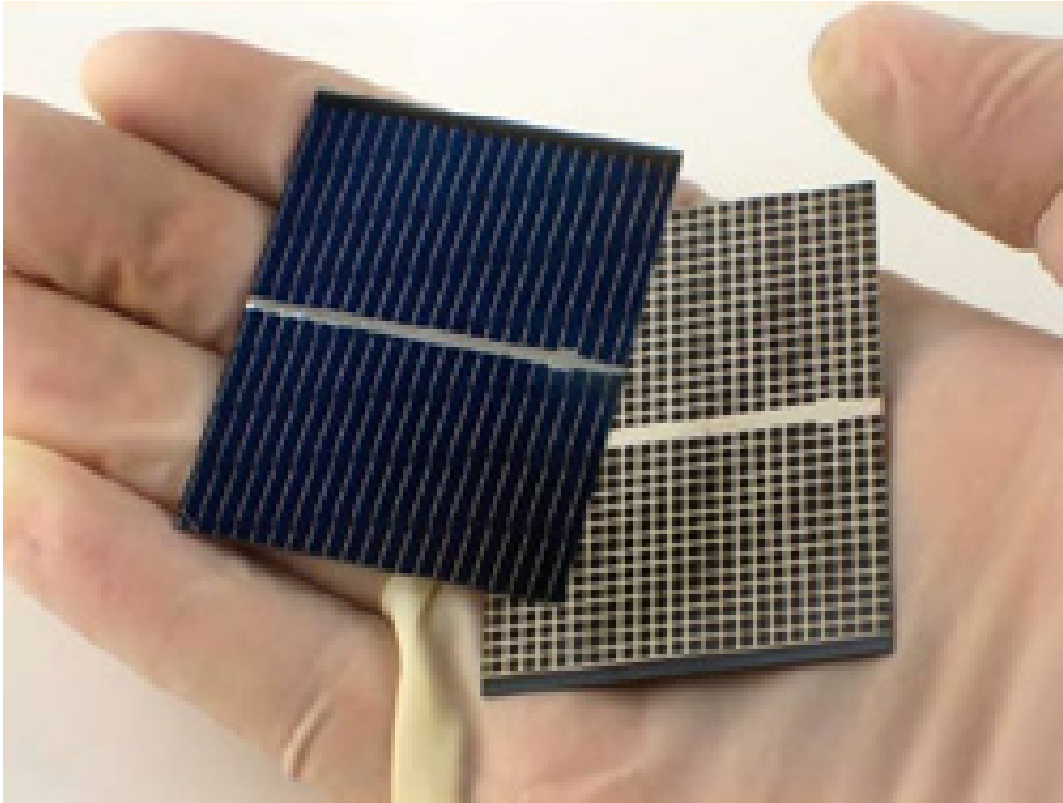
The flexibility of renewable energy installations allows for virtually any association amongst themselves, for producing electricity (wind power - solar photovoltaic, bio-gas - hydroelectric, etc), thermal (solar thermal - biomass, etc.) and even mixed thermal-electric generation (Stirling motors with Photovoltaic tracking, etc) or hot - cold (solar thermal systems with absorption machines, combinations with geothermic exploitations such as cold sources in absorption machines, reducing consumption).

Energy networks: the network concept evolves towards a system that integrates and manages generation distributed throughout the territory, with new storage technologies and new energy vectors. Technologies for self-management and self-production of demand will become the basis of the supply system and will mean a radically different concept in the management and interconnection of the energy flow networks. Each centre will have the ability to self-manage demand and cover with new technologies and accumulation systems.

Together with generation using renewable sources, resolving storage and transport of energy will become a critical point. In this regard, it is necessary to point out the advances in new technologies for storage and transport of hydrogen, which will act as a vector for the introduction of renewable energy in the energy system, by eliminating the intermittent nature inherent to these resources. At the same time, the development of emerging renewable energies will mean new opportunities for the generation of hydrogen, reaching high volumes of production.

Energy systems and technologies based on hydrogen and fuel cells will become common in applications for transport, stationary systems as well as portable applications. Hydrogen will store and transport the energy that has been previously produced in the consumption points, to later recover their energy content efficiently by using fuel cells. In this way, demands for electricity, heat and cold in different activity sectors of the activity will be met in an efficient, safe and clean manner.

The different alternatives for hydrogen production from renewable sources will be as follows: solar thermal energy will allow high temperatures and high production efficiency to be reached; photolysis based applications, using solar energy to separate water directly through photovoltaic cells, like current panels today are used to ge-



nerate electricity, production of hydrogen from wind power, biomass gasification, or technologies based on the use of biofuels, etc.

This will require significant work in R+D+i, aimed at obtaining greater efficiency in the conversion of renewable energies, in the design of electrolyzers or in the development of control electronics, among others.

The development of a proper infrastructure to produce, store and distribute hydrogen will open up new markets for its final consumption. Fuel cells will have changed their size according to their different applications, offering different solutions for a complete range of powers. Their use will extend to not only stationary applications (hot water or heating) but also for portable devices.



But the application in transport will be what will have the greatest impact on hydrogen demand. A proper fuelling network and development of fuel cells, along with the implementation of solutions to store fuel in the vehicle, will boost a high penetration of its use in the automotive industry. Other sectors such as maritime or aeronautical will benefit from these developments.

In short, technological foresight, as an indispensable tool for joint action measures, shows a whole new universe of future assets in the efficiency of energy use and the necessary push in the field of renewable technologies.

Below is a table for the positive reference trends for each of the main activity sectors of energy policy and other transversal policies, whether regarding the process of technological innovation such as the features that are demanded from this technology in the implementation of the new energy model:

Transport	<p>Prevalence of collective transport.</p> <p>Light.</p> <p>New materials.</p> <p>Highly efficient vehicles.</p> <p>Promotion of the railway for freight.</p> <p>Zero carbon emission technologies for land transport. Hydrogen (fuel cells). Biofuels.</p>
Buildings	<p>Energy efficient buildings (highest rating).</p> <p>Energy self-sufficiency using renewable resources.</p> <p>Majority use of ICT.</p> <p>Use of fuel cells.</p> <p>Individual energy management.</p> <p>Storage systems.</p>
Mobility	<p>Reduction of daily journeys (work, school, etc.).</p> <p>New structure for towns based on a smaller scale design according to daily activity (work, study, leisure, consumption...).</p>
Production	<p>More efficient technologies with a greater ability for individual management.</p> <p>Majority use of ICT.</p> <p>Training in energy use to be able to make proper decisions.</p> <p>Internalisation of energy costs.</p> <p>Maximum use of renewable resources.</p>
Agriculture	<p>Use of efficient machinery and efficient irrigation systems.</p> <p>Use of distributed low power renewable energy.</p> <p>Use of biofuels.</p> <p>Reduction in the use of fertilisers and pesticides.</p> <p>Expansion of new more energy efficient agricultural systems.</p> <p>Adequacy of the structures to the exploitations.</p> <p>Introduction of energy efficient criteria in the design and construction of livestock facilities.</p>
Electricity generation	<p>Prominence of renewable energy sources.</p> <p>Hydrogen and new energy fluids.</p> <p>Distributed generation systems.</p> <p>Distributed and interconnected storage.</p>
Energy networks	<p>New interconnection networks between the distributed centres.</p> <p>Thermal energy networks (hot-cold).</p> <p>H2 networks.</p>

Chart 2
Positive reference trends
by activity sectors of
energy policy





The trajectory of the Andalusian Energy Policy: 2003-2006 PLEAN balance

The Autonomous Community's energy policy has been created in agreement with the principles and criteria of European and national policies; promoting the diversification of safe energy sources with low carbon emissions, the decentralisation of production and greater energy efficiency.

In 2001 the wording for the Andalusian Energy Plan 2003-2006 (PLEAN 2003-2006) was agreed, which closed a cycle in which, undoubtedly, energy planning and the very creation of the Andalusian energy system achieved the rank that corresponds to an advanced society.

The PLEAN 2003-2006, besides from having just energy targets, was the first document to integrate energy policy with other horizontal policies of the Andalusian Regional Government, and also the first of its kind to be agreed under the Social Partnership agreements, specifically in the 5th Social Partnership Agreement, approved by the Governing Council and signed between the Andalusian Regional Government, the Andalusian Business Confederation and the Trade Unions.

Viewed from a broad perspective, the PLEAN 2003-2006 was a step that was necessary to take, ambitious in its approach, especially if one considers that in its planning there was no steady remuneration framework for the kWh produced under a special regime (cogeneration and renewables). Only wind power had a premium which made it profitable to promote projects.

Among the events that occurred whilst the PLEAN 2003-2006 was valid, the consolidation of a remuneration framework for both investment and production of renewable technologies, the regulatory development derived from basic energy legislation and the strong growth in energy demand in Andalusia is highlighted.

Among the Plan's achievements the significant advances in our knowledge of the energy situation in Andalusia stand out, having achieved electric self-generation and without doubt, opening up the way for the widespread implementation of technologies to harness renewable resources in the autonomous region, which has allowed aspects that are relevant to decision-making in public policy to be seen. With respect to energy saving, in



The PLEAN 2003-2006 made significant advances possible for the improvement and sustainability of the Andalusian energy system

2006, the growing trend for primary energy consumption was reduced for the first time until reaching 1.7%, although the significant economic development in Andalusia over these years has made the savings to be less than those expected.

One of the strategic objectives of PLEAN 2003-2006 was the creation of the Andalusian Energy Agency. This public entity assigned to the Ministry of Innovation, Science and Enterprise was launched in 2005 and since then has carried out the duties entrusted to it by Law 4/2003. The constitution of the Agency has strengthened and centralised the various actions in energy matters that are developed in the Community, significantly increasing the resources allocated to it. Amongst its duties are managing financial incentives to promote renewable energy, energy savings and efficiency, development of infrastructures, as well as the promotion of an energy policy in the Community.

Another of the commitments acquired in the PLEAN was the enactment of the Law to Promote Renewable Energy and Energy Savings and Efficiency in Andalusia. In 2006 the Governing Council approved its Draft bill, the stage prior to its final approval by the full Andalusian Parliament in March 2007. This law places the Autonomous Community of Andalusia at the forefront of Spain in the regulation of Renewable Energy. It sets out a primacy in renewable sources over all other sources and regulates energy savings and efficiency starting with the mandate that gives public authorities the necessary legal instruments for its promotion. As its final aim, the Law achieves a sustainable and quality energy system for Andalusia.

Together with the aforementioned, to comply with the objectives listed in PLEAN 2003-2006, a framework of financial incentives was set up. During the first two years that the Plan was in force, there were four incentive orders on energy matters⁴; which regulated the granting of incentives to promote the use of renewable resources and technologies, savings and improving energy efficiency in consumer sectors, as well as distributed generation in the Autonomous Community of Andalusia.

The approval in 2005 of the Order of 18th July meant there was an advance by joining the four previous Orders into one sole Order. Among the main new features of this Order we should highlight the discount in interest rates from bank loans as an incentive, as well as direct incentives with non-refundable funding, the introduction of electronic processing, the expansion of potential beneficiaries and the scope of projects provided with incentives, projects incorporating biomass logistic supply and a wide range of incentives for energy savings and efficiency.

4 Order of 21st January 2000, Order of 22nd June 2001, Order of 24th January 2003 and Order of 31st July 2003.

During these years, the number of projects with incentives has doubled relating to the previous calls for orders for aid in energy matters, with a total of 9,821 approved projects, since its publication until 31st December 2006.

TYPE OF PROJECT	NUMBER	IMPORTANCE	INVESTMENT (€)	INCENTIVE	AVERAGE %
1 ENERGY SAVINGS AND EFFICIENCY	412	4.2%	109,695,065	16,263,856	14.8
2 ELECTRICITY PRODUCTION UNDER SPECIAL REGIME	23	0.2%	36,490,618	11,384,628	31.2
3 RENEWABLE ENERGY	9,141	93.1%	44,323,674	15,737,578	35.5
4 BIOFUEL PRODUCTION AND PREPARATION OF SOLID FUELS	15	0.2%	280,699,896	16,315,405	5.8
5 BIOMASS LOGISTICS PROJECTS	14	0.1%	6,226,306	2,449,204	39.3
6 ENERGY TRANSPORT AND DISTRIBUTION	111	1.1%	25,931,913	7,874,360	30.4
7 AUDITS, FEASIBILITY STUDIES AND INFORMATIVE ACTIONS	105	1.1%	8,149,134	3,255,738	40.0
TOTAL	9,821	100%	511,516,606	73,280,768	14.3

The financial amount for the incentives reached 73.3 M€, of which 22.3% was aimed at projects to produce biofuels and prepare fuels derived from biomass, 22.2% to energy savings and efficiency and 21.5% to renewable energy. Electricity production under special regime took 15.5% of the total, with the rest being destined to incentives for transport and energy distribution projects, energy audits and feasibility studies and biomass logistics projects.

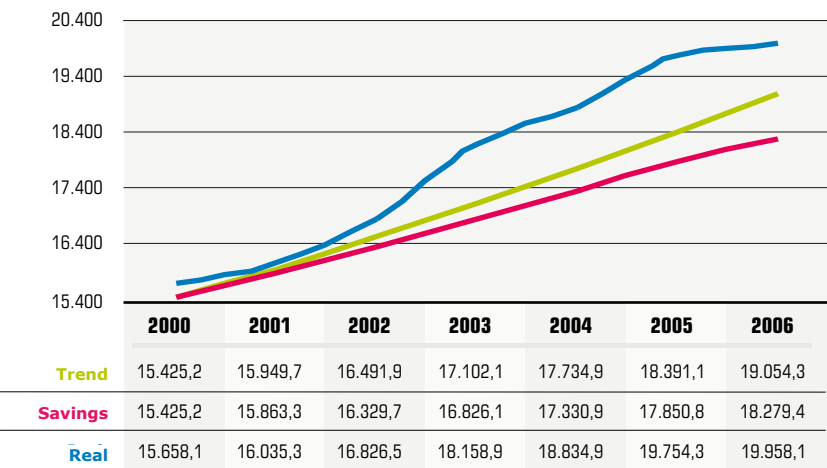
With regards to the **energy situation** analysis during PLEAN 2003-2006, the evolution of primary energy consumption in Andalusia stands out, which increased by 27.5%, four percentage points above the expected trend scenario. This difference is accentuated comparing it with the reference Plan, the savings scenario, where growths of 18.5% were suggested, 9 points below the actual evolution of the planning period.

However in 2006 the growth of primary energy consumption has been 1%, breaking the upward trend of the previous years when the average annual growth was 4.8%.

Chart 3
Projects provided with incentives through the Order of 18th July

Graph 5
Evolution of primary
energy consumption
between
2000 and 2006

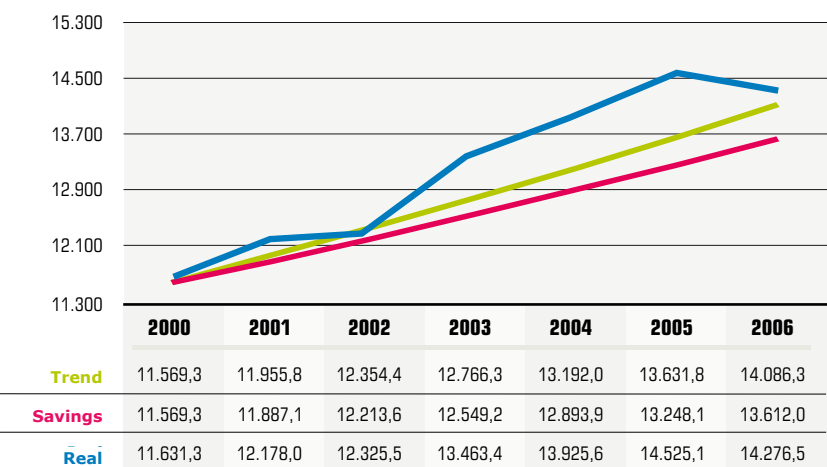
UNIT: Ktoe
SOURCE:
Andalusian Energy Agency



Likewise, the reduction in final energy⁵ consumption seen in 2006 has partly corrected the divergent trend of the previous years with respect to the reference trend, placing it at the end of the period at 1.4% above the anticipated demand for that year in the trend scenario, with an accumulated increase of 22.7% and an average annual variation rate of 3.5%.

Graph 6
Evolution of final
energy consumption
between
2000 and 2006

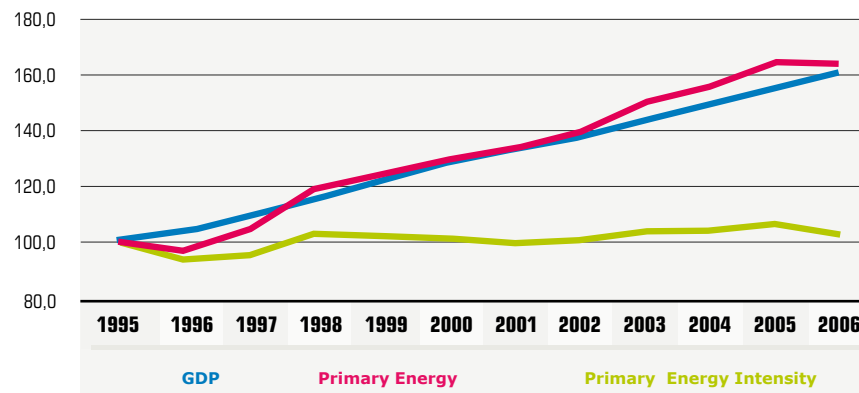
UNIT: Ktoe
SOURCE:
Andalusian Energy Agency



⁵ To calculate the evolution of the final energy consumption in the two scenarios proposed in the Andalusian Energy Plan 2003-2006 the own consumptions of the energy sector were included. According to the new adopted methodology, these consumptions are not accounted for in the final demand, and therefore the real final consumption data does not show them. The review of the data corresponding to kerosene demand in Andalusia which comes from information provided by the sources consulted (CLH and Petresa) change the energy balance listed in the Andalusian Energy Plan for the year 2000, so that primary and final energy consumptions in the real scenario differ from those collected for trend and savings scenarios for that year.



The pressure exerted by increasing energy consumption is reflected in primary energy intensity⁶, defined as the ratio of energy consumption in a territory and its Gross Domestic Product. This indicator, which is a measure of the efficiency in the use of energy to produce goods and services needed in the development process of a country or region, shows a growing evolution in the Andalusian Community, which is the same as nationally. In the European Union this indicator has been reduced to a 1% annual average.



Graph 7
Evolution of primary energy intensity in Andalusia

UNIT: Ktoe

SOURCE:
Andalusian Statistics Institute and
Andalusian Energy Agency

To achieve the framework objective set out by PLEAN, *to obtain an Andalusian energy system that is: adequate, efficient, rational, renewable, environmentally friendly and diversified*, the Plan structured the actions into four main sections: promotion of renewable energy, energy saving and efficiency, infrastructures for generation, transport and distribution of electricity, and infrastructures for gas transport and distribution.

⁶ Energy intensity can refer to primary energy, primary energy intensity, or final energy, then called final energy intensity. In turn this indicator can be calculated by distinguishing it in each of the sectors: industry, transport, residential, services, primary and the energy sector.



Promotion of renewable energy

The average contribution of renewable energy to the primary energy structure of Andalusia between 2003 and 2006 has been 6.5% more (960.3 ktoe) than that produced in the period 1995-2002.

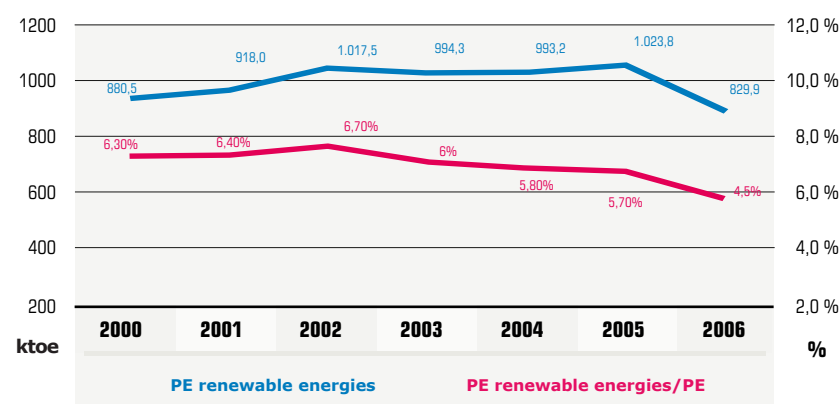
This indicator is strongly influenced with biomass exploitation for energy purposes, which during these years represents approximately 80% of the total consumption of renewable energy in Andalusia. Thus, the timing of rainfall and agricultural seasons has a major impact in this contribution, with the olive season being especially significant.

During the term of the plan, a biomass export to other European Union countries has occurred, mainly due to the existence of a remuneration framework in Spain which could not compete with the prices achieved for this fuel in other countries. This situation has been corrected due to the approval of RD 661/2007 which is an improvement in the remuneration to biomass electricity facilities with respect to the previous situation. Furthermore, the reduction in 2006 of 40% in the olive season when compared to previous years has caused a cut in the quantity of biomass (olive marc) used for energy purposes. This current question has influenced in the supply to existing installations that use this fuel, which has been reduced during this period.

The average contribution of renewable energy to the primary energy structure⁷ between 2000 and 2006 has been 5.9%, a rate that has been greatly influenced by the aforementioned strong growth in demand. The current effect of the decrease of biomass in the olive campaign placed renewable energy in 2006 at 4.5%.

Gràph 8
Evolution of consumption
and the percentage of
primary energy from
renewable sources

SOURCE:
Andalusian Energy Agency



⁷ Primary energy does not include uses that are not for energy purposes

The following chart summarizes the degree of compliance of the targets set at the beginning of the planning period and the parametric values in Andalusia, ie, installed capacity in each of the renewable technologies, except in thermal biomass and biofuels, which are measured in terms of energy, and solar thermal energy (measured in m² installed).

Renewable energy by technologies		2000	2003	2006	PLEAN Objectives	Degree of compliance of the targets / objectives	2007(d)
Hydraulic special regime	MW	83.2 (a)	101.7	129.8	107.2 (a)	121.10%	129.8
Hydraulic ordinary regime	MW	474.7	464.2	464.2	(b)	(b)	464.2
Wind power	MW	147.3	234.1	607.9	2,700.00	22.50%	1,600.0
Isolated solar photovoltaic (c)	kWp	3,391.70	4,554.30	5,779	6,076.30	95.10%	6,400.0
Connected solar photovoltaic	kWp	245.7	3,593.40	15,425.00	4,423.70	348.70%	50,000.0
Thermal solar	m2	130,552	223,696	347,182	411,552	84.40%	380,000.0
Solar thermoelectric	MW	0	0	11	100	11.00%	11.0
Biomass thermal use	ktoe	638.7	578.1	367.5	643	57.20%	600.0
Biomass for electricity generation	MW	51.3	114	164.6	164	100.40%	181.0
Biofuels consumption	ktoe	0	21	36.1	90	40.10%	50.0

Chart 4
Parametric values of the renewable energy installations in Andalusia

- (a) Power adjustments after the publication of the PLEAN have caused a change in the situation to 31-12-2000, going from 78MW to 83.2MW. Taking into account that the aim is to increase the power installed in 24MW for scope of 2006, the absolute quantities for that year have been changed together with the intermediate objectives.
- (b) The PLEAN does not cover a specific target for hydraulic power under the ordinary regime; however, the energy provided from it is added to the overall calculation of primary energy consumption from renewable sources. Does not include pumping.
- (c) Includes mixed and micro wind power.
- (d) Estimate.

SOURCE:
Andalusian Energy Agency

By technologies, the compliance of objectives regarding the contribution of renewable energy to the primary energy structure of Andalusia has been very successful in the case of biomass for electricity generation - which has exceeded the target set-, hydraulic under special regime -with a 121.1% degree of compliance-and for solar photovoltaic energy. In the latter case, the degree of compliance has been placed at 201.9%, following an exponential growth trend, nearly quadrupling the target in the case of photovoltaic installations connected to the network, and covering 95% of those of isolated photovoltaic installations.

Andalusia is the leading autonomous community for low temperature solar thermal energy, with 216,630 m² being installed since 2000, which has meant a total of 347,182 m² by 2006, with a compliance degree of the PLEAN objective of near to 85%.

With regards to thermosolar technology, the only power station that has been set up in Europe is in Andalusia. A good remuneration regime for this type of technology was set up in 2004, although the period of technological development and the building of the power



plants is wider. There are currently 11 MW in operation, approximately 190 MW in construction and a significant number of power plants planned, which makes Andalusia one of the main reference points for this technology in the world.

The biofuel sector in Andalusia is presently in a process of accelerated growth. In 2006 biofuel consumption rose to 36.1 ktoe, compared to the 90 ktoe proposed in the PLEAN for that year. However it is a sector on the increase as there is already a plant in operation, six plants in production and started up for pure biofuels and additives and another 20 plants in construction or under project development, which would mean a production of more than 3 million toe/year.

With regard to biomass, fuel transfer available at the end of the period from thermal uses to power generation plants, which as has been pointed out have exceeded targets listed in the energy plan-, and the export of biomass in recent years to other European countries, has meant that the consumption target for thermal use has been covered by 57.2%.

In wind power, after the final resolution of all ZEDEs (Special Evacuation Areas) in 2004, actions among all agents involved were coordinated so as to obtain maximum MW from wind farms installed in the shortest period possible. Currently, there is authorisation to connect a total of 3500 MW to the transport network, which means a total guarantee for their installation. Of these, nearly 1,000 MW are already in operation, another 2,000 MW in a very advanced building stage and 500 MW under development. The remainder until the global target planned in PLEAN (4,000 MW) has been reached will be the subject of a tender offer for connection points.

In Chart 4's last column, we see an estimate at the end of year 2007 with the parametric values of the different renewable energies. With this column we hope to highlight the advanced stage of development through which installation of such technologies in Andalusia have taken place, gradually approaching the compliance of the objectives set, which have suffered a temporary displacement due to various factors mentioned above, and which predict a substantial change in the contribution of renewable sources within the autonomous community.

Forecasts suggest that wind power could increase by 163% compared to the end of 2006, with the commissioning of 1,000 MW in 2007 from work that has been carried out over recent years within the procedure established by the central government, and who in this last year offered good prospects for the coming years, strengthening the route to effectively implement the objectives set out in the PLEAN.



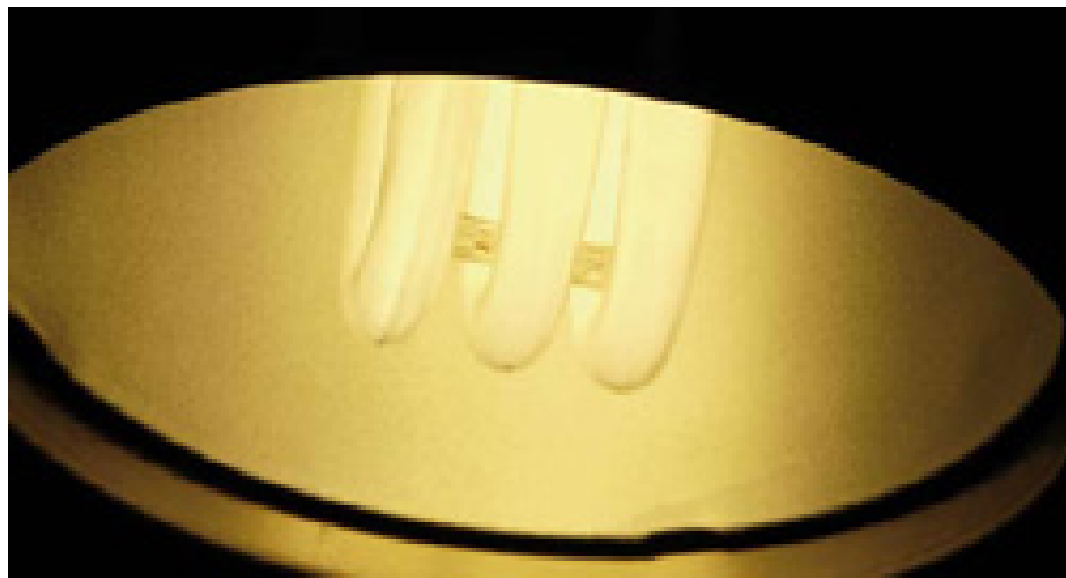
The combined contribution of all biomass to the primary energy structure would grow by 68% in 2007, a fact largely motivated by establishing a competitive remuneration structure which competes with the fuel prices paid by other countries, thus slowing export and also due to the success of the olive season, which has greatly increased the fuel available.

Solar photovoltaic would increase by 166% due to the start up of the projects built and that have obtained government authorisation in the different Andalusian provinces, whilst waiting to resolve their final connection to the network.

Therefore if the previous estimates are reached, and allocating a number of operating hours for this year according to their effective implementation, the contribution of renewable energy to the primary energy structure of the Andalusian community would be placed at 1,376 ktoe, which represents a growth of 65.8% compared to 2006 and a contribution to the primary energy matrix of 7.34%⁸, which would show the excellent behaviour of the different renewable technologies in the past year and the start of a substantial change in the participation of these sources in covering energy demand in Andalusia.

With regards to energy generated with renewable sources, this would rise to 3,436 GWh, which would represent 8% of the total electricity generated in the autonomous community.

⁸ Primary energy used in Andalusia (excluding non energy consumptions) rose in 2006 to 18,488.9 ktoe. According to the data collected from the different companies that operate in our region and supposing that the strong promotion undertaken by the Andalusian Regional Government in energy savings and efficiency gives the expected results, the consumption of primary energy in 2007 will be near to 18,750 ktoe, 1.4% higher than the figure in 2006.



Energy savings and efficiency

The significant economic growth we are experiencing in the last few years has caused an increase in the demand for energy, influencing, as mentioned earlier, the amount of savings expected. However, for the first time, during 2006 this growth trend in primary energy consumption was reduced to 1% partly due to the measures set up during 2005-2006 which have meant savings in Andalusia of 159,146 toe/year, i.e., the annual electricity consumption of nearly half a million people. Savings have been produced above all in the production sector.

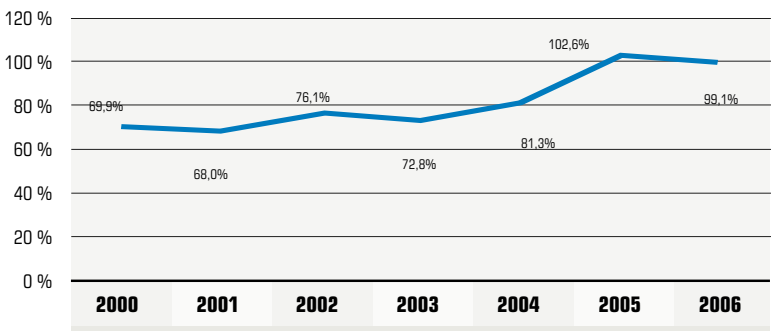
The new instruments available, such as the Order for Incentives for Sustainable Energy Development and the recent approval of the Technical Building Code and Law 2/2007, of 27th March, to promote renewable energy and energy savings and efficiency in Andalusia, which develops and widens the scope of the energy certificate not only for buildings but also for industrial installations, are going to mean important advances in the improvement of energy efficiency in the Autonomous Community.

Achieving effective energy savings targets will in the future have to be based on the specific incentives for technologies and processes. A clear example of this has been the success attained through the Order for Incentives for Sustainable Development in Andalusia, of 18th July 2005, which has incorporated as a new support line for energy savings, which to a great extent has led to the aforementioned savings.

Infrastructure for the generation, transport and distribution of electricity

The PLEAN intended to achieve at least self-generation of electricity by 2006, put the standards for quality service in Andalusia at the same level as those nationally and continue improving the infrastructure for transport and distribution of electricity, so that all the evacuation and transport of all the electricity generated could be guaranteed.

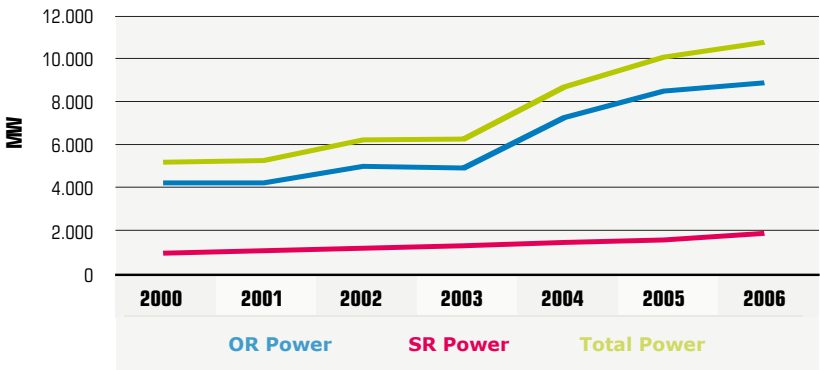
Andalusia attained electricity self-generation in 2005. The greatest generation of electricity in the Community came from the enlargement of the Andalusian generating installations with the start up of 4,790 MW combined gas cycle as well as the new wind farms and biomass plants. This meant that the Autonomous Community of Andalusia who has historically been an importer of energy now became an exporter of electricity.



Graph 9
Evolution of the level of self-generated electricity

SOURCE:
Andalusian Energy Agency

From the end of 2000, the electrical power installed in Andalusia has doubled, going from 5,183.3 MW to 10,805.7 MW. This increase has come from more efficient technologies and lower emission levels to those of the existing electrical installations at the beginning of this period.



Graph 10
Evolution of the power installed in Andalusia 2000-2006

SOURCE:
Andalusian Energy Agency

Chart 5
Data for the evolution
of the power installed in
Andalusia

SOURCE:
Andalusian Energy Agency

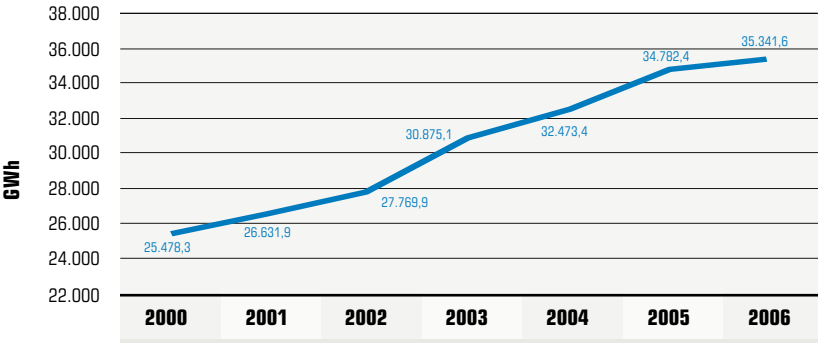
Power (MW)	2000	2001	2002	2003	2004	2005	2006
Ordinary regime	4,213.7	4,218.3	5,012.3	4,940.3	7,262.3	8,493.2	8,936.2
Special regime	969.6	1,068.2	1,201.1	1,310.9	1,443.1	1,591.0	1,869.5
Total power	5,183.3	5,286.5	6,213.4	6,254.2	8,705.4	10,084.2	10,805.7

The successive expansion of the power installed has covered the great increase in electricity demand over these last few years, a consequence of economic and social development in Andalusia. The final demand for electricity in the Autonomous Community of Andalusia has experienced continuous growth although this lessened in 2006. This growth was generalised in the different activity sectors until 2005, the consumption in the primary sector and industry, in this order decreasing in 2006. During the period assessed, accumulated growth went from 38.7%, being 1.6% during 2006 and reaching 35,341.6 GWh in the same year.

Gráph 11
Evolution of final electricity
consumption

It includes self consumption and
excludes consumption in the
transformer sector.

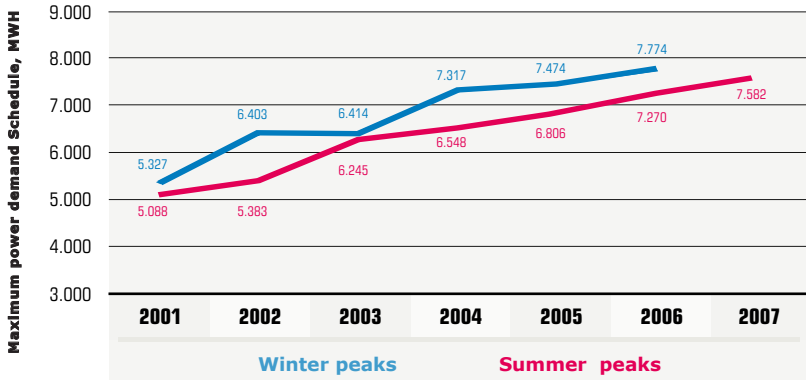
SOURCE:
Andalusian Energy Agency.



In the same way as for accumulated demand, peaks in winter and summer have shown a strong rising trend during the period the Plan has been in force.

Graph 12
Evolution of demand peaks

SOURCE:
Andalusian Energy Agency and Endesa
Distribución Eléctrica





The total length of the transport and distribution network circuits of more than 50 kV grew by 7% in the period 2003-2006, reaching 13,573 km by the end of 2006.

The table below shows the kilometres of existing transport and distribution lines by voltage steps.

	Voltage (kV)	2003 (km)	2006 (km)
Transport Network	400	1,297	1,543
	220	2,615	2,644
Distribution Network	132	2,896	2,955
	66-50	5,871	6,432
TOTAL		12,679	13,573

Chart 6
Extension of the electricity network

SOURCE:
Endesa Distribución Eléctrica and the Andalusian Energy Agency

During the period the PLEAN was in force, the transformation capacity in substations grew by 42.1%. The table below shows the existing transformation power by voltage levels.



Chart 7
Transformation capacity in
the electricity network

SOURCE:
Endesa Distribución Eléctrica and the
Andalusian Energy Agency

Voltage (kV)	Power (MVA)	
	2003	2006
400/220	6,720	9,720
400/132	180	780
HV/HV	10,607	14,249
HV/MV	10,322	14,788
TOTAL	27,829	39,537

During the period 2003-2006 the number of overland and underground medium voltage lines increased by 4.2% and 32.3% respectively. In low voltage, the stretch of overland lines increased by 3.4% and the underground lines increased by 9.2%. The power in the transformation centres increased by 16.0%.

The table below shows the parametric values of the distribution network of low and medium electricity voltage.

Chart 8
Parametric values in the
electricity network at low
and medium voltage

(1) It only includes distribution centres
with MV/LV transformation.
(2) The decrease is due to the cleaning
of the Endesa Distribución Eléctrica
database.

SOURCE:
Endesa Distribución Eléctrica.

	2003	2006
Overhead medium voltage lines (km)	35,971	37,490
Underground medium voltage lines (km)	8,028	10,625
Overhead low voltage lines (km)	51,269	53,029
Underground low voltage lines (km)	13,040	14,243
Transformer substations (No.) ⁽¹⁾	50,248	45,787 ⁽²⁾
Power of the transformer substations (MVA) ⁽¹⁾	13,813.2	16,021.2

Moreover, following incidents in electricity supply that took place in summer 2004, the Andalusian Regional Government that year set up the Coordination, Monitoring and Control of Electricity Supply Unit so as to continuously monitor electricity parameters and incidents during supply.

The quality indicators System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) have improved considerably in recent years and are in a clear convergence process towards reaching the national average.



AREA ⁹	MAXIMUM (hours) Art. 106 RD1955/2000)	SPAIN 2005	ANDALUSIA 2005	ANDALUSIA 2006	Variation Andalusia
URBAN	2	1.44	1.82	1.28	-30%
SEMI-URBAN	4	2.30	3.06	2.05	-33%
CONCENTRATED RURAL	8	3.13	5.26	4.34	-17%
DISPERSED RURAL	12	5.01	6.72	5.72	-15%

Chart 9
SAIDI evolution according
to territorial units

SOURCE:
Ministry of Industry, Tourism and Trade
and Endesa Distribución Eléctrica.

AREA	MAXIMUM (nº) Art. 106 RD1955/2000) ¹⁰	SPAIN 2005	ANDALUSIA 2005	ANDALUSIA 2006	Variation Andalusia
URBAN	4	1.76	2.58	1.79	-31%
SEMI-URBAN	6	2.62	3.68	2.73	-26%
CONCENTRATED RURAL	10	3.21	5.27	5.03	-5%
DISPERSED RURAL	15	4.31	5.68	5.23	-8%

Chart 10
SAIFI evolution according
to territorial units

SOURCE:
Ministry of Industry, Tourism and Trade
and Endesa Distribución Eléctrica.

9 Classification of the different areas:

- Urban: Municipalities with more than 20,000 supplies
- Semi-urban: Municipalities between 2,000 and 20,000 supplies
- Concentrated Rural: Municipalities between 200 and 2,000 supplies
- Dispersed rural: Municipalities with less than 200 supplies

10 The limits set out in Article 106 of the RD 1955/2000 of 1st December, to comply with zonal quality have been amended by Royal Decree 1634/2006, of 29th December, with the new values in force not being listed here.



The gas pipeline has been growing at a fast pace over the last few years

Transport infrastructures and gas distribution

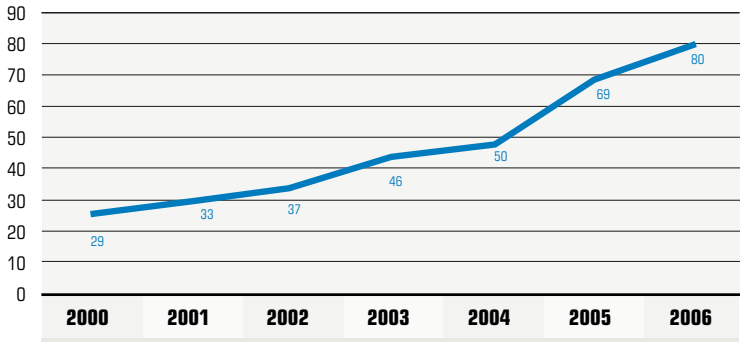
The PLEAN's objective was to be able to supply natural gas to 90% of the population that live in towns with a population of more than 20,000 and to reach the eight Andalusian provinces with piped natural gas.

The Andalusian Regional Government, aware of the advantages provided by the use of natural gas not only in the final sectors but also in electricity generation, with respect to the use of other resources such as derivatives from oil and coal, has made a great effort while the PLEAN was in force to promote the development of a natural gas transport and distribution network, with a global and integrated view of its plans, especially with Spatial Planning in the Andalusian Territory (POTA). Its main aim has been taking care of the needs of people and activity in Andalusia.

Between 2003 and 2006, there has been a lot of active involvement in planning the natural gas sector, specifically in reviewing the planning approved in 2002 and the proposals submitted to the Ministry of Industry, Tourism and Trade for the new planning, effective through to 2016, in which regional development strategies based on the same Town System envisaged in the territorial planning have been included.

The gas pipeline network has been growing at a vast rhythm over the last few years. The length of the transport network increased by 73.7% in the period for 2000-2006 and the distribution one by 114.3%, making primary and final consumption of natural gas in the Community to record a raise of 218.5% and 36.0% respectively in the period studied. This significant development has to a great extent been the reason for attaining the self-generation electricity target, where the plants of combined cycles with natural gas have played an undisputed role.

The Agreements signed between the Andalusian Regional Government and the different gas companies made the first objective possible in 2006. Taking into account all the municipalities that have gas, 105.9% of the PLEAN’s target was reached at the end of the period. Considering only the population of municipalities with a gas supply of more than 20,000 inhabitants, at the end of 2006 the population affected by the domestic-commercial distribution represented 98.1% of the PLEAN’s target.



Gràph 13
No. of municipalities with a natural gas supply for domestic and commercial use

At the end of 2006, the only Andalusian province that did not have a natural gas pipeline was Almeria. The arrival of this required the definition of the gas infrastructures associated to the international Medgaz project between Algeria and Spain, whose phase for a feasibility study has been delayed to what had originally been planned. It will be 2008 when it is thought that Almería will be integrated into the national gas system with the start up of the future gas pipelines “Almería-Chinchilla” and the Link to Lorca.

4





Energy situation in Andalusia

4.1. THE ECONOMIC-TERRITORIAL STRUCTURE OF ANDALUSIA

Energy is closely related to basic economic functions: production and consumption. In the Andalusian structure what stands out from the production point of view is the importance of services and an industry that is quite large, although it is less important in the economy than that corresponding to Spain and Europe.

Regional production shows, as a whole, increasing marginal propensity to energy consumption, expressed by an energy intensity which is below the national average, but higher growth in recent years, and slightly higher than the energy intensity of the Europe of the twenty-five. An intensive production structure of energy consumption generates greater insecurity in the structure of costs and a greater degree of vulnerability in the economy when faced with supply crisis situations.

The link between consumption and energy is enshrined through an increase in population, their asset and services acquisition level and the mobility habits which each time use more and more energy. Andalusian people's welfare levels are becoming more and more dependent on energy consumption, reproducing the patterns observed in other western countries.

In the case of Andalusia, on analysing the resident population it is necessary to incorporate another two contingents that are of great importance in the energy system's functioning: the population that lives temporarily in holiday homes and climate residents.¹¹ The incidence of these population contingencies is increasingly important in the evolution of the consequences of aggregated energy consumption.

Analysis of the production structure

Andalusia has been recording a 3% yearly economic growth over the last 20 years and a 3.6% growth over the most recent ones.

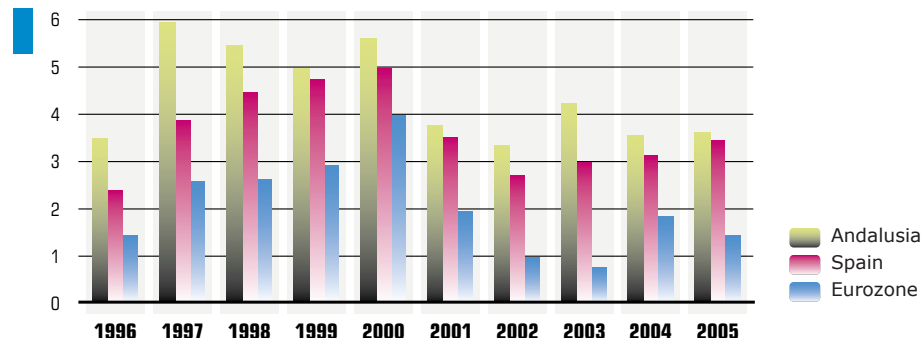
Andalusian people's welfare levels are more and more dependent on energy consumption, reproducing standards seen in other Western countries

¹¹ Climate residents.- A contingent of the population who goes to live in Andalusia during the greater part of the year without this reason being linked to a job. The main reasons are due to the climate and this is why they are so called.

Gràph 14
GDP Evolution

Inter-annual percentage variations
Chained volume index reference
2000

SOURCE:
IEA; NSI; Eurostat. Created by:
General Secretariat of Economy,
Andalusian Regional Government



During this period, family income has grown at an average rate of 7.6% per year, which means that the increase in affordable assets and services has been greater than the economic growth.

The regional GVA shows continued growth during eight years with rates higher than the national ones. Even more significant is that productivity is improving when compared to the Spanish average and the obvious productivity per employed in 2004 experienced an increase with respect to the previous year, highlighting industry as the most productive sector in the Andalusian economy.

In these good economic figures we also find the contribution from energy, whose GVA grew in 2005 around 10.0%, even though a slowdown in this rate is forecast for 2006 (3.5%). Energy consumption from industry in turn shows a moderate growth. The Andalusian industrial sectors that use the most energy in monetary value are: Different non-metallic mineral products (19.9%), metals and manufactured metal products (19.3%) and food, beverages and tobacco (13.7%). The three sectors show an increase in production over the last few years and represent 43% of the region's industrial GVA. The success rate of the industrial production in these sectors has contributed to the increase in final energy consumption in industry.

The agricultural sector is the main economic activity in 80% of the Andalusian municipalities in rural areas, occupying 53.3% of the Andalusian surface area. With an increase in the last 15 years (1990-2005) of 92.11% of production in the agricultural sector, highlighting the special relevance over these last few years of the agro-industry in the growth of the Andalusian economy.

The building sector continues being the most dynamic sector in Andalusia despite the important slow down of the growth rates, falling from 9.7% in 2001 to an anticipated



4.9% in 2006. The energy impact of this growth is mainly seen in the auxiliary industry, especially cement and brick works.

The main sector in GVA and in assets utilisation in the region is in providing commercial services, in the hotel industry, to individuals, to companies and public services. This predominance in services is part of western developed economies and has a high correlation with the welfare level linked to the high income per head.

To better understand the Andalusian production phenomena and their relationship with energy, we should differentiate the transport sector from the rest of services, and within these, single out tourism as an export activity which is submitted to different dynamics than the rest of services.

Services provide more than 50% of the regional production value. Estimates for 2006 point to an inter-annual GVA growth in this sector of 3.9%, maintaining a rising evolution trend during the last few years. Generally, the services sector is performing more favourably than in the nation as a whole, strengthening the process of outsourcing in this economy. Services, except transport, demand a reduced amount of energy compared to its production value and the demand for final energy in this sector amounts to about 10% of the total final energy demanded.

Services associated to tourism evolve with a slight increase in the production value. During the last few years we have seen a trend in a reduction in the average daily spending in the destination, at the same time as an increase in overnight stays, which results in an increase in the energy cost per unit of value produced.¹²

To complement these analyses based on the sectoral structure we must make a special reference to a phenomenon that is characteristic of Andalusia's economic-territorial structure: the significant and relative importance of the second home. Over the last few decades Andalusia has specialised in providing holiday areas with a strong residential predominance. All over the region there are individual homes which are used temporarily and urbanised areas with a large amount of homes used just for holiday periods.

In 1991 there were 773,792 second or empty homes, and in 2001 1,062,847¹³ were recorded, and currently this figure has increased to a million and a half and according

Economic growth over the last few years has meant an increase in energy demand

¹² Source: Ministry of Tourism, Trade and Sport / Tourism Indicators / Hotel Movement NSI.

¹³ Source: Population and Housing Census 1991 and 2001 - NSI



to the Ministry of Development, around 363,000 new homes have been built between 2002 and 2005¹⁴ in Andalusia. The majority of these homes are found on the coast. The energy consumption pattern of these homes has a strong impact on the increase of the power installed and the appearance of demand peaks in the summer, as they are used for just a few days in the year, but during these days they are used to the limit of their capacity.

For the energy system, the existence of this large accommodation capacity has destabilizing consequences. Holiday homes are unoccupied during most of the year and they record intense activity in the summer that is not just limited to energy demand in the residential sector, because in areas where this occurs energy demand for public and private services also takes off at the same time. If we take in account all the energy consumption associated to this phenomenon (domestic consumption, associated public and private services and private mobility), for the current installations of these holiday homes we can estimate a final demand that is near to 700 ktoe per year, a figure that represents nearly half of the Andalusian primary energy production (renewables, coal and gas).

¹⁴ Source: Building Construction Statistics (municipal licences for sites) Directorate General of Economic Planning. Ministry of Development.



Transport represents 12% of the production value in services and 6% of the regional production, however it is one of the main components of regional energy consumption, contributing to more than a third of the final energy demanded. Its production behaviour over the last five years has been characterised by growth that has been maintained above 5% per year.

The most prominent structural feature is the modal distribution of freight transport, with a strong predominance of road transport and the constant reduction over years in public transport being used for passenger mobility. Both factors have a clear impact in the increase in intense energy consumption to satisfy the basic transport needs: distribution of goods and urban mobility. The use of other modes of transport for goods different to road (rail and sea), and greater penetration of public transport in urban mobility in similar proportions to those registered twenty years ago, would have very positive effects in the reduction of consumption from oil derivatives.

Population, welfare and consumption

At the time this is posted, the region counts on a population of about eight million people, with an average annual increase of 0.77%, but with significantly higher numbers in recent years (1.4%) due to labour and climate migration, who are gradually registering themselves on council records. The rise in demographic growth is in fact more closely related to the 420,000 foreigners in the census than with the endogenous vegetative growth. We should add at least another 500,000 people to these figures, as they are those who live permanently in Andalusia but are not on the census. These flows, both through the entry of labour immigrants as well as those due to climate, show an upward trend (the foreign population registered between 2000 and 2005 has doubled) and will be maintained over the coming years.¹⁵

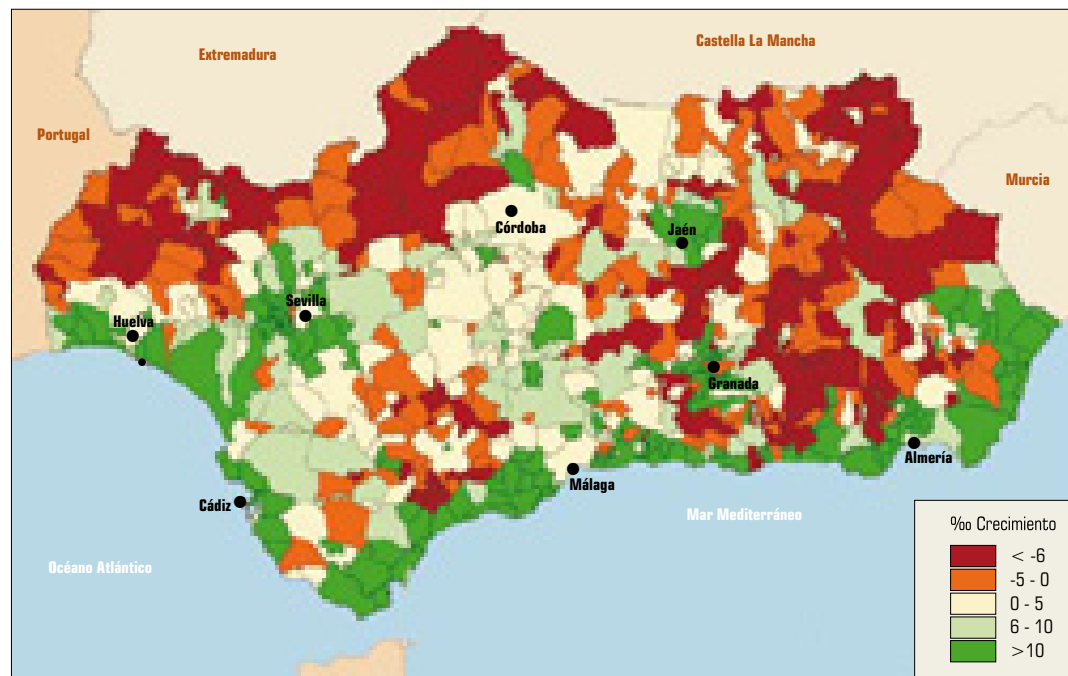
It is clear that the increase of climate immigration, and its associated demand for housing, has a direct effect on the construction and employment in this sector, on auxiliary industry (industrial sector with a high energy consumption per unit of production) and on labour immigration and that this later means a higher consumption in domestic energy, consumption of public and private services and in consumption from cars. If energy demand associated to a main home (domestic, services and cars) is estimated at 1.78 toe/year, in the case of those for climate this can go up to 4.48 toe/year due to their higher income level with more appliances and habits that use more energy.

The increase in population, whether fixed or seasonal, and changes in consumer habits are important factors in energy planning

¹⁵ Source: Population and Housing Census 2001 and Council Register 2006

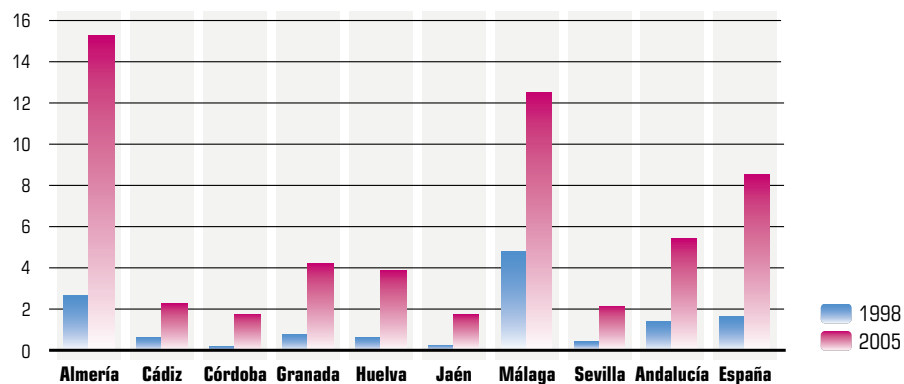
Chart 11
Demographic growth rate
1996-2002

SOURCE:
Second Andalusian Territorial
Development Report



Graph 15
Percentage of foreign
population over the total
population in each area

SOURCE:
Andalusian Economic Report 2005.
Ministry of Economy and Finance



In the region's evolution and its basic energy requirements concerning consumption, demographic factors, consumption patterns and transportation demand are mainly affected. Together with demographic growth as a result of immigrants, it is necessary to highlight the greater consumption tendency for goods and services and a greater energy consumption in homes, equipped with more appliances and with low energy saving ways. The increase in the consumption of goods and the greater production complexity of the western economy results in an increase in freight transport by road, with a higher energy



cost and in distribution and commercial services. Furthermore we see a sharp increase in mobility, which to a large extent is met through the use of private vehicles, with a high energy cost per trip.

According to the latest figures, the spending on electricity, gas and other fuels is 3% of the total expenditure of Spanish families. This figure is not perceived as a strict constraint on household budgets and the energy dimension is not present in spending decisions and consumption. Another factor which is occurring very significantly in the energy consumption of homes is the change of climate comfort standards, evolving in Andalusian society towards generalised HVAC behaviour as an expression of welfare. This pattern was seen two decades ago in the warm weather areas of the United States and is being implemented in European Mediterranean countries.

Increased energy consumption recorded in parallel to an increase income is also observed when comparing the Andalusian average consumption to the consumption of climate immigrants and holiday residents, who, with a greater average family income than the Andalusian population group, show a greater energy consumption per capita in both domestic and automotive demand.

The exponential increase in mobility with private vehicles is another of the biggest elements for Andalusian energy demand. Currently there is a figure of more than four and





The Spatial Planning Plan
for the Andalusian Territory
(POTA) sets out
the Andalusian Sustainable
Energy Plan as its own
instrument

a half million vehicles in circulation (the fleet is growing by 5.2% per year), and vehicle registration is near to 260,000 per year over the last few years¹⁶. These figures undoubtedly explain part of the spectacular increase of the consumption of diesel for cars (40% between 2000 and 2004) and the increase in fuel consumption for cars which is over 7% in the last three years. Despite these increases, the levels of motoring for the Andalusian people is still less than in other European regions, which is why we should not rule out the absolute and relative increase of the amount of cars and its effect which leads to an increase in mobility.

The Andalusian Motorization Index¹⁷ was 378 in 2001 and although it has been rising steadily, remains below the national average values for the same year (441) and from those in the vast majority of European countries (Germany -521, Italy -563, France-463). In 2005 the regional Motorization Index went up to 422 and in Spain to 459, which shows that over these past four years it has increased more quickly in Andalusia than in Spain, at 2.9% per year in the Autonomous Community compared to 1% nationally.¹⁸

The combined effect of energy consumption in homes, the impact of public and private services and car consumption explains, to a great extent, the Andalusian energy demand which is responsible in large part for the accelerated growth of the last few years.

Territorial dimension of energy consumption

In an overview of the region's main issues of spatial planning and economic development, urban development, water management and mobility appear in first place and the three issues are directly related to the availability and use of energy. Mobility and its energy impact on the system have been dealt with in a previous section on production structure.

Spatial Planning in the Andalusia Territory (POTA) states that the Andalusian Sustainable Energy Plan is an instrument of the Plan itself, given the impact of the energy system in the configuration of the territorial structure. On the other hand, POTA has many references in its articles on energy issues that have been taken into account when creating this Plan.

Given the impact on energy demand and therefore on energy planning, of the strategies and objectives set out in spatial planning, we set out a brief analysis of the territorial dimension of energy consumption below.

¹⁶ Source: SIMA. IEA

¹⁷ Motorisation Index = No. cars/1,000 inhabitants

¹⁸ Source SIMA. IEA



Urban development

The analysis above highlights two major economic and territorial phenomena (residential growth and industrial development) that make up the major issues to be highlighted right now and in the coming years in Andalusia. Of the two, however, it is necessary to point out the importance of urban growth due to its multiplying effects on other consumer sectors such as private services, public urban services and transport.

The urban growth that is being recorded in Andalusia is mainly of a residential nature. The rising dynamics of property development in recent years does not show indications of slowing down, as the majority of councils on the coast and built up urban areas are reviewing their urban planning so that they can include the extraordinary growth into areas of building land. Urban growth is responsible for the demand in housing, pushed by various factors: the acquisition of holiday homes and homes for climate immigrants-residents, the reduction in the number of homes built according to surface area (from 2.44 homes per thousand square metres in 1991 to 2.14 homes/m² in 2003), the new housing requirements for labour immigrants and the investment from families in unoccupied homes.

In 2001 3.5 million homes were registered in the region (2.8 in 1991).¹⁹ These homes are mainly found on the coast and in the built up areas of Sevilla, Granada and Córdoba. As a consequence of these, the surface area built on in the region grows at 4% per year. It is not only domestic energy demand, transport and services that increase with the expansion in areas of building land, but we also have to take into account the energy consumption of urban public services, above 100 ktoe/year. Amongst these we must highlight to date, public lighting (around 70% of council costs), water and waste treatment and consumption in public buildings. However, in the near future consumption from the desalination of water to supply housing, pools and water gardens and golf courses will play a very important role.

In the current housing stock, of course, we have the main housing group of registered households (about two-thirds of the total). However the most highlighted characteristic of the regional housing stock is the large amount of holiday homes that have highly concentrated usage patterns (summer) and in the area (coast), an issue that has already been mentioned in the section on the production sector. These holiday areas generate situations that have very low social and territorial profitability with regards to the energy installations and the system's capacity which is maintained idle for most of the year.

¹⁹ Ministry of Development.

The built-up surface area in the region is growing at a compound yearly rate of 4%



On the coast and in built up urban areas the total housing stock is quickly increasing due to the high rate of property developments. A part of this promotion is related to opportunity factors and is oriented at satisfying basic needs and families investing their savings. But most of the promotion being studied (especially on the coast) and an increasing part of the completed housing is due to the market of climate residents.

As a consequence of urban growth, the municipalities have experienced continuous development over the last few years, based on the expansion and creation of new council services, which is inducing a consolidated upward trend in the energy consumption of municipal facilities, whether these be public lighting, for pumps, offices or services in general, which is causing an increase in energy bills for the Andalusian town/city halls.

On the other hand we must also take into account that the changeability of the weather in Andalusia has a direct impact on energy demand in the residential sector and on services. Changes in weather mean that the energy demand needed to meet the requirements for HVAC and to produce hot water can vary tremendously throughout the Community. This influence is reflected in a territorial segregation where we can identify areas of high



energy consumption as a result of climatic harshness (inland areas) and other areas with reduced consumption due to the mild climate (coastal).

In fact the new Technical Building Code in its basic document HE1 "Limiting Energy Demand", sets out a series of thermal insulation demands according to the so called climate area (in Andalusia there are five and in the rest of the country there are twelve).

Water management

The management of water, a scarce resource in our region, is also related to urban development, reaching saturation levels on the coast and there is a predictable energy and environmental infeasibility of many operations in the pipeline.

The management of water resources has become critical given that it is being submitted to an increasing shortage scenario and multiple areas of the region have reached the strict limit of its use. The problem lies mainly on the coast, not only due to agricultural use but also in urban areas and for their planned growth or that which is under study. A solution to this difficult problem of economic and territorial feasibility is the desalination of sea water or brackish waters. This solution transfers the problem of water scarcity to the energy system, putting more pressure on its difficult balance which follows European, national and regional policies.

Although water demand at a European level is a lot greater than that of the Andalusian Community, we are seeing a certain convergence of the continuous increase for demand in our region. Water scarcity in Andalusia obliges us to use very costly methods from an energy point of view such as desalination which is about 4.0 kWh/m³ ²⁰. In this context, water demand need for golf courses and large property developments and obtained from desalination becomes an energy problem whose magnitude we see if we take into account that to obtain water to alleviate the current water deficit in Andalusia through desalination would mean an additional consumption of 300 ktoe/year of primary energy.

Water and energy are limiting factors for urban growth

²⁰ Source: Ministry of the Environment 2004 Technical Advances in Water Desalination.

4.2. THE ANDALUSIAN ENERGY SCENARIO

Despite the growth shown by the main energy indicators in Andalusia being greater than the national and European Community average, these are still below the values.²¹

Chart 12
Energy indicators 2006

	Andalusia	Spain	European Union - 25
Increase in primary energy consumption since 1995 (%)	65.0	48.3	10.6
Primary Energy Intensity (toe/MC cte. 2000)	185	188	180
Primary energy consumption per capita (toe/inhabitant)	2.5	3.2	3.8
Final energy consumption per capita (toe/inhabitant)	1.8	2.3	2.5

Regarding the structure of primary energy consumption by sources in Andalusia in 2006 the following aspects are included:

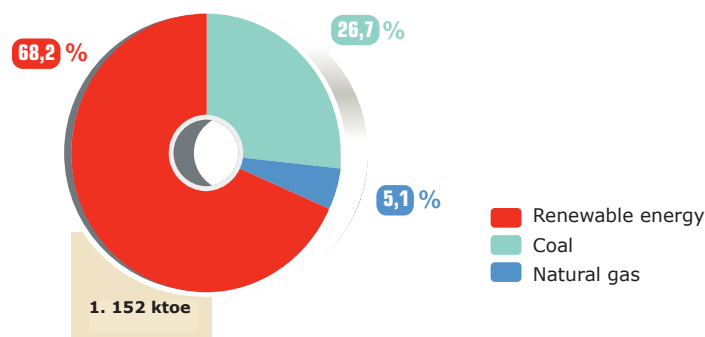
- The energy supply model for the Andalusian economy continues being closely linked to fossil fuels, mainly oil and its derivatives. The percentage of primary energy consumption corresponding to this source reached 50.4% in 2006.
- The changes produced in Andalusian electricity generating installations directed from the growing involvement of natural gas generation has made this energy source take second place in the Andalusian primary energy structure, covering 31.3%.
- Coal has gone to covering 14% of the energy consumed in Andalusia.
- Energy that comes from renewable sources provided 4.5% of the Andalusian Community's total consumption once non energy uses have been excluded.

Andalusia has a high dependence on foreign energy as over 90% of the primary energy consumed comes from imports. In 2006 the energy consumption that came from native sources was 1,152 ktoe, taking into account the total primary energy consumption for this year, the degree of self-supplied energy in Andalusia reached 5.8%.

²¹Data referring to 2006 for Andalusia and Spain and to 2004 for the European Union Source: Eurostat, Directorate General for Energy Policy and Mines (Ministry of Industry, Tourism and Trade) and Andalusian Energy Agency. To calculate primary energy intensity renewable energy sources are included.



Production that came from renewable energy sources represents a very high percentage of the total production destined for consumption in the Community, 68% in 2006.



Graph 16
Production structure
for domestic energy
consumption in Andalusia
in 2006

SOURCE:
Andalusian Energy Agency.

In terms of final energy in the energy sources structure, the following aspects are included:

- The same as in primary energy, the Autonomous Community continues depending on a very high percentage of oil derivatives, 62.4%.
- The development of the transport and natural gas distribution network in Andalusia has made this source of energy sources accessible to a major part of the Andalusian population and industry, reaching a percentage in the final consumption structure of near to 12.7%.
- Another important fact, and one that coincides with greater economic and social development in Andalusia, is the greater consumption of electricity. After oil products it holds an important position in the final consumption structure in the Andalusian Community, with a relative importance of 21.3%.

To summarise, the current Andalusian energy scenario is characterised by certain relevant aspects:

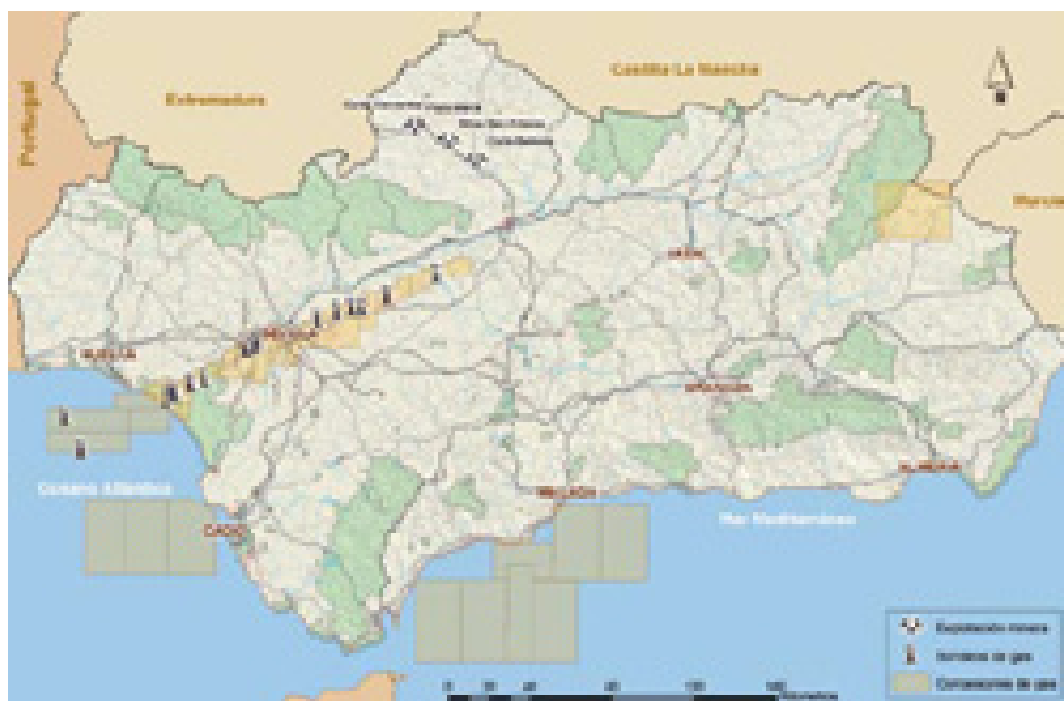
- an energy consumption that increases above the Andalusian GDP, which means an increase in consumption to produce the same;

- an energy supply structure that is closely linked to fossil fuels;
- consequently there is a very high energy dependency from abroad;
- an electricity generation mix, based nearly completely, on coal;
- a high increase in the consumption of electricity that has been covered by the generation of gas combined cycles;
- as well as, production using renewable energy which in 2006 represented 68% of the total autochthonous energy production aimed at consumption in the Autonomous Community.

4.2.1. ENERGY RESOURCES IN THE REGION

Andalusia has energy resources amongst which we do not find oil, on which it is strongly dependent on. Coal production from the mining areas of the Valle del Guadiato, natural gas extraction from deposits in the Gulf of Cadiz and Valle del Guadalquivir, together with the exploitation of renewable resources above all, constitute the region's energy potentials.

Chart 13
Gas and coal exploitations



SOURCE:
Andalusian Energy Agency.



Non renewable resources

Andalusia has five natural gas deposits: El Romeral, El Ruedo and Las Barreras, located in the province of Sevilla, Poseidón in the Gulf of Cádiz and Marismas, located between the provinces of Huelva and Sevilla, and since 2005 has been used as underground storage.

With reference to coal, there are four coalfields in the Andalusian Community in the Valle del Guadiato, in the province of Córdoba: Corta Cervantes, Pozo María, Corta Ballesta and San Antonio.

Renewable resources

The abundance of autochthonous renewable resources in the Autonomous Community of Andalusia is allowing, through active policies, that energy generation from these resources be maintained at a high level in the region, even though the margin for growth is still vast.

- **Biomass.** The total potential for biomass in Andalusia stands at 3,327 ktce/year, distributed amongst agricultural residues (43%), energy crops (17%), forest residues (4%) and industrial residues (18%), of which approximately 30% are used.

Andalusia has a great potential to exploit renewable energy sources

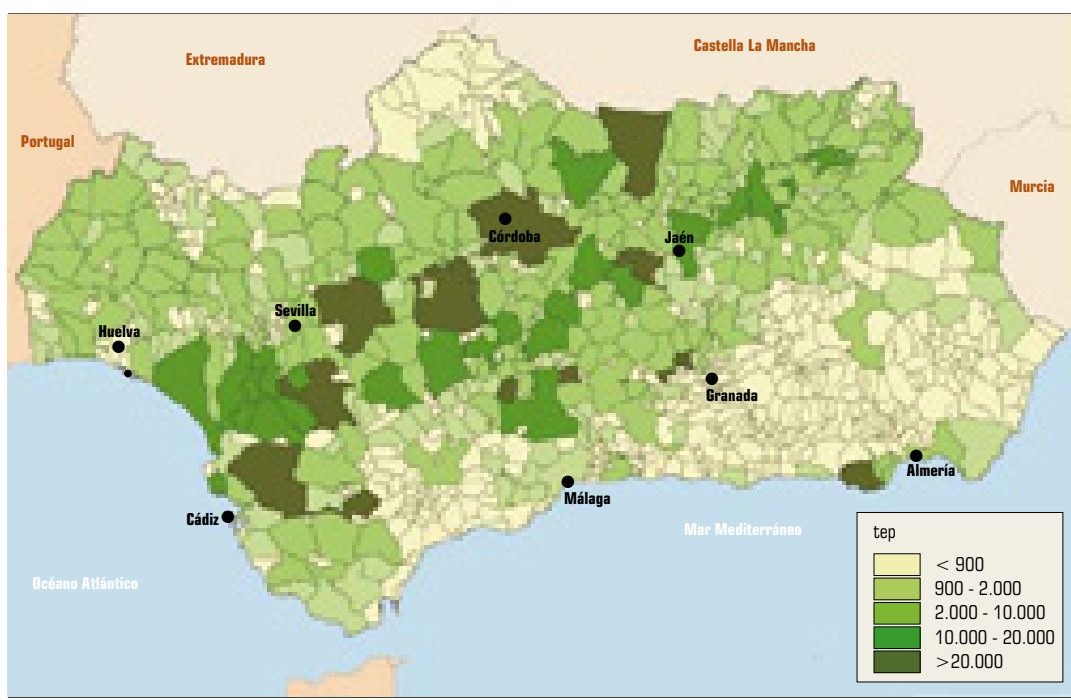


Chart 14
Distribution of usable biomass potential in Andalusia

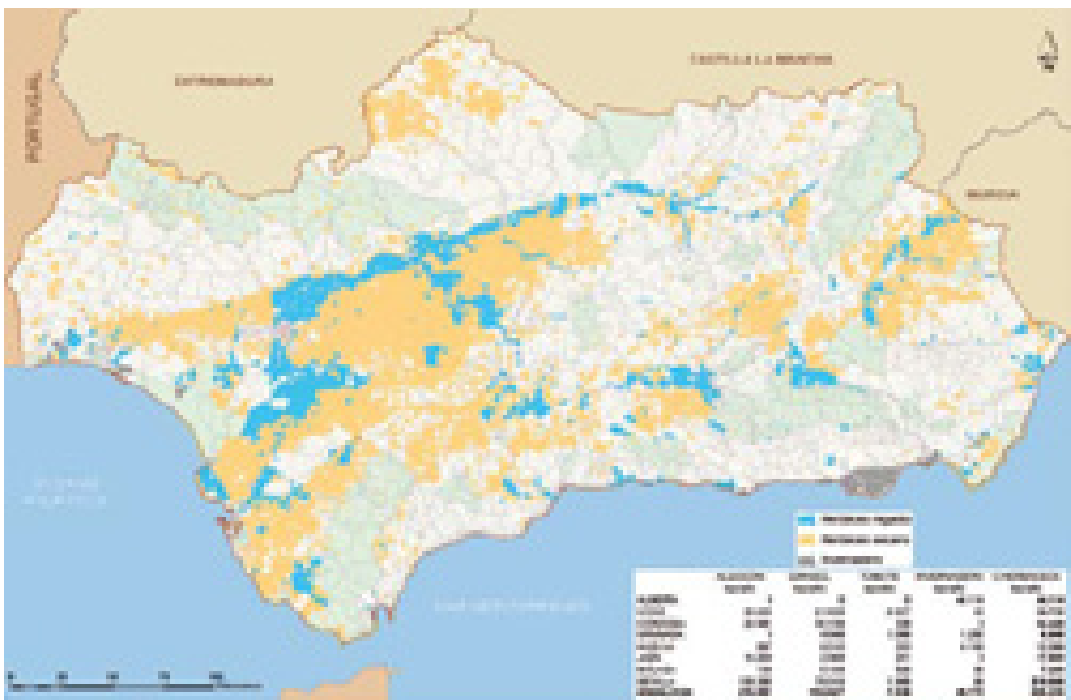
SOURCE:
Andalusian Energy Agency.



- **Biogas.** Obtaining methane from organic residue is a technology little used in Andalusia. The sectors in which obtaining biogas is most used is in plants for urban waste water, solid urban residue plants and industrial installations. The potential of biogas energy use is vast.
- **Biofuels.** The production of biofuels is determined by the availability of raw materials for their manufacturing and the existing consumption of these. Andalusia has a very significant agricultural surface area which could provide the raw materials (seed oil) needed to manufacture biodeisel in the community. To this we should add the research that is being carried out to incorporate new crops which are suitable to obtain oil, with a greater performance than traditional ones, which could to a great extent lead to a more efficient exploitation of the agricultural surface area.

Without a doubt, the great challenge is the development of second generation biofuels, which would allow the use of raw materials from different types of biomass, and it is here where Andalusia has a very high potential to supply its industry with biofuels.

Chart 15
Distribution of arable crops
and potential



SOURCE:
Andalusian Energy Agency.



- **Wind power.** Due to the region's great expanse and its geographic location, wind power resources in Andalusia are a renewable resource with very high potential. The exploitations are located in the so called "wind power basins": Campillos, Medina, Bajo Guadalquivir, Tahivilla, North Huelva, South Huelva, East Andalucía, Algeciras, Tarifa, Vejer, Sierra Carchuna, Sierra de Aguas, South Sierra Nevada, Marquesado de Zenete and Serranía de Baza.
- **Hydraulic power.** The future development of hydroelectric energy is conditioned and limited to the exploitation of the scarce hydraulic infrastructures that exist and are being planned, and the exploitation of the highest flows in areas with little or no agricultural use. Of the gross hydroelectric potential existing in the basin of Guadalquivir, only 14% can be technically developed. Taking into account that there are other non technical restrictions, the margin for growth is limited. However there is potential for mini and micro type hydraulic exploitations.
- **Solar energy.** Andalusia has a privileged position regarding the solar resource, with an average solar radiation of 4.75 kWh/m² per day.

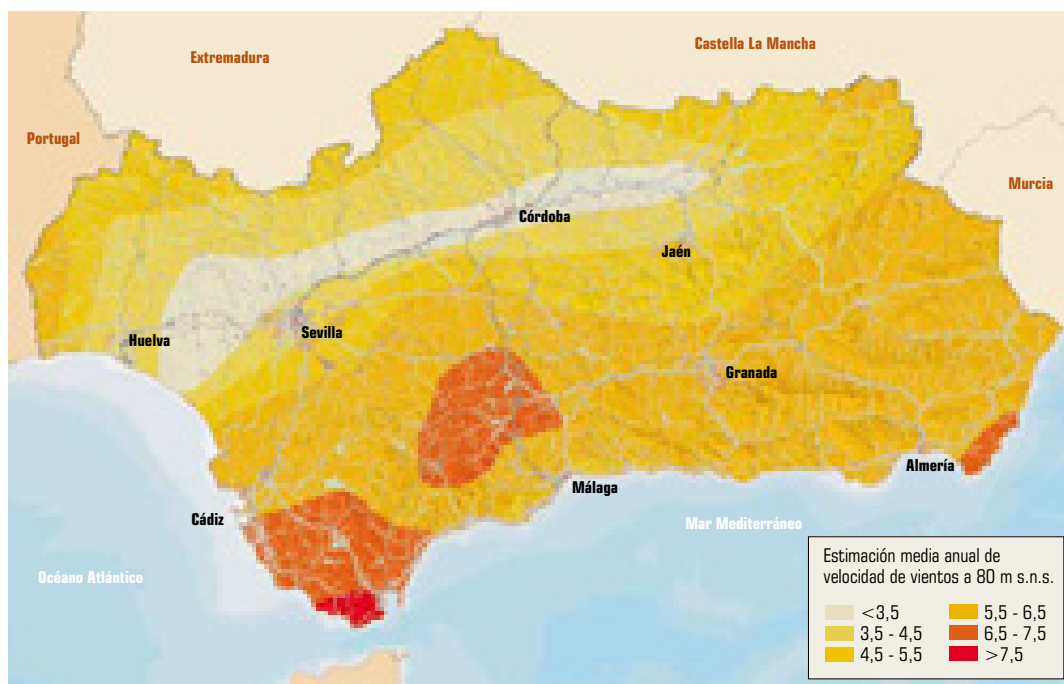
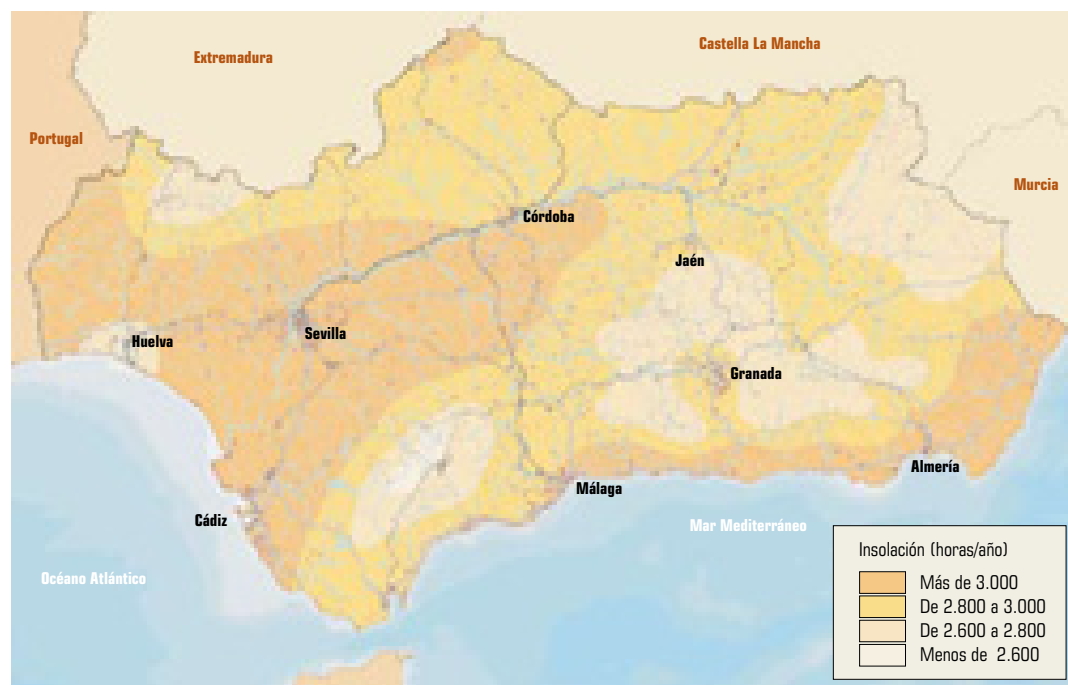


Chart 16
Wind power resources in Andalusia

SOURCE:
Andalusian Energy Agency.

Graph 17
Solar Insolation Map of Andalusia

SOURCE:
Andalusian Energy Agency.



This, together with the vast expanse which occupies, 87,597 km², makes Andalusia the Spanish region with the greatest solar potential. Stressing therefore both its high potential for solar thermal energy to obtain thermal energy, as well as solar photovoltaic for electricity production.

Solar energy is becoming more and more relevant in Andalusia every day, with regards to its contribution in supplying energy to the community. With this, it is necessary to point out the contribution from the photovoltaic power plants connected to the network, a vast potential of this same technology on urban land and the installation of commercial thermosolar power stations, which in Andalusia have an important solar resource and an orography that to a great extent allows their implementation.

4.2.2. Energy infrastructures

Electricity infrastructure

Andalusia basically has three north-south transport lines: Pinar del Rey-Guillena, Tajo de la Encantada-Guadame and Litoral-Rocamora, linked in the south by a horizontal line, that starts on the Coast and ends in Pinar del Rey, and that goes through the substations of Caparacena and Tajo de la Encantada. The link points of the vertical and horizontal



Chart 18
Electrical transport and
distribution network

SOURCE:
Spanish Electricity Network (Red
Eléctrica de España) and Endesa
Distribución Eléctrica

tracks coincide with three of the production centres with the most important power production, Algeciras, Tajo de la Encantada and Carboneras.

Additionally a double circuit of 400 kW has been set up in Guillena to Huelva (SET Palos), whose main task is to evacuate power installed in the Huelva province.

As international connections, Andalusia has two underwater cables of 400kW that join the Terminal Stations of Tarifa and Fardioua in Morocco.

By the end of 2006, Andalusia had a total of 1,543 km of 400 kV line and a total of 2,644 km of 220 kV line, managed by the operator of the Electricity System, Spanish Electricity Network (Red Eléctrica de España). With regards to the transformation power installed at the substations, at the end of 2006 Andalusia had a power of 9,720 MVA in 400/220 kV and 780 MVA in 400/132 kV.

In the HV distribution network at the end of 2006 it had 2,955 km of 132 kV and 6,432 km of 66-50 kV, with the HV/HV transformation capacity being 14,249 MVA and HV/MV of 14,788 MVA (not covering transformer with a primary at 400 kW).

Chart 19
Length of lines and
transformation power

With regards to the MV network the total length of overground lines at the end of 2006 was 37,490 km and underground lines was 10,625 km. With respect to LV, the total over-ground length was 53,029 km and underground lines were 14,243 km. The power in the transformation centres reached 16,021 MVA.

In the tables below we summarise the lengths of the lines and transformation power co-responding to the distribution network of Andalusia.

Voltage (kV)	Lines (km) 2006	Voltage (kV)	Transformation at substations (MVA)
132	2,955	HV/HV	14,249
66-50	6,432	HV/MV	14,788
Medium voltage lines (km in 2006)		Overground	37,490
		Underground	10,625
		Total	48,115
Low voltage lines (km in 2006)		Overground	53,029
		Underground	14,243
		Total	67,272
Transformation centres (No.)			45,787
Power of the transformer substations (MVA)			16,021

SOURCE:
Endesa Distribución Eléctrica

Electricity generation has experienced a great change all over Spain since the liberali-sation of the market in 1997. This change has been especially important in Andalusia, where the current generation scenario, both under the Ordinary Regime as well as under the Special Regime is substantially different to the previous one before this framework.

At the end of 2006, Andalusia counted on a generator park of 10,805.7 MW. The power under the Ordinary Regime being 8,936.2 MW. The Combined Cycle Power Plants for natural gas (CTCC) have become the most important technology (11 groups in 5 power plants - 4,790 MW) displacing those of coal, which historically has been the basis for generation in Andalusia, to second place (4 groups in 3 power plants - 2,051 MW). The power in hydraulic plants under this same regime reaches 1,034.2 MW of which 570 MW correspond to pumping power plants. The list of generation parks under the Ordinary Regime are rounded off with the two Fuel-Gas power plants that add up to a power of 1,061 MW.

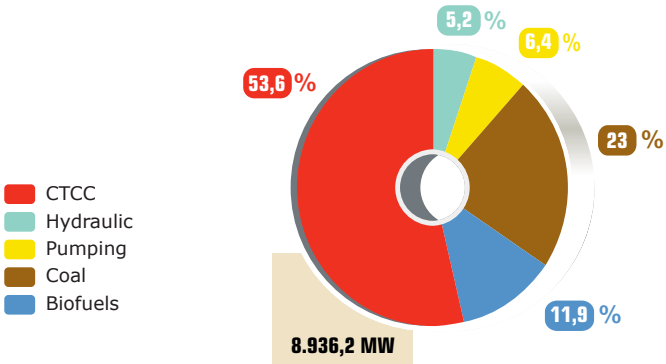


Technology	Power plant	Fuel	Province	Number of Groups	Power (MW)
Coal	Almería coast	Imported coal	Almería	2	1,159
	Los Barrios	Imported coal	Cádiz	1	568
	Puente Nuevo	National coal	Córdoba	1	324
	Total Coal				2,051
Fuel Gas	Bahía de Algeciras	Fuel-gas	Cádiz	2	753
	Cristóbal Colón	Fuel-gas	Huelva	2	308
	Total Fuel-Gas				1,061
Combined Cycle	San Roque	Natural Gas	Cádiz	2	797
	Campo de Gibraltar	Natural Gas	Cádiz	2	781
	Palos de la Frontera	Natural Gas	Huelva	3	1,195
	Arcos de la Frontera	Natural Gas	Cádiz	4	1,619
	Colón	Natural Gas	Huelva	1	398
	Total Combined Cycle				4,790
Pumping	Guillena	Pumping Power Plant	Sevilla	3	210
	Tajo de la Encantada	Pumping Power Plant	Málaga	4	360
	Total Pumping				570
Hydraulic	Non Pumping Hydraulic				464.2
	Total Non Pumping Hydraulic				464.2
	TOTAL				8,936.2

Chart 20
Electricity generating installations under the Ordinary Regime in Andalusia

SOURCE:
Andalusian Energy Agency.

The following graph shows a percentage representation of the power installed under the Ordinary Regime by technologies:



Graph 17
Power installed under Ordinary Regime by technology 2006

SOURCE:
Andalusian Energy Agency.

The geographic location of the installations found under the Ordinary Regime in Andalusia is shown on the following map:



Chart 21
Ordinary Regime
Power plants

SOURCE:
Andalusian Energy Agency.



Chart 22
Special Regime
Power plants

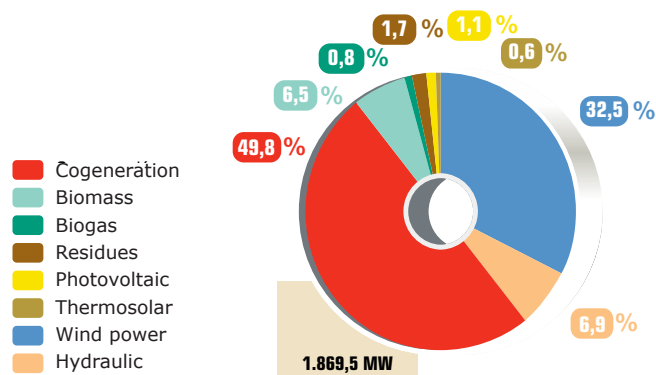
SOURCE:
Andalusian Energy Agency.





Whilst the power installed under the Ordinary Regime is very localised and concentrated into certain areas of the Andalusian geography, the distributed character of the generation under the Special Regime converts it into a territorial growth catalyst to promote a homogeneous electricity system in the territory.

Generation under the Special Regime at the end of 2006 reached an installed power of 1,869.5 MW. Of this power we should point out co-generation (931.3 MW) and wind power energy, which is the most important among the renewables under this generating Regime (607.9 MW). The distribution of power by technologies at the end of 2006 was the following:

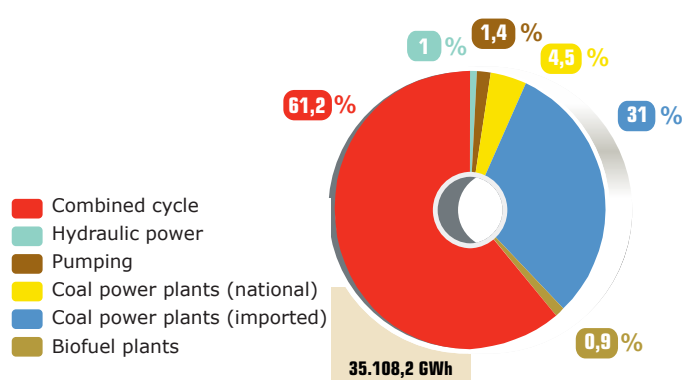


Graph 18
Share of power installed by technology under Special Regime 2006

SOURCE:
Andalusian Energy Agency.

With regards to electricity generation in Andalusia, at the end of 2006 gross production rose to 41,417.9 GWh; 84.8% of which originated from the Ordinary Regime generation and the rest, i.e., 15.2% was provided by the Special Regime.

The breakdown by production technology from the Ordinary Regime is shown on the following graph where the importance of the natural gas power plants, followed by the coal ones, can be observed.



Graph 19
Gross production under Ordinary Regime 2006

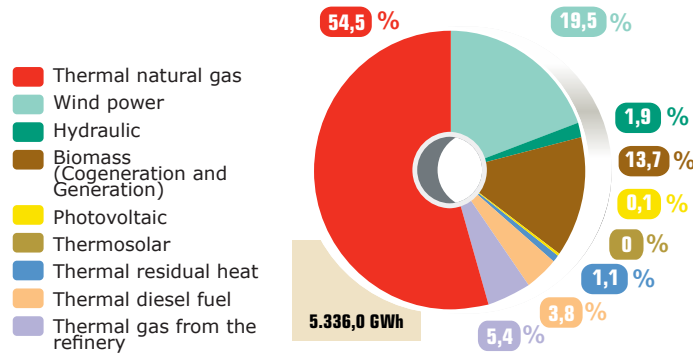
SOURCE:
Andalusian Energy Agency.

With relation to the Special Regime, at the end of 2006, the energy provided by this regime rose to 5,336.0 GWh. Adding generation consumptions, self-consumptions and the isolated photovoltaic solar energy to this amount, a gross production of 6,309.7 GWh is obtained.

The following graph shows the distribution of the production that comes from the Special Regime by technologies at the end of 2006.

Graph 20
Energy acquired under the
Special Regime 2006

SOURCE:
Andalusian Energy Agency.



Gas infrastructure

The geographical location of Andalusia makes it an essential link in the national gas system, as it hosts two major entry points of this fuel into the peninsula; the international connection Maghreb-Europe, which links the Algerian deposits of Hassi R´Mel with the peninsula through the municipality of Tarifa (Cádiz), and the regasification plant of liquid natural gas (LNG) in Palos de la Frontera (Huelva). At the same time, Andalusia has the only natural gas deposits existing in Spain as of 2007, one of which, Marismas has been recently converted into underground storage.

Together with the previous infrastructure, the region has a remarkable network of pipelines to transport and distribute natural gas, which on the one hand allows a good part of Andalusia to be in a position to be supplied with piped natural gas and on the other, it links the previous entry points with the peninsula's central area.

The primary transport network ($p \geq 60$ bar) of the Andalusian Autonomous Community at the end of 2006 had reached a total of 1,731.3 km. The secondary transport network ($60 \text{ bar} > p > 16 \text{ bar}$) reached 73.81 km at that date.

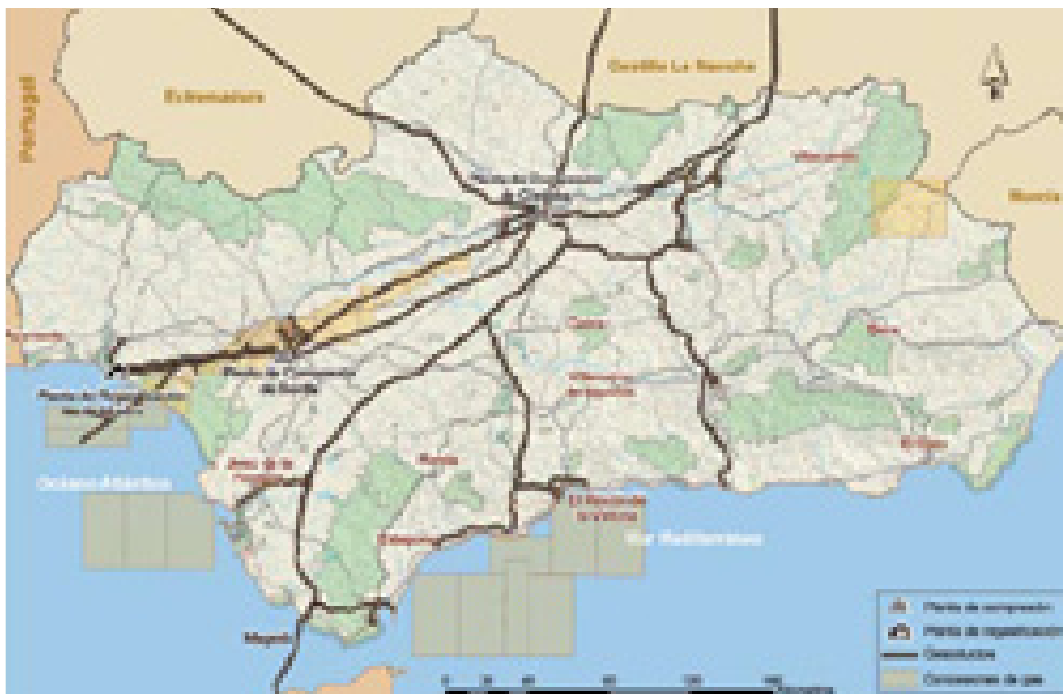


Chart 23
Gas system

SOURCE:
Andalusian Energy Agency.

With regards to the distribution network, the domestic-commercial network had reached 2,849.6 km at the end of 2006, and the Andalusian APA network (preferentially for industrial use) had reached 414.2 km in length by 2006.

By the end of 2006 there were storage plants for liquid natural gas (LNG) for domestic-commercial use in service at Baza, Guadix, Cádiz, Rota, Almería, Ayamonte, Vélez-Málaga, Ronda and El Ejido with a total capacity of 1,120 m³

Infrastructure associated to the oil sector

The refining activity in Andalusia is carried out at two refineries: "La Rábida", located in the municipality of Palos de la Frontera (Huelva), and "Gibraltar" located in the Bay of Algeciras in the municipality of San Roque (Cádiz). The two refineries together add up to a nominal capacity to treat crude of 17,000,000 t/year and a storage capacity of approximately 3.4 million cubic metres between crude and finished products.

Andalusia has a vast network of oil pipelines distributed in two main areas, the oil pipeline called "Rota-Zaragoza", which really goes up to Campo de Gibraltar and the oil pipeline called "Huelva-Sevilla-Córdoba", which also connects with Málaga, and with ten installa-

Chart 24

Infrastructures for coal and oil

SOURCE:
Andalusian Energy Agency.



tions for oil product storage with a capacity to store 1,447,160 Nm³ of products, to which we should add 15,338 m³ of storage capacity distributed amongst six airport facilities.

As well as the previous infrastructure, the Andalusian Community has loading and unloading points for oil products in the provinces of Huelva, Cádiz (Algeciras and San Roque), Granada (Motril) and Málaga and 1,656 car fuel sales points.

Infrastructure associated to the coal sector

Andalusia has three coal import entry points at the ports of Huelva, Bahía de Algeciras and Almería, with the last two coinciding with the electricity generation power plants which use this fuel: “Los Barrios” power plant and “Litoral de Almería” power plant.

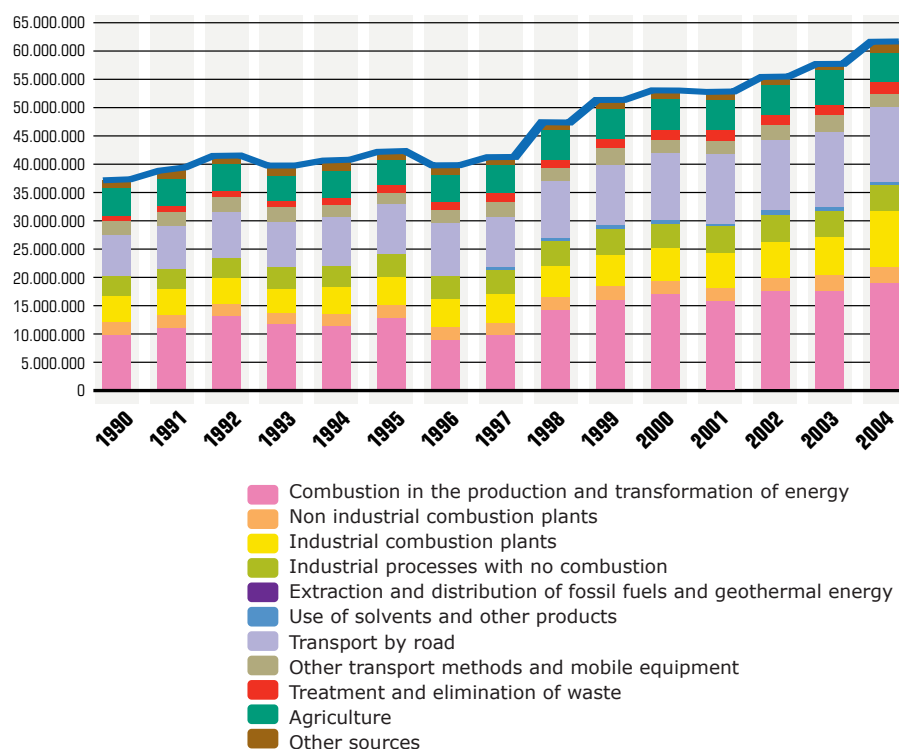


4.3. ANALYSIS OF EMISSIONS IN THE ANDALUSIAN ENERGY SECTOR

Economic and social development has come about because of the continuous increase in greenhouse gas emissions,²² to such an extent that climate changes nowadays are a great threat to the environment and to a good part of the uses and activities on the planet. The disassociation between economic growth and use of resources is therefore the great challenge ahead to achieve a new sustainability model.

Economic and social development have gone hand in hand with a continuous increase of greenhouse gas emissions

Greenhouse gas emissions in Andalusia are experiencing a considerable increase. Between the years 1990 and 2004²³ they had increased by 67.2% (above the national average, which was 52.9%), representing 14.5% of the total emissions associated to the national territory. The emissions produced by the Andalusian energy sector grew by 92% in the same period, and nearly a third of GHG emissions are due to the energy sector, with this sector encompassing the activities of production and transformation of energy and extraction and distribution of fossil fuels.



Graph 21
Evolution of the GHG emissions by sectors in Andalusia

UNIT: Tons equivalent to CO2

SOURCE:
Andalusian Action Plan for Climate
2007-2012: Mitigation Programme

22 Greenhouse gases (GHG): carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride.

23 Source: Andalusian Action Plan for Climate 2007-2012: Mitigation Programme

This situation reflects the strong link between Andalusian economic development and an increase in the fossil fuel consumption, which means high indices of CO₂ emissions.

The analysis of emissions per capita gives us the following data: the tons of CO₂ equivalent per person in Andalusia in 2004 was 8 tons of CO₂ eq/per, under the national average (9.9 tons CO₂ eq/per). In 1990 the ratio of these figures was 5.2 tons of CO₂ eq/per in the Andalusian Community and 7.5 tons of CO₂ eq/per in Spain, with both cases experiencing a continuous growth in the period 1990-2004, 54.3% and 38.1% respectively. These figures reflect the general process of reducing the development differential between Spain and Andalusia, placing themselves in both cases below the average of the Member States average which took part in the distribution of the objectives set out in the Kyoto Protocol (EU-15) (11 tons of CO₂ eq/per).

The essential link between the three basic aspects of sustainability, (economy, society and environment), is made up by energy. Economic growth implies, according to the prevailing model, an increase in energy demand, which has traditionally been met by fossil fuels, leading to what has been termed a “carbonization” of the economy, which results in high rates of CO₂ emissions.

The distribution by sectors of greenhouse gas emissions in Andalusia reflects the importance that the activities of extraction, production, transformation and distribution of energy have on the total. In the period 1990-2004 it can be observed that there are two sectors whose contribution to total emissions is important and has grown during those years, burning to produce and transform energy and road transport.

In 2004 nearly a third of the greenhouse gas emissions in the Andalusian Community were due to the energy sector. Andalusia has important plants for processing and transforming energy; power plants with coal, fuel-gas and natural gas combined cycles, as well as the refineries located in Cádiz and Huelva, together with facilities for extraction, transport and distribution of fossil fuels: coal, oil products and natural gas. Despite this, the change in the electricity generation mix of the Autonomous Community, with a greater importance in renewable energy and natural gas, means a reduction in emissions coming from this sector per GWh produced.







A new energy model for Andalusia

The energy model described in this chapter represents the reference we should take into account in the future. A new energy model based on greater energy diversification with a higher exploitation of autochthonous and renewable energy resources; in the management of demand, putting in value energy saving and efficiency measures; and in the high levels of self-sufficiency in the consumption centres.

This will need a thorough transformation of the current energy system, whose scope, given its significance, should be placed in the long term.

5.1. A NEW ENERGY CULTURE

The general context of the energy situation has been characterised by uncertainties linked to climate change on Earth and vulnerability derived from the shortage of fossil resources. This fact has meant a conceptual change on traditional energy planning focused on guaranteeing energy supply at an affordable price with suitable quality.

This change should establish a new energy framework to attain sustainable development in the Andalusian society, understood as the ability to ensure citizens' welfare in the long term, maintaining a reasonable balance between safety and energy supply, economic development, meeting social requirements, competitive energy services and protecting the environment locally and globally.

It is no longer to just assess what infrastructure and energy services are needed to meet a growing demand without seeming to affect its limits, but a need to assess whether long-term demand can be met or not under criteria of sufficiency, sustainability and solidarity, introducing **demand management** as an exercise prior to meeting this. This is fundamental to the direct involvement of all agents involved, government, economic and social agents, researchers, educators, media and the general public, creating a collective awareness to a problem, that of energy, which is already a reality, in what will be a new energy culture.



A new development model
requires an in depth
transformation of the current
energy system

For decades western society has incorporated deep set values on energy availability based on high performance and progress led by the combination of large energy production facilities (plants and refineries) and efficient distribution networks. We must change this paradigm for another that governs the principles of self-sufficiency and that adapts to specific conditions. Self-sufficiency means only those demands for energy that are not possible to be resolved with self-sufficiency and renewable solutions will be transferred to the network. And adapting the way of producing and welfare to the climatic, territorial and cultural conditions.

If we want the new energy planning for Andalusia to reach its main objective of guaranteeing a sufficient quality energy supply for all the Andalusians over the next few years, for it to always contribute to Andalusia's development under the conditions of economic, social and environmental sustainability, it is essential that there is a greater **integration with other sectoral policies** through permanent dialogue and a joint action with all those involved.

Energy planning must incorporate other policies to achieve the objectives and planned contents of the energy policy. Not only must the investments carried out in the energy sector be planned under the view of sustainability, but it is essential to incorporate criteria for using energy well into the territory planning process from the start, in the configuration of the territorial structure itself and into the models for spatial planning for uses and activities, in urban plans and for mobility, industry, tourism, the building sector, taking into account that today's planning will be tomorrow's reality and that the policies that act on the socioeconomic reality of the Autonomous Community of Andalusia have a greater margin of action.

This change makes for a more sustainable energy model from the social, economic and environmental viewpoint and cannot happen without the determined involvement of all the Andalusian people, in all areas. And all of this will only be possible if **a collective awareness** is created that values energy as a valuable and limited resource, accepting that there are limits and that the shortage of it leads to the **need to adapt** to other consumption measures and to collaborate in creating balanced conditions in the energy system.

The citizen is in the end the final object of the system. It is he who demands energy services to undertake daily activities, and it is also he in whose hand it is to provide to a great extent the change towards a new energy culture where self-sufficiency, responsible



consumption and the value of renewable energy and efficiency are the basic components of the habits and decisions of companies and the general public.

The action of the Andalusian Regional Government in this historic cycle should combine the effort in developing the elements of national and European policies that correspond to renewable energy, savings, efficiency, innovation and network management, with a greater medium and long term effort so that this new culture prevails among people, companies and public administrations. The implementation of this new culture in Andalusian society sets out one of the main challenges, if not the main one, in this route that opens up new Andalusian energy planning.

The concept “new energy culture” comes from the unavoidable need to respond to the complex challenge of climate change, the vulnerability of an energy system supported by fossil fuels and the commitment of guaranteeing a quality energy supply to the people.

In this way, Andalusia proposes the following key points for the success of its new energy framework:

- proper management of an increasing energy demand,
- self-sufficiency,
- progressive abandoning of fossil fuels in favour of renewable energy,
- integration of innovation and new technologies in energy matters,
- mainstreaming of energy strategies in all aspects, with special consideration in spatial planning,
- and to make society aware of the value of the rational use of energy.

Fundamental pillars
of this model: greater
energy diversification,
exploitation of
autochthonous and
renewable energy
resources, management
of demand and
innovation

5.2. A NEW ENERGY MODEL FOR ANDALUSIA

The formulation of the Andalusian Sustainable Energy Plan 2007-2013 (PASENER 2007-2013), from the Agreement of 13th June 2006, of the Governing Council, which includes the need to create a new energy plan based on the commitments made in the Kyoto Protocol as set out in the fifth axis of the 6th Social Partnership Agreement, incorporates the changes in the principles of energy policies that, on the one hand, delve into the pillars that shaped these policies in the PLEAN 2003-2006 and, on the other, raise the scope of the energy policy aims aspiring at an energy model change which fosters structural changes in the system and consolidates a new energy culture impregnated by collective awareness that considers energy to be a valuable and scarce resource.

In this structural reorganisation of the Andalusian energy system we should look for a repositioning based on a **better exploitation of energy resources in the region** and the global definition of an energy model that is totally adapted to the climatic, cultural and economic conditions of Andalusia.

For years, regional policies, coupled with European ones, have been focused on diversifying energy sources, in modulating demands (savings and efficiency) and in optimising the performance of networks. At present, we should also confront energy demand at its roots, studying the viability of certain energy demands and bringing about a self-sufficiency level in the consumption centres. This way energy networks would receive mainly demands that cannot be resolved in any other way at the demand and consumption centres and which are essential for productive activity and the welfare of Andalusian people.

This profound innovation can and should be the trigger for a configuration and expansion of the cluster of regional goods and services businesses, both to meet the needs of Andalusian businesses and families as well as to export the model, knowledge and products to other areas with comparable conditions.

With respect to productive sectors (agricultural, industrial and services), the energy policy should be oriented at providing companies with solutions under the new energy framework, bringing about installations that increase self-sufficiency (renewable energy and co-generation), savings and efficiency.

With respect to the residential sector, which probably will be the factor that has the most impact on the Andalusian energy system, not only in its conformation and organisation, but also in its own viability, the scenario we are facing could question the basic principle of energy policy during the last century of meeting demands without caring about its volume



or how it was produced, as well as its impact on transport. Due to this, it is especially relevant to ensure that only those energy demands that cannot be resolved using their own means should be transferred to the network. Thus, the conditions for buildings and developments to resolve with design criteria a better integration in their environment so as to reduce energy requirements and for them to have the proper means to generate as much renewable energy as possible will be favoured.

Public administrations, in their capacity as those that demand, also have the unavoidable challenge to lead and be responsible for these new guidelines not only in all areas and public facilities, but also in their buildings. Public lighting or waste disposal installations and the many public buildings can incorporate systems to generate renewable energy so that they can supply themselves with part of the energy they need, improve the efficiency of their facilities and incorporate strict management criteria that represent, as a whole, a reference for all of society.

Regarding transport, care must first be taken to implement quality, and other factors should be considered such as environmental friendliness and favouring a balanced modal delivery of mobility, with a predominance of the most efficient ways through the development of public transport networks, which are intra and inter urban, and the diversification of energy sources through the development of a proper distribution network.



In this new energy model the citizen will play an active role, as he will not limit himself to demanding and consuming energy, but he must do so under the criteria of energy savings and efficiency. For this, prior work must be carried out in training and providing information by the Government to attain the progressive implementation in the Andalusian society of the new values such as those that energy is a basic and scarce resource. This change in values also means the acceptance of adaptation principles. That is, Andalusian people should live in a unique way, adapted to the environmental and territorial conditions of the region.

Together with all these unavoidable challenges, Andalusia has been given a historic opportunity to be at the forefront of a new energy model at a world level. Andalusia has the energy technologies and sensitivity, human proximity, geography and climate in relation to the third world. We are the best technological and cultural bridge between Europe and Africa as well as between Europe and Latin America. The new energy models that are being developed in Andalusia can be easily transported to other areas in the world. It is possible to configure an energy model that will act as a reference to other regions and create opportunities for the export of goods and services with our production materials.

Thus, the Andalusian Community, although lacking in fossil fuel resources, is very rich in renewable energy; it can convert the renewable energy industry into a strategic industry from not only the point of view of energy safety, but also from sustainable economic, social and environmental development which means an opportunity that demands great innovative ability, as **“innovative activities are a main factor to stimulate growth in productivity and competitiveness and a key factor to achieve sustainable growth”** (European Council of Lisbon).

All the aforementioned introduces new issues into the planning process that can be summarised in the following points:

Transversal character of the energy policy

Energy policies should be actively incorporated into the spatial planning process from the start and introduce the energy dimension into the basic decisions for urban growth and planning of uses to guarantee a balanced and sustainable development. In the current situation, we cannot allow energy supply to be a later contribution to the study of spatial planning, simply to meet its needs.

It is therefore necessary to internalise that energy policy, which has a transversal character in relation to other policies for which we must establish new coordination channels through the territorial planning instruments of Law 1/94 on Spatial Planning, or other inter-administrative mechanisms that are enabled.



Therefore, for example, the environmental impact on the natural environment from the new ways of producing useful energy from renewable sources, the environmental issue of emissions from power plants or the energy and environmental consequences of urban and productive growth or the sustainable increase in mobility, are issues that will be covered in the preparation and approval process of the new planning and in its development instruments.

In particular, new collaboration procedures should be set up to ensure the viability and suitability of urban growth in areas which have a saturation risk such as the coast and built up urban areas.

In this same sense, the planning tools should assess the demand context for urban and industrial developments, the energy consequences of mobility related to spatial planning, new ways for leisure and sport, territorial priorities in the scenario of a shortage of energy resources and the economic development potential in certain territories in relation to the new energy plan.

It is necessary for energy policy to acquire a transversal dimension in relation to other policies, especially territorial ones

Optimal management of demand and distributed generation

The culture for energy saving is integrated into the population with this new energy model, influencing their consumption habits, transport methods and demand for energy services. Collective awareness about the energy problem and its environmental consequences will move citizens and companies to use energy rationally, providing the highest level of self-sufficiency, using more efficient systems and ensuring the greatest savings.

On this route towards a new culture for self-sufficiency and energy savings the messages and information that the citizen receives will be key together with the solutions that are completely adapted to the climate, economic, environmental and social conditions of Andalusia.

The Government should be an example on how to use energy wisely, taking on their own commitment to self-sufficiency and energy savings, which will act as a reference for the general population. It is necessary to change the current model of public contracting, introducing criteria for energy efficiency in any supply or energy service that the government requires.

These good practice criteria should also be introduced into policies that are not directly related to energy, such as urban policies, reduction of basic mobility demands, the modal change in travel or in industrial policies, incorporating into urban planning the actions that will give generation facilities to public management service systems, as well as to



the different consumption centres (industrial estates, buildings, etc...) and the measures that optimise energy consumption of buildings and estates by applying criteria for design and execution. In this sense, we hope to incorporate regional policies aimed at having a greater impact on energy management to share management intervention criteria based on innovation (and also on historical experience) in ways to use land, products and processes that are fully adapted to the Andalusian territory.

Prioritise the use of renewable energy

In the new energy model, renewable energies occupy a predominant position in their own right, due to their sustainability, distributed and in harmony with the environment. Faced with the threat of climate change, and whose consequences could already be irreversible and with an emphasis on energy supply problems, which draw us to an ever closer scenario of a shortage of fossil fuels to cover the increasing demand for energy, at very high prices, the exploitation of the important renewable resources that Andalusia has means providing it with this autochthonous and safe energy to lessen the impact of the uncertainties of the international energy market in the future.

Furthermore, the development of its own skills in the renewable energy field brings economic, social and environmental benefits, constituting an excellent opportunity to be in an advantageous position in an increasingly competitive market, stimulating economic growth, exports of goods and services and creating jobs.

The existing exploitable wind power potential, high availability of biomass, large production capacity for energy crops and the especially abundant solar resources, makes Andalusia stand out from the rest of the Autonomous Communities as well as most regions of the European Union.

However, despite the important effort that has been undertaken to develop renewable energy, there are still many barriers that persist and make the development of these technologies difficult. In this new phase, we must look for the solution to the strangleholds that impede or delay the complete development of the generating potential from renewable resources, whether destined for the network or for self-consumption.

We should not only encourage the use of energy coming from renewable sources, but also the renewable energy industry itself, which can be listed as *added value* and becomes a strategic industry, from not only the safe energy point of view but also from an economic and social development one.



Among the main characteristics of the industrial network associated to renewable energy, the following are highlighted: their dynamism, as they are products that are continuously advancing and transforming; their innovation, as it is necessary to adopt solutions that allow for advance, not only in products but also in the structures of the companies themselves; their high technological development, as the products require the incorporation of telematic technologies, new materials, micro-electronics or design; their capacity to expand because although local companies are the seed of the industry, the future that is envisaged will be in other developing countries that demand more efficient technologies than the current ones; their demand for jobs, characterised by their *stability*, as it is a sector with very important projection; their *high technological qualification*, given the continuous advance of the different technologies and their *social recognition*, due to the dual role as an energy provider and protector of the environment.

The large scale development of the different technologies to make use of the renewable resources will mean, in the long term, deployment for a large capacity of storage and transport, not only in time (storage of energy produced for later use) as well as in the expansion of the land needed for this storage, and for putting into effective practice the concept of consumption next to the generation through local networks that will boost distributed generation of electricity as well as thermal energy.

Innovation of technology and processes

Innovation is the key to economic and social progress in the most advanced countries. In a global economy, a model for economic development that is socially balanced and sustainable in the long term should be maintained in innovation and creation of knowledge, with R+D+i being the tip of the iceberg of competitiveness.

R+D+i activity has an impact in benefitting society through various mechanisms: it produces knowledge and technology that contribute in improving the quality of life for the people, it increases competitiveness of local industry and generates value for itself, by exporting know-how, patents and procedures.

Regions of the developed world are energy dependent on fossil fuels, which are generally extracted from less wealthy areas of the world. The Andalusian region is especially delicate due to the shortage of their own conventional energy resources.

The transition from an unbridled consumption of fossil fuels, whose availability is limited and whose environmental impact is unsustainable, towards an energy system based on clean technologies, renewable energy and high efficiency, raises an unavoidable challenge in science-technology and in the social field.

The new energy technologies are generally emerging technologies. They have a great market penetration, making them more attractive, if that is possible, to undertake an effort in development and innovation. In other fields (such as aviation, computers etc.) technological maturity and full development of markets was reached in the second half of the twentieth century causing there to be areas and regions of the world that are already technologically positioned. In the renewable energy field, the new saving techniques, the innovative management systems for energy etc. their markets are anticipated to have been completely developed by the first decades of the 21st century.



Thus, innovation in energy matters is not only an imposed necessity, but also an excellent opportunity for Andalusia to be among the most advanced regions of the world, as it is deficient in fossil energy resources but rich in renewable resources. There is exploitable wind potential, high availability of residual type biomass, great capacity to produce energy crops, and where Andalusia especially stands out, with respect to the rest of the EU regions (and the developed world in general) is with its abundant solar resource. There are many high level research groups at universities and research centres (mainly public funded), and in the private sector there are also technologically advanced companies in energy technology.

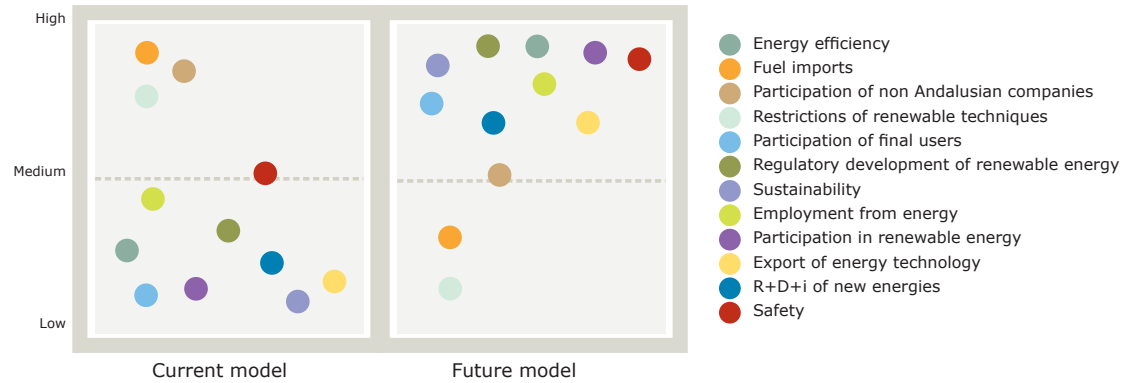
Technological innovation will position Andalusia among the most advanced regions in the world

The completion and coherence of the whole approach of this Plan is the approximation to a **new energy model** that will give responses to the power supply needs of companies and citizens without creating environmental, economic and social imbalances, and favourably influencing in generating employment. To do this, the best approach is to adapt to the emergence of peak energy demands, the self-sufficiency of consumer units, generation of electricity, transport and applying energy to Andalusia's specific conditions in relation to climate, natural environment, territory, culture and how historically Andalusian society has related to its environment.

The definition of this model requires a thorough innovation in energy policy but also in territorial and environmental policies, technology, economics, social habits and many other areas of knowledge and public action. However the benefits that can be obtained justify the efforts from the Andalusian society in this aim. Not only because of the evident improvements that would be produced in the energy system's operation, but also due to the opportunity of being able to confront the uncertain years that are coming up with a productive structure that is more competitive, able to internationally head up a production model and export technology, goods and services resulting in an improvement in Andalusian people's welfare.

All the aforementioned can be graphically represented according to the following diagram, through qualitative analysis of the main aspects that differentiate the current energy model from the future model in the long term:

Graph 22
Comparative diagram
current model/future model



In the future energy model, aspects such as the participation of renewable energy in energy combination, energy efficiency or the mitigation of greenhouse gas emissions, which do not play an important role in the current energy system, will reach a high degree of development and implementation. Greater activity in research, development and innovation will be decisive in achieving these objectives.

This would all mean greater safety in energy supply and less vulnerability when faced with supply problems due to a lesser dependence on imported fuels. On the other hand, the Andalusian corporate sector, supporting innovation and technological development, would position itself in the new model with a much more competitive structure, exporting energy technology and acquiring a more important role in the Andalusian economy as well as in national and international markets, having a very positive impact on job demand.

Greater activity in research, development and innovation will be decisive in achieving the Plan's objectives

The change in the Andalusian society's energy consumption trends, together with the pattern of a globalised economy in which it finds itself, obliges an in depth review of the current energy model. This important challenge provides opportunities for Andalusia based on its demonstrated ability to adapt to historic changes, in its soundness to lead in the production of efficient and quality goods and services, in its effort to transfer this strategy to all socio-economic sectors and ultimately, in its ability to position itself as a world reference, offering innovative and competitive responses according to the new energy context.

6





The Plan's Objectives

The change in consumption habits, migration towards a new energy infrastructure system and the development of new technologies means base changes in a very consolidated sector with great inertia, hence the effective implementation of the new energy model advocated in previous sections will be a matter that is achievable in the long term.

The Andalusian Sustainable Energy Plan represents the first step towards this new model, which covers the period between 2007 and 2013 and that hopes to:

The plan pursues introducing a new energy culture into society

- encompass economic growth with social cohesion throughout the territory, protecting Andalusia's natural and cultural heritage without causing imbalances in the global ecosystem, especially those associated with the great challenge posed by climate change,
- introduce into society a "new energy culture," so as to bring out a collective awareness that values the ability to access different energy sources with high levels of safety and quality, and the effects this causes in the environment and to make decisions consistent with this.

These premises are formulated through the following **strategic objectives**:

- To prioritise the use of renewable sources as a measure to increase energy self-sufficiency of the Andalusian people, environmental protection and the implementation of a distributed energy system.
- To involve all of society (government, economic and social agents and citizens) in the principles of a new energy culture, to entrench in it energy awareness as a basic and sparse asset, and promote energy efficiency and savings in all Andalusian consumer sectors.
- To contribute to a balanced regional planning and economic growth through a system of energy infrastructures that ensures a supply that is secure, stable, diversified, efficient and of quality to all Andalusian people, which is consistent and adapted to the territorial model established in POTA.

- To promote a competitive business fabric based on the knowledge of the economy in the energy technology field, contributing to the robustness of the whole system through innovation and links with Andalusian reality.

The previous objectives define the energy policy of the Andalusian government for the next few years. The success in achieving these is a challenge as well as a commitment that the Andalusian Regional Government takes up under the framework of the powers it has as the Autonomous Community.

A series of objectives that are listed below were chosen to assess this commitment.

OBJECTIVES

The foreseeable evolution of energy demand in Andalusia over the next seven years makes up the scenario in which the response to the Andalusian energy system has to be unravelled and based on decisions taken and related to energy planning, reflected in these pages. The exercise conducted on anticipated demand was made based on the scenario called basic scenario variables (see Annex), but given the complex context that surrounds this analysis, several assumptions have had to be adopted.

With the trend scenario, the actions on energy savings and efficiency will mean a decrease in primary energy of 1,465 ktoe in 2013, resulting in a **savings scenario**, which is taken as a reference to adopt the Plan's objectives. The accumulated growth in final and primary energy demand in this scenario will be 20.9% and 26.0% during the period the planning is in force, with average annual increases in these demands of 2.7% in the case of final energy and 3.4% for primary energy.

The hypotheses adopted give as a result the installation of renewable technologies that are listed in the following table, which means a primary energy contribution from renewable sources estimated at 4,282 ktoe in 2013, with this being the energy source with the greatest increase over the next few years, with an average variation rate of 27.5%.



Renewable energies by technologies (parametric)		2007	2010	2013
Hydraulic special regime	MW	129.8	137.8	148.0
Hydraulic ordinary regime	MW	464.2	476	476
Wind power	MW	1,284	4,000	4,800
Solar photovoltaic	MWp	36.2	220	400
Thermal solar	m ²	407,000	765,228	1,341,554
Solar thermoelectric	MW	60	250	800
Biomass thermal use	ktoe	583.5	615.6	649.0
Biomass for electricity generation	MW	169.9	209.9	256.0
Co-firing of biomass	MW	0	61	122
Biogas thermal use	ktoe	2.1	2.5	3.0
Biogas for electricity generation	MW	16.0	17.1	20.1
Biofuels consumption	ktoe	50	220	460
Biofuel production	ktoe	263.7	2,000	2,300
Primary energy from renewable sources	ktoe	1,401	2,591	4,282

Chart 25

The hypotheses on which the planned savings are based are listed in the table below.

Accumulated savings by sector (ktoe)	2007	2008	2009	2010	2011	2012	2013
Industry	63.5	111.9	159.5	207.8	257.3	307.6	358.9
Transport	111.5	188.7	264.8	342.0	421.1	501.5	583.4
Tertiary building	10.4	21.4	28.3	34.1	38.1	40.5	42.8
Residential building	13.5	27.9	36.9	44.5	49.7	52.8	55.8
Domestic	11.2	24.8	32.4	38.5	47.6	55.2	59.8
Public services	29.9	53.9	77.6	101.6	126.2	151.2	176.6
Primary (agricultural and fishing)	9.5	14.3	19.2	24.0	29.0	34.0	39.0
Cogeneration	3.6	21.5	39.5	57.6	75.8	79.6	83.5
Transformer sector	10.6	19.5	28.3	37.3	46.5	55.8	65.3
Total	263.7	483.9	686.5	887.4	1,091.4	1,278.0	1,465.1

Chart 26

The final approach to the assumptions used in the outlook for renewable facilities and for sectoral energy savings presented in previous tables depend heavily on public-private cooperation, which will be translated partly by maintaining a stable and sufficient incentive framework for both lines, and on the other hand through a strong private sector initiative for the implementation of projects.



Eleven objectives associated with the scenario pursued in the present scenario planning have also been selected: the savings scenario. These objectives have a marked indicative character, as in effectively achieving the same, they also coincide with the public administration's impulse, other factors that escape its competitive environment.

Part of these objectives are included in the current European and state energy framework, aimed at assessing the situation that Andalusia finds itself in the renewable energy, energy savings and CO₂ emissions field, which outlines the path of energy sustainability pursued by the Plan.

Besides the abovementioned, other targets more related to the Andalusian context itself and the energy consumed by the Andalusian people are included. These are formulated in final energy terms, excluding consumption in production, transformation and distribution, given that Andalusia is an exporting region for energy and energy vectors, the inclusion of these consumptions would partly distort the conclusions that could be extracted from the consumption of energy derived during daily life in Andalusian society.

Finally, with respect to renewable technologies, it also accommodates not only objectives that are closely linked to climate conditions (production of raw materials, electricity generation, primary energy), but also others that are more linked to the installations themselves (installed power).



01 Consumption of primary energy from renewable sources compared to the consumption of primary energy in Andalusia for exclusive energy purposes.

In 2013 there will be a contribution of 18.3% in renewable energy sources to the primary energy structure.

02 Total electric power installed with renewable technologies compared to the total electric power existing in Andalusia.

In 2013 this indicator will stand at around 39.1%, which will be a nearly five-fold increase of power with renewable technologies with respect to the position in 2006.

03 Gross production of electricity with renewable sources against net electricity consumption of the Andalusian people (consumptions from electricity generation and refineries are excluded).

In 2013 this indicator would be 32.2%.

04 Savings in primary energy with respect to primary energy consumption in Andalusia, for exclusively energy purposes, registered in 2006.

In 2013 it is anticipated there will be an 8% saving in the primary energy consumed in 2006.

05 Total primary energy consumption in Andalusia against Andalusian GDP. This is the indicator for primary energy intensity and shows an increasing trend over the last few years which is expected to slow down during the term of the Plan.

Primary energy intensity is expected to be reduced by 1% in 2013 with respect to 2006.

06 Consumption of biofuels in the total consumption of petrol and diesel by the Andalusian people in the transport sector.

In 2013 this indicator would be 8.5%.



- 07

System Average Interruption Duration Index (SAIDI) in Andalusia in 2013 compared to the current SAIDI. With this objective we intend to lower the SAIDI in each of the areas (urban, semi-urban, concentrated rural and disperse rural) by 33% compared to current values.

The aim for 2013 is to place SAIDI in urban centres in 0.86 hours, in semi-urban areas in 1.37 hours, in concentrated rural areas in 2.89 hours and in disperse rural areas in 3.81 hours, which would mean a SAIDI for the whole of Andalusia of 1.56 hours.
- 08

Resident population in urban centres of between 10,000 and 20,000 inhabitants to have a gas distribution network for domestic-commercial use compared to the resident population in all the urban centres of between 10,000 and 20,000 inhabitants in Andalusia.

In 2013, 80% of residents in urban centres of between 10,000 and 20,000 inhabitants should have the possibility of being able to access the natural gas supply, due to a balanced distribution of this source of energy in the territory.
- 09

CO2 emissions derived from the generation per electric unit in Andalusia.

In 2013 CO2 emissions per electric generation unit would be reduced by about 20%.
- 10

CO2 emissions avoided due to the energy savings and efficiency measures and greater generation using renewable energy during the Plan's term.

In 2013 the CO2 emissions avoided would reach 11 million tons.
- 11

Final contribution of all renewable energy sources to the final energy consumed by the Andalusian people (which excludes consumptions in production, transformation, distribution), for exclusively energy purposes.

In 2013 this indicator would be 27.7%.

This last objective is new in the sense that the indicator that supports it aims to give an idea of the degree of “renewability” of the energy supply structure measured on the basis of net consumption of the Andalusian people after excluding non-energy uses.

By formulating the objective in this way we hope to focus the analysis exclusively on those consumptions that are attributable to the Andalusian people, thus avoiding high primary energy demands associated to installations that partly supply transformed energy to other territories, as is the case in refineries and electricity generation power plants.



Objectives grouped by action area

Renewable energy

Renewable energy contribution	Primary energy
Electric power installed with renewable technologies	Total electric power installed
Renewable energy contribution	Final energy consumed by the Andalusian people
Production of electricity from renewable sources	Final electricity consumed by the Andalusian people
Biofuel consumption	Total consumption of petrol and diesel in cars

Energy savings and efficiency

Primary energy consumption	Gross Domestic Product
Energy saving	Primary energy consumption in 2006

Energy infrastructures

SAIDI in Andalusia in 2013	SAIDI in Andalusia in 2006
Resident population in urban centres of between 10,000 and 20,000 inhabitants with possible access to gas	Resident population in urban centres of between 10,000 and 20,000 inhabitants

CO2 emissions

CO2 emissions from electricity generation	Electricity generated
CO2 emissions avoided	

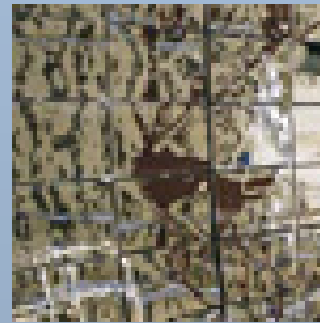
objectives

2013

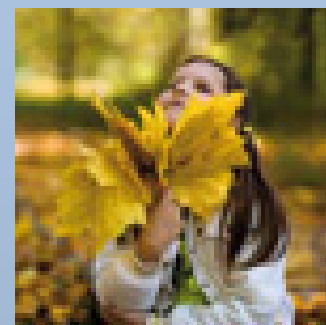
2 Position around 39.1% of installed electric power using renewable sources, when compared to the total electric power.



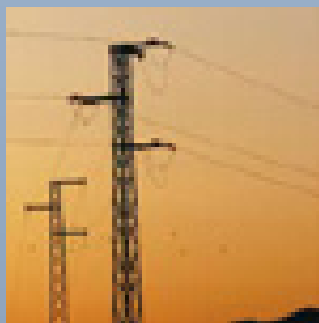
3 Position the gross production of electric power using renewable resources at 32.2% of the Andalusian people's net consumption of electricity.



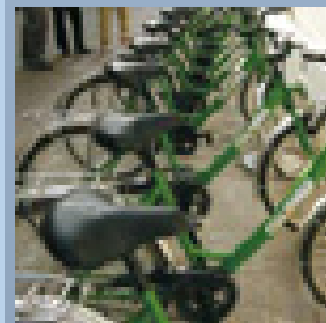
4 Reach savings that are equivalent to 8% of primary energy consumed exclusively for energy purposes in 2006



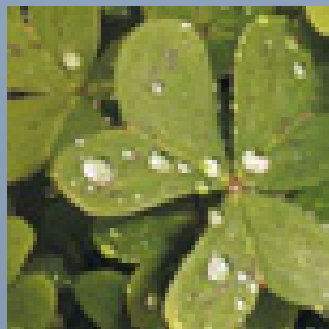
5 Reduce the primary energy intensity by 1% with respect to 2006



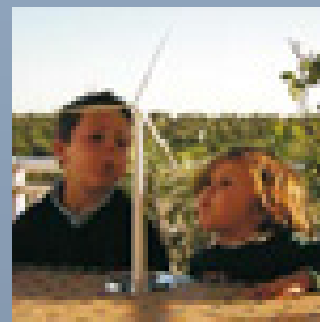
6 Position the consumption of biofuels with regards to the total consumption of petrol and diesel in transport at 8.5%.



7 Position the System Average Interruption Duration Index (SAIDI) in urban areas in 0.86 hours, in semi-urban areas in 1.37 hours, in concentrated rural areas in 2.89 hours and in disperse rural areas in 3.81 hours, which would mean a SAIDI for the whole of Andalusia of 1.56 hours.

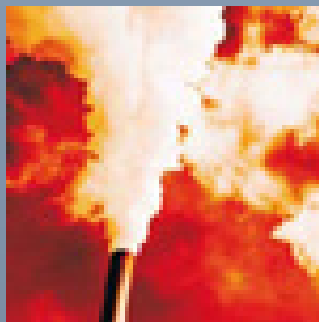


8 Provide 80% of residents in urban centres with a population of between 10,000 to 20,000 with access to a natural gas supply.

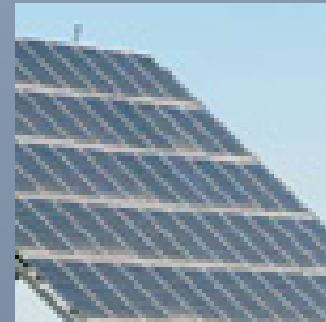


9 Reduce CO2 emissions per unit of electricity generated by 20%.

10 Avoid the emission of 11 million tons of CO2.



11 Make the total contribution of renewable energy sources to represent 27.7% of the final energy consumed by the Andalusian people.





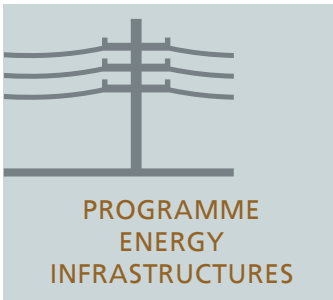
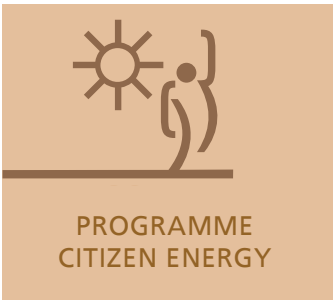
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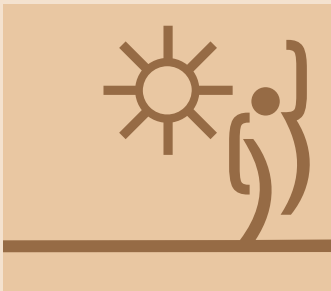


Programmes

The change towards a new energy model will not be possible without the involvement of all the elements that intervene one way or another in the complex structure that makes up Andalusia's energy system. Three of them, citizens, economic and social players and the government make up the major target subjects, whilst sharing involvement and responsibility, benefit in welfare, quality of life, productivity, etc.. that is associated to the use of energy, and at the same time share the negative effects on health, the environment, competitiveness, territory, etc. which the current system of production, transportation, distribution and use of energy has. The fourth element is made up by the horizontal type, energy infrastructures.

Actions aimed at achieving the strategic objectives formulated in this Plan have been divided taking into account each of these areas, establishing four action programmes **"Citizen Energy"**, **"Energy Competitiveness"**, **"Energy and Administration"** and **"Energy Infrastructures"**. The application and development of the measures set out in these programmes will compulsorily have the territorial areas identified in the Urban Planning Plan of Andalusia, known as: Regional Centres, Coastal towns, Medium sized Inner cities and Network of Rural Settlements.





7.1. THE “CITIZEN ENERGY” PROGRAMME

The change in the energy model demands the approach of a scheme based on the social concept of the new energy culture, analogous to that set out in the planning for the management of water resources as a new “culture of water” , to be able to respond to the need to properly manage energy demand, avoiding waste. In this new model the citizen becomes the centre, but not only by the fact of helping and incorporating himself as a passive agent to approach the measures set out by the competent bodies on energy matters, but as an active subject who is essential when it comes to decision-making and in the dissemination of an active positioning by being aware of the energy problem.

Action Line “Incorporating energy efficient management and integration of renewable energy into consumption habits”

Reference	Measure
MC1	<p>Incentive programme to install renewable technologies for individuals and communities in the domestic market.</p> <p>The incentive line established for solar thermal installations, thermal biomass and other renewable sources will continue. The use of renewable sources to produce mainly hot water and heating will be promoted. In the community area there will be a promotion of networks to produce centralised hot water and HVAC (hot-cold) with renewable energy. Installations with renewable sources will be especially encouraged in geographic areas where presently there is a scarce implementation of them.</p>
Reference	Measure
MC2	<p>Promote the installation of photovoltaic solar energy in isolated areas.</p> <p>This measure aims to exploit solar energy to supply electricity to urban areas that are far away from the network, paying particular attention to the Network of Rural Settlements.</p>
Reference	Measure
MC3	<p>Promote that existing homes are adapted to the energy requirements set out in the Andalusian energy certificate.</p> <p>Law 2/2007 which promotes renewable energy and energy savings and efficiency in Andalusia makes it compulsory for new buildings to have an accredited energy certificate which complies with the minimum energy efficient requirements set out by law. This measure will encourage actions in energy saving and efficiency in existing homes, such as improved thermal insulation, improving the energy efficiency of heating and air conditioning or improving the energy efficiency of lighting systems, as an instrument to bring its energy efficiency in line with the energy requirements set out in the Andalusian energy certificate.</p>

Reference	Measure
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MC4 Renewal Plan for air conditioning equipment.

Air conditioning systems with an Inverter type A label allow the energy consumption associated to this equipment to be considerably reduced. However, the domestic sector has still not adequately perceived the benefits linked to its use.

This measure examines setting up an incentives programme to substitute domestic air conditioning systems with less than 12 kW refrigeration power with other inverter class A type.

Reference	Measure
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MC5 Plan to substitute inefficient electrical appliances.

The plan proposes to help citizens change their old low-efficiency appliances, and which therefore have a higher energy consumption, for electrical appliances labelled as class A or higher (A + and A + +).

Additionally, carrying out training courses for sellers of appliances to give them proper training to advise potential users correctly on energy labelling and the advantages of the equipment listed in Category A and above (A + and A + +) will be promoted.

Reference	Measure
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MC6 Renewal Plan for domestic electric meters.

The measure aims to provide the domestic user with information on his energy consumption times so as to be able to change his user habits, thus contributing to improving energy demand and efficiency of the overall energy system.

Reference	Measure
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MC7 Promote the acquisition of unconventional technologies for air conditioning and lighting in homes.

This measure seeks to promote the integration of HVAC and lighting equipment based on emerging technologies (such as evaporative cooling equipment, high efficiency boilers, solar absorption systems and/or biomass, LED lighting technology, etc..), which will allow high energy savings and which have not widely penetrated the domestic market due to their higher costs compared to conventional technologies.

Reference	Measure
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MC8 Promotion of microcogeneration.

The technical specifications and reduced size of the low power cogeneration equipment make its penetration into the domestic sector easier. This measure intends to promote the materialization in the residential sector of projects based on low-power cogeneration (microcogeneration) as a highly energy efficient system to meet the demands of a housing complex.



Reference	Measure
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MC9 Development of an incentives line to incorporate greater energy efficient cars.

New cars would allow energy consumption and environmental pollution to be reduced by having more efficient technologies than old cars. The purchase of electric powered cars that are, hybrid or fuelled by natural gas, liquefied petroleum gas, hydrogen or biofuels with a high concentration in the mixture (B-100 and E-85), will be encouraged through financial assistance to offset the additional costs of these alternative vehicles.

Reference	Measure
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MC10 Facilitate the incorporation of ICT for energy management of households.

This aims to raise awareness among citizens of remote automation systems for energy efficiency at home and encourage the incorporation of these through incentive programs.

Action line “Information for citizens”

Reference	Measure
-----------	---------

MC11 Specific dissemination aimed at the general public on the Incentive Programme for Sustainable Energy Development in Andalusia.

It hopes to promote awareness in energy consumption and change citizens’ habits, making them aware of the institutional support they have from the Andalusian Regional Government for investments in energy improvements.

Reference	Measure
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MC12 To undertake campaigns to encourage good energy practices at home, and encourage the use of products and services with a high energy qualification.

With this measure it is hoped that citizens will take part and be conscientiously involved in the need to adopt control habits in their homes, not only with direct energy consumption, but also by reducing their ecological footprint on all the goods that they acquire. This action will be carried out in collaboration with neighbourhood associations, consumer associations and educational centres.

Reference	Measure
-----------	---------

MC13 To carry out campaigns to encourage the use of renewable energy in homes.

The measure aims to develop guidelines, campaigns in the media, organisation and participation in conferences, etc. It will give the consumer the power to opt for renewable sources at home with a complete guarantee regarding their effects and benefits.

Reference	Measure
-----------	---------

MC14 To promote the Andalusian energy certificate in homes.

There will be a vast information campaign for people on the energy certificate in housing, regulated by Law 2/2007 to promote renewable energy and energy savings and efficiency in Andalusia, in order to explain the energy advantages of a home with a A or A + energy rating.

A Web platform will also be set up where the citizen will be able to check his real energy consumptions with those envisaged in his energy certificate and identify the causes of this deviation.

Reference	Measure
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MC15 Campaigns to promote efficient driving habits and use of biofuels as well as incorporating energy efficiency criteria in the purchase of private vehicles.

It aims to raise citizen awareness on the problem that the passenger transport causes as the main source for greenhouse gas emissions and the need to reverse unsustainable habits in road traffic.

Reference	Measure
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MC16 Carry out campaigns to encourage more efficient ways of undertaking trips.

In line with the previous measure it is intended to encourage ways to undertake trips that are much more energy efficient such as public transport, car-sharing, motorbikes and bicycles, putting in detriment the underused private vehicle.

Reference	Measure
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MC17 Dissemination of energy labelling for cars.

Through ROYAL DECREE 837/2002, of 2nd August, which governs information relating to the use of fuel and CO2 emissions, it is compulsory for new cars that are for sale or lease in Spain, to be labelled with their fuel consumption and CO2 emissions, and this label should be clearly visible on each model of new cars. Additionally, and voluntarily, there is the possibility that this label could also include the classification by comparative consumption of the car. This measure hopes to have a bearing so that due to this labelling we will adopt energy saving and efficiency criteria when purchasing vehicles.

Reference	Measure
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MC18 Creation of a Virtual Information Centre for Citizens.

A Website will be made available to all citizens, which is like a "Citizen Customer Care Centre," which will guide and inform on everything that is related to facilities (type, operation, specifications, suitability for use and location of the installation, etc.) and on renewable energy use, energy savings and efficiency, with the possibility of them being able to participate and request advice on energy matters caused by conflicts.

Reference	Measure
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MC19 Set up awards for efficient management and incorporation of renewable technologies.

This seeks to examine recognition to citizens or groups of citizens who excel in the incorporation of renewable technologies or in energy efficient management.



Action line “Education of citizens”

Reference	Measure
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MC20 To promote a continuous activity in energy education.

This intends to increase social awareness around the energy problem. The measure examines specific training on energy matters at educational and training centres.

Reference	Measure
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MC21 Signing of agreements with social entities to coordinate training programmes on energy education.

The dissemination of educative material in the energy field will increase support and universality in the message if the support of different groups (universities, schools, associations of consumers and users, NGOs, etc.) is obtained.

Reference	Measure
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MC22 Specific support for pilot or special interest projects that demonstrate the feasibility and benefits of strategies in energy saving and efficiency and by incorporating renewable energy generation.

The support to suitable citizen initiatives is of interest (NGOs, associations declared of public utility, collective defence of consumers and users, etc.) which are especially visible and help disseminate the benefits of proper energy management.

7.2. THE “ENERGY COMPETITIVENESS” PROGRAMME

Andalusian companies play a dual role, as demanders of energy and energy technologies and developers and offerers of these technologies.

Energy consumption is critical in the economic balance of companies. Production activity is the first where changes and measures related to energy are felt, either by the international instability of energy supply, lack of adequate supply and distribution infrastructures, the price volatility of the fossil fuel energy sources, with continued increases in the price of oil, or because it is the first to feel the effects of regulatory measures and control of greenhouse gas emissions.

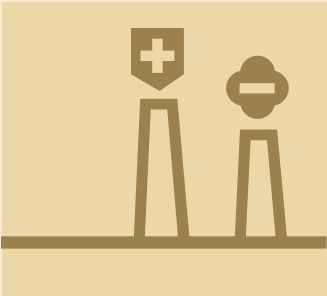
There is a clear need to undertake deep structural changes that involve incorporating measures to increase self-supply and efficiency in transformation, transport, distribution and the final use of energy.

All this favours the formation and expansion of a group of Andalusian goods and services companies, designed to meet the new demands arising from implementing the new energy model.

On the other hand, a unified European market, at the forefront in competitiveness is set out by those companies that promote innovation, savings and efficiency in production processes. The high availability of autochthonous resources from renewable origins poses a unique opportunity for Andalusian companies to place themselves technologically in a leading world position, promoting the optimal use of clean energy sources and exporting technologies and expertise to other regions of the world.

Action line “Adopting criteria for efficient management and incorporation of renewable technologies in companies”

Reference	Measure
ME1	To promote investments in energy savings and efficiency. This measure hopes to promote investments that aim to reduce energy consumption in the different facilities or equipment of the energy consumer centres of the different activity sectors. In a more precise manner, it will cover topics as diverse as the renovation of existing facilities in buildings (heating, cooling, lighting and hot water production), rehabilitation of the thermal insulation, improvement of processes and industrial installations, etc.





Reference	Measure
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ME2 To promote the installation of renewable technologies in companies.

This measure intends to induce the sector producing goods and services by incorporating technology based on renewable energy sources, with special emphasis on improving the processes and costs for SMEs.

Reference	Measure
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ME3 To encourage the undertaking of energy audits in industrial companies.

This measure is intended to help in decision-making for making investments in energy matters by conducting energy audits in industrial consumption centres of the various production sectors. This will involve a huge campaign to promote the measure in collaboration with the most representative business associations of each sector, with which voluntary agreements can be set up.

Reference	Measure
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ME4 To promote the Andalusian energy certificate in industrial facilities.

Law 2/2007 to promote renewable energy and energy savings and efficiency in Andalusia creates the obligation for new consumer centres in the industrial sector, from a certain level of energy consumption set out by law, to have an energy certificate as an accredited document to state they comply with the energy requirements demanded by law.

This measure intends to promote a high energy qualification in new industrial centres, by carrying out communication and dissemination campaigns on the energy advantages of this certificate.

Reference	Measure
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ME5 Programme to promote energy savings and renewable energy in the traditional tourist sector.

The traditional tourist sector represents one of the sectors with the greatest impact on energy consumption in the services sector in Andalusia. The importance of this sector, together with a potential for high energy savings and use of renewable energy in current Andalusian hotel facilities, justifies the need to develop a specific energy programme for the traditional tourist sector.

This programme examines the development of communication and dissemination campaigns for energy saving measures that can be implemented in hotel facilities, whether for lighting, air conditioning, laundry or kitchen, using alternative renewable energy, solar or biomass, to generate hot water or air conditioning in buildings or heating/pool heating, and of the existing incentives to implement them. This measure will be carried out in collaboration with the main business associations in this sector.

Reference	Measure
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ME6 Encourage the incorporation of renewable energy systems such as generating equipment in isolated areas for the services sector, reinforcing the concept of sustainable tourism.

It is necessary to increase confidence in the energy supply through renewable energy sources in areas away from built up areas, particularly promoting the viability of isolated network energy solutions in natural areas, rural accommodation, camps and camping areas, cottages, etc..



Reference	Measure
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ME7 Programme to promote energy savings and renewable energy in the agricultural food industry.

The agricultural food industry in Andalusia represents approximately 70% of the total number of Andalusian industries and 20% of the energy consumption in the industrial sector. This is characterised by the great range of industrial processes, the high energy intensity of some of its sub sectors and the high potential of energy savings, over 13% of the overall primary energy consumption.

This programme examines the development of communication and dissemination campaigns in savings that can be implemented in this sector (substitution of oil derivatives for those from natural gas, use of boiler drains, installation of heat recovery systems, waste heat utilisation, cogeneration) as well as alternatives using renewable energy, mainly biomass for thermal generation and thermal solar energy at half temperature for production processes.

This measure will be carried out in collaboration with the main business associations in this sector with which voluntary agreements could be set up.

Reference	Measure
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ME8 Promoting energy efficiency criteria and use of renewable energy in agriculture.

This measure considers substituting agricultural machinery for more efficient machinery, and more energy efficient building systems in greenhouse farming and development of energy modernization programmes for irrigation systems. The use of biofuels in tractors and agricultural machinery will be encouraged, as well as carrying out energy audits on current irrigation installations.

Training sessions will be given to farmers on energy efficiency (techniques for crops, improved energy efficiency in machinery, efficient use of water, etc.) and on the opportunity of renewable sources for the sector.

Reference	Measure
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ME9 To encourage the undertaking of energy audits in service sector companies.

This measure is intended to help in decision-making to make investments in energy matters by conducting energy audits in sectors with the greatest consumption of the services sector.

This will involve a vast campaign to promote this measure in hospitals, hotels, shopping centres and office buildings in collaboration with the most representative business associations of each sector.

Reference	Measure
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ME10 Disseminate the contents of the Energy Certificate.

Law 2/2007 which promotes renewable energy and energy savings and efficiency in Andalusia makes it compulsory for new buildings to have an energy certificate as an accredited document which complies with the energy efficient requirements set out by law.

This measure intends to promote a high energy qualification in new buildings, by carrying out communication and dissemination campaigns on the energy advantages in a building with a A or A+ rating.

Reference	Measure
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ME11 Promote the implementation of energy management plans in existing consumer centres.

The energy management plans aim to ensure with time the maintenance of energy efficiency of the facilities in a consumer centre. This measure intends to promote the implementation of energy management plans in existing consumer centres whether in the services sector or industrial sector.



Reference	Measure
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ME12 Promote distributed energy power generation projects with renewable energy and efficient technologies in enterprise technology parks and industrial estates.

This measure aims to promote local energy supply systems (electricity and/or thermal, promoting cogeneration systems) in self-managed networks of concentrated business areas where a proper management of energy supply through renewable energy installations is feasible.

Reference	Measure
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ME13 To promote the installation of photovoltaic solar energy in concentrated business and industrial areas.

This measure intends to promote electricity supply through photovoltaic technology in industrial estates and business parks.

Reference	Measure
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ME14 To promote the development of cogeneration in Andalusia.

This measure considers identifying existing cogeneration potential in Andalusia, conducting feasibility studies of new facilities as well as establishing an incentive program to the develop cogeneration projects.

Reference	Measure
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ME15 To promote energy audits in existing cogeneration centres.

It is also important to carry out a review on the condition of the cogeneration power plants in operation to ensure their suitability and optimal functioning. The audit can therefore detect possible increases in the system's performance by using the best technology available on the market.

Reference	Measure
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ME16 Develop a renewal programme for the Andalusian marine fleet.

The area of freight and passenger transport on the sea has been traditionally left out of mobility policies. This measure seeks to incorporate innovative approaches in this sector in efficiency and renewable energy applications, such as the replacement of engines with others which have a lower fuel consumption, improved propulsion systems or innovations in fishing operations that use less fuel and encourage the introduction of biofuels.

Reference	Measure
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ME17 Promoting mobility plans in large industrial, commercial or service centres.

The measure includes the promotion of transport plans in large industrial, commercial and service centres and in companies with more than 200 employees, the appointment of an expert in charge of the management and promotion of energy studies for industrial transport companies, either for passengers or goods to improve the energy management of its transport fleet.

This measure is completed with the development of specific training programmes for the efficient driving of professional drivers of cars and industrial vehicles, specific training programmes for experts in the efficient fuel management in transport fleets.



Reference	Measure
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ME18 Increase the number of bio-fuel petrol stations in the Andalusian Autonomous Community.

So that the routine use of biofuels is normal and takes off requires the commitment of the distribution companies to make as many petrol pumps as possible available for citizens and conduct dissemination campaigns on their existence. Biofuel pumps with a high degree of mixture of B-100 and E-85 will be made available.

Action line "Social dissemination of the incorporation of the new energy culture to the production system"

Reference	Measure
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ME19 Develop training plans aimed at teaching technicians on energy in buildings.

It aims to have a bearing by reducing the lack of education that planners, site management and others involved in the execution of building projects have regarding their relationship with energy consumption: Technical Building Code, energy rating and certification, bioclimatic design of buildings, building materials, energy criteria in urban design, etc.

Reference	Measure
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ME20 Undertake training activities for companies in the renewable energy and energy savings area.

The measure examines the development of specific programmes to train experts in matters of energy management, as they are responsible for the implementation of energy management plans in large energy consumer centres.

It also examines the training of energy experts that respond to the demands of competitive energy services in different sectors.

Reference	Measure
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ME21 To promote the practical application of new energy technologies as a result of Andalusian research and dissemination of results obtained.

The Andalusian Regional Government intends to act as an application and media vector for the achievements attained in R+D+i by emerging Andalusian companies and groups, in the field of energy, which stand out in generating added value in technological applications and business excellence.

Reference	Measure
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ME22 To promote the start up of Corporate Social Responsibility companies which include an energy side.

This measure seeks to promote the start up of outstanding management protocols in companies, based on the orientation towards efficiency in processes, involvement of people in continuous improvement and innovation and integration of the social awareness aspect with respect to energy saving resources.



Reference	Measure
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ME23 Design and regulate the access conditions for a seal that certifies the quality of equipment and renewable energy facilities.

This measure examines the incorporation of a quality seal in Andalusia for all renewable energy equipment and installations, which guarantees the production process of its main components, the design of the installation and its assembly. The first phase will set out the guidelines to be met by equipment and facilities, so that the second phase continues with a certification process.

Reference	Measure
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ME24 To develop a legal framework that will authorise the use of an energy efficiency seal by companies with a high energy rating.

This measure examines the development of a legal framework that allows companies, which prove to have high energy efficiency in their energy certificate, the use of an energy efficiency seal on their products or communication campaigns. Existing industrial centres will be able to be eligible for this energy efficiency seal once they can prove their high energy efficiency by obtaining the corresponding Andalusian energy certificate.

Reference	Measure
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ME25 Set up awards for efficient management and incorporation of renewable technologies.

This measure examines the recognition of business projects that stand out with their incorporation of renewable technologies or in their efficient management of production processes or in the development of their service.

Action line “Promotion of innovation and research in the energy area”

Reference	Measure
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ME26 To promote an Advanced Technological Centre for Renewable Energy - CTAER.

It aims to promote research in the field of renewable energies by the joint action of Government and businesses, thus creating the CTAER foundation.

The Centre will work on innovative energy projects such as: off-shore wind power, tidal power, geothermics, use of new materials, generation, storage and hydrogen use, etc

Reference	Measure
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ME27 Encourage the use of innovative sustainable energy solutions.

This measure pursues to financially support companies wishing to incorporate into their production and management processes solutions that increase the balance in energy solutions towards savings and efficiency in energy consumption, and which have a highly innovative character as an initiative catalyst based on knowledge.

Reference	Measure
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ME28 To boost the incorporation of ICT's to improve energy management.

The actions are aimed at energy management in industries and companies in the services sector as well as in fleet management of passenger and freight transport companies.

Reference	Measure
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ME29 To carry out sectoral studies that will serve as a basis to identify the technology improvements applicable to each subsector.

The ongoing search to identify barriers for each different subsector of the Andalusian business network, with regards to the efficient management of energy consumption and innovation in production processes, requires a previous diagnosis to be considered when applying this measure.

Reference	Measure
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ME30 To enable the development of new renewable technologies in Andalusia.

Future technological development will lead to the appearance of new technologies to exploit renewable sources. This measure intends to open the way to attract the implementation of these technologies in Andalusia in order to drive innovation in energy matters.

Reference	Measure
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ME31 Conduct studies of the implications the development of the sectors linked to renewable energy and energy savings and efficiency will have on employment.

The development of the business network connected to renewable technologies and energy savings and efficiency will have a positive impact on business competitiveness and job creation. The realization of economic and employment prospects will be the subject of these studies.

Reference	Measure
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ME32 Advise companies and research centres in the commercialisation of results in energy innovation, on a knowledge and equipment level.

It is essential to channel in its development, all technological development work in the energy sector, starting with basic research, to then pave the way for the incorporation of Andalusian companies into a fully competitive market.

Reference	Measure
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ME33 To promote the development of patents for energy products.

Setting up patents ensures the intellectual property rights of the products or systems developed. Currently the number of patents established by Andalusian scientists, technicians or companies is not very high. It is necessary to encourage these, setting up channels that allow access to establish patents by any Andalusian citizen or company.



Reference	Measure
ME34	To encourage the participation in innovative energy projects by research centres, businesses and other Andalusian organisations in cooperation with other organisations from the State, European Union or third party countries. It aims to promote cooperation and the training of stable clusters that foster significant progress in the innovation of energy matters in Andalusia. It aims to have a continuous and important presence in the different national and European research programmes.

Reference	Measure
ME35	To promote Andalusia abroad as an area for activities in research and development. To take part in international forums to disseminate the advantages of the Andalusian Community with regards to climate, research centres, availability of qualified professionals etc., to house the research and development activity in new energies.

Reference	Measure
ME36	To create networks among universities, research centres and Andalusian companies, favouring the exchange of knowledge and technological transfers. This measure examines the promotion of contracts and technological cooperation agreements between companies and research centres and universities in Andalusia, the promotion of plans and doctoral programmes linked to energy sector companies and the development of a professional exchange programme in the Andalusian energy sector with companies in other parts of the world.

Action line "Support to set up a leading business sector in re-newable energy, energy savings and efficiency technologies."

Reference	Measure
ME37	To promote the collaboration of financial institutions in the development of energy projects through third party financing mechanisms. This measure hopes to involve banks in financing energy projects by developing financial instruments specially adapted to their needs. Furthermore, within this measure there will be a catalogue of financial instruments to support investments in energy savings for their dissemination among companies in the energy sector and banks.

Reference	Measure
ME38	To promote and attract investments aimed at starting up renewable technology and energy savings and efficiency companies. This measure intends to induce a business development opportunity in the business sector which promotes renewable energy and energy saving and efficiency in Andalusia. The objective is to attract investments aimed at starting up energy component factories in Andalusia.

Reference	Measure
ME39	To encourage the creation of investment companies for renewable technologies and innovative type savings techniques.
Investment in innovative energy technology is often capital intensive which is why we consider promoting business aggregation in companies, foundations and other types of investment support backed by the Administration. Existing incentive lines would be used as the main tool for this action.	

Reference	Measure
ME40	To develop diffusion and promotional campaigns among companies in the sector to publicise existing market opportunities in the field of new energy technologies and the competitive advantages achievable through R+D+i in this field.
This measure, which complements the former, allows the ability to value and transfer innovative Andalusian entrepreneurship, placing it at the forefront of technology and knowledge in equipment and advanced energy services.	

Reference	Measure
ME41	Creation of a Network of energy companies.
A network of energy companies is intended as a boost for Andalusian business in the energy sector, being the element through which it aims to promote the integration of all the Andalusian companies in the energy sector, promote innovation, development and technology transfer from research centres, facilitating the participation of Andalusian companies in globalised markets and strengthening, in short, the value chain of any industry or energy service in Andalusia.	

Reference	Measure
ME42	To set up a programme aimed at entrepreneurs, and particularly young entrepreneurs, to create energy service companies with the collaboration of the Territorial Support Network for the Entrepreneur.
This is to support the creation of Andalusian companies which come to meet the demand for these services, in view of the business opportunities generated under the new legal context (new European Union energy framework, Technical Building Code , Law of Renewable Energy Development and Energy Savings and Efficiency, etc..)	



7.3. THE “ENERGY AND ADMINISTRATION” PROGRAMME

In the new energy culture the public administrations must take on the role of true catalysts for the paradigm change, particularly local administrations whose work in implementing specific measures is key for the evolution speed towards the strategies based on efficient consumption of resources and a large scale use of renewable energy as a source of generation.

Where we should more strongly embody the promoting effect of governments is in the need to unite and integrate all efforts in feasible sustainable energy policies of good governance at all levels, that is, promoting a true **transversal energy policy**. Energy policies should, for example, be actively incorporated into the spatial planning process from the start, introducing into the energy dimension the basic decisions of urban growth and planning of uses to guarantee a balanced and sustainable development in the cities.

It is unacceptable that energy supply is a contribution that comes after territorial and urban planning simply to meet anticipated demands.

Action Line “Incorporating energy efficient management and integration of renewable energy into the administrations”

Reference	Measure
MA1	<p>Development of the Andalusian Regional Government’s Energy Network.</p> <p>Among the actions to be developed by the Energy Network in the consumer centres attached to the Network the following are highlighted: a) carry out energy studies that allow us to assess the feasibility of the energy saving measures and use of renewable energy that can be implemented in their consumer centres; b) advice and training to implement current guidelines at any time; c) advice on general guidelines and technical specifications of relevant energy procuring; d) monitoring of energy facilities to ensure their energy efficiency; e) dialogue with energy companies in the procurement of supplies and equipment, and centralisation of incidents received from these companies to facilitate and expedite their resolution; f) promotion of public tenders to select and contract centralized energy supply services.</p> <p>Execution by the Network of the aforementioned services will require the development of a series of appropriate management tools (inventory, billing, monitoring, events) and communication between all those involved: technicians in charge from the government, Network, energy suppliers, etc. To do this, the construction of a Energy Network on the Internet is planned, where all public entities will have access, created as a tool by which to provide the technician in charge of the consumption centres the technical means needed to optimize the energy consumption of their facilities, reduce environmental impact and the impact on the historic and cultural heritage, improving the quality of public services and implementing the Andalusian Regional Government’s Savings and Promotion Plans for Renewable Energy.</p>

Reference	Measure
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- MA2** Diffusion of the Local Government's support lines in the field of energy improvements, which incorporate the Andalusian Regional Government's incentive programme for sustainable energy development.

It is essential to establish a comprehensive programme to be disseminated throughout Andalusia that will update and bring to the attention of local government the support for investment in energy improvement projects that can be implemented into municipal facilities together with the incorporation of renewable sources. Given the importance of public lighting as a major energy installation in a municipality, a special effort will be devoted to measures relating to the renewal of public lighting installations, incorporating regulation and control elements into these installations, or the incorporation of LED technology.

Reference	Measure
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- MA3** Promote the implementation of Energy Optimisation Plans in Andalusian municipalities.

Energy Optimisation plans carried out up to 2006 in more than 200 municipalities in Andalusia demonstrate the high potential of energy savings that currently exists.

The measure also includes the momentum to carry out energy optimisation plans, promotion of implementing investments in energy savings and efficiency in municipal facilities, as well as boosting renewable energy and diversifying the conventional energy sources used.

Reference	Measure
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- MA4** Promotion of urban networks for heating and comfort cooling in publicly promoted housing.

In line with this measure centralised networks for heating and cooling in new urban developments pertaining to the promotion of public houses, as well as centralised management systems with high energy efficiency in internal renovation processes, should be promoted.

Reference	Measure
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- MA5** To promote the undertaking of urban mobility plans.

Draft mobility plans in the metropolitan and municipal field: Boost the drafting of Sustainable Mobility Plans in territorial areas managed by transport consortiums at a metropolitan and town level, so as to ensure accessibility through public transport and non-motorised means.

Reference	Measure
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- MA6** Promote mobility energy studies for vehicle fleets that provide regular public transport passenger services to improve their management.

A proposal which intends to assess the current operating diagram of general use of public passenger transport, locating the potential to improve efficiency in the routes undertaken and its general management. In this measure undertaking of pilot schemes to improve public transport and its integration into other modes of transport are also considered.

Reference

Measure

MA7 Develop a programme to renew the vehicle fleet for urban public transport.

Fleet renewal of urban public transport vehicles of town/city halls or public companies who are in charge of urban public transport, powered by petrol or diesel, hybrid vehicles, fuel cells, propelled by natural gas or biofuels.

In this measure the incorporation of ICTs to improve the fleet management of public transport is also considered.

Reference

Measure

MA8 Use of biofuels in the vehicle fleets that provide general regular ongoing transport services to passengers, as well as the vehicle fleet owned by the Andalusian Regional Government.

The Andalusian Regional Government will incorporate biofuels into its vehicle fleet, as well as regular transport passenger buses that are included in Law 2/2007. An objective for 2010 to use 10% biofuels for buses and 15% in fleets owned by the Andalusian Regional Government has been set. Attention will also be given to the purchase of vehicles that accept biofuels in their mixtures (B-100 and E-85) and a biofuel pump network will be promoted to provide coverage to users.

Reference

Measure

MA9 Develop specific training programmes for energy efficient urban transport management.

Specific training programmes by experts in the efficient fuel management of public transport fleets and specific training programmes for efficient driving for professional drivers of the administrations or concessionary companies of a public service.

Reference

Measure

MA10 Develop a Municipal Ordinance Model for Energy Savings and Efficiency and use of renewable energy to be applied in the Andalusian municipalities.

The adoption of this measure would mean the organisation of a common council regulatory framework in Andalusia, which would set minimum criteria for energy savings and efficiency, as well as including renewable energy installations. The development of this measure would be undertaken in collaboration with the Andalusian Federation for Municipalities and Provinces (FAMP).

Reference

Measure

MA11 To set up energy awareness and information programmes aimed at government staff.

Among the actions to be undertaken would be to create an energy ethical code that would promote energy efficient behaviour guidelines for workers in the Andalusian Regional Government.

Reference

Measure

MA12 Search of financing lines for projects of local interest.

This measure intends to develop financial instruments adapted to fund energy saving and renewable energy projects for town/city halls. Amongst the projects to promote are the mechanisms for funding from third parties. There will be collaboration with financial institutions and the Andalusian Federation of Municipalities and provinces (FAMP) to develop this measure.

Reference	Measure
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MA13 Encourage “energy service” contracts in the exploitation of municipal facilities.

This measure seeks to improve the energy efficiency and management of municipal facilities by implementing proper energy management techniques to control energy consumptions.

Reference	Measure
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MA14 Incorporate energy efficiency criteria in public procurement or in the selection of concessionary public service companies.

This measure intends to incorporate energy efficiency criteria in the selection of any product or service needed to be contracted from any public administration.

Reference	Measure
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MA15 Includes energy efficiency criteria in electricity consumption equipment of the Catalogue of Approved Goods from the Andalusian Regional Government

The Andalusian Public Administration intends to take up certain corporate social responsibility criteria by paying special attention to being aware of high energy efficiency when buying equipment.

Reference	Measure
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MA16 To promote the figure of municipal energy manager and by creating a network of municipal energy managers.

This measure intends to promote the figure of technical advisor or consultant in energy matters who can actively and transversally advise in taking decisions in local administrations and in implementing municipal ordinances and energy optimisation plans.

Reference	Measure
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MA17 Develop a Municipal Energy Services Portal.

Proposes to incorporate into the corporate website of the Andalusian Energy Agency a specific portal to advise municipal energy managers in developing actions on energy matters.

Reference	Measure
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MA18 Publish guides on good practices to maintain facilities in Andalusian Public Administrations.

This is an accompanying measure to the above, so as to have an additional support tool for both government technicians as well as energy managers and workers in general.

Action line “Boost for the energy sector through the government”

Reference	Measure
MA19	Statutory Development of the Law to promote Renewable Energy and Energy Savings.
This measure intends to bring about the development of this Law on specific strategies, objectives and support measures in the least time possible. The regulations, in the first phase, will govern:	
a) The obligatory use of renewable energy in buildings of the Andalusian Regional Government.	
b) The obligatory use of biofuels in public transport buses that provide regular services for passengers.	
c) The energy exploitation of biogas.	
d) Setting up and regulating the Andalusian Energy Certificate for new buildings and industrial estates.	

Reference	Measure
MA20	Development of technical regulations applicable to renewable energy facilities in Andalusia.
This measure intends to bring about, improve and ensure the provisions and operating of renewable energy facilities that exist in Andalusia. The regulations developed will be applied to installations carried out in Andalusia, and should adapt to national and European ones, distinguishing them for our community in order to respond to the operation of the facilities due to our climate, building type, usage and type of facilities, etc..	

Reference	Measure
MA21	Create a specific administrative procedure to install solar photovoltaic energy in Andalusia.
This procedure intends to establish a standard for authorisation, project approval, declaration of public utility, construction, commissioning, modification, transmission and closure of photovoltaic grid-connected and isolated facilities, as well as their inclusion in the Register of production facilities under Special Regime.	

Reference	Measure
MA22	Development of administrative procedure using ICTs for streamlining authorization files of infrastructures associated with renewable and energy efficient technologies.
It aims to create and organise tools to manage cases related to savings, energy efficiency and renewable energy, in the Andalusian Regional Government.	

Reference	Measure
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MA23 Creating a Plan to identify Preferential Areas for Renewable Energies (APER).

Law 2/2007 to promote renewable energy and energy savings and efficiency in Andalusia defines the Preferential Areas of Renewable Energies (APER) as potential areas that are compatible for generation and renewable energy transformation infrastructures. This measure intends to identify these areas and analyse the renewable resources and feasibility of the exploitations. To determine these areas and their characterization it is necessary to take the territorial areas identified in POTA as obligatory reference.

Reference	Measure
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MA24 Create a programme to promote energy crops.

The measure examines carrying out a programme to promote energy crops, with participation from the private and public sectors, which will bring about agroenergy development in Andalusia.

Reference	Measure
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MA25 Undertake a biofuel programme.

The measure examines undertaking a biofuel programme that analyses raw materials, R+D+i requirements, production systems and final uses.

Reference	Measure
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MA26 To contribute from territorial and urban planning to reduce mobility needs, encourage the use of public transport, non-motorised transport networks and optimise the design of housing estates and buildings to improve energy efficiency.

This measure intends to achieve the correction of structural imbalances in territorial and urban planning which subsequently cause energy demand situations (residential and transport) incompatible with this Plan's objectives and with those defined for different territorial areas identified in the Territorial Model for Andalusia set out in POTA.

Reference	Measure
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MA27 Introduce an energy consumption assessment during the life cycle of developable areas under study, as sizing criteria of urban planning.

An energy dimension should be added to a city's design and dimensioning process, in order to assess the feasibility of the integral cycle (incorporating basic resources and emissions) of municipal urban growth and its compatibility with the PASENER objectives and the Andalusian Spatial Planning Plan. For this, solvent estimation modules by physical units and comparable criteria in the simulation should be fixed to establish limits that are necessary, if applicable, by the urban and territorial administration.



Reference	Measure
MA28	To contribute effectively so that territorial and urban planning instruments anticipate the reserves and organisation of uses needed to meet the requirements of the energy networks and infrastructures.
This is a measure to improve territorial and municipal planning procedures so as to integrate the backup requirements of land and proper coordination of use in the planning uses of energy networks and their associated infrastructures, consistent with the territorial model defined in POTA.	

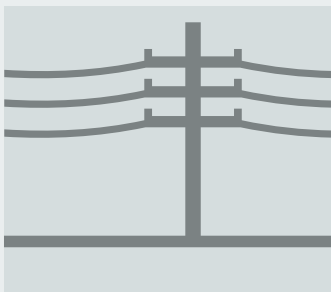
Reference	Measure
MA29	Conduct studies of the implications that the development linked to renewable energy and energy savings and efficiency would have on health.
With proper coordination amongst the Ministries and other affected organisations, there will be studies on the potential impact on health and these will consider the effects of:	
a) The impact of biofuel emissions on the transport sector versus those from fossil fuels.	
b) Minimum air renewal to avoid sick building syndrome and how this affects energy efficiency.	
c) Research on substituting current equipment that has a risk of Legionnaire's disease developing by other efficient ones with less risk.	
d) Beneficial effects of using clean technologies with renewable energy and avoiding pollutants produced with the conventional fuel processes.	
e) Effects of the concentration of conventional generation in specific areas, against others with less concentration.	

Action line “Approach to the Society of Knowledge through re-
search and innovation in the energy area”

Reference	Measure
MA30	Encourage the incorporation of ICTs. Incorporation of ICTs to improve the management of public transport fleets and energy management in the administrations. Dissemination of the advantages that are generated through the use of ICTs by reducing energy consumption in a public administration. The use of ICTs is also considered to speed up the administrative processing of renewable and efficient technology projects.

Reference	Measure
MA31	Maintain and expand the functions of the Energy Assessment and Monitoring Centre. This measure intends to improve the quality of energy services in Andalusia.





7.4. THE “ENERGY INFRASTRUCTURES” PROGRAMME

Spatial planning and operation of transformation, transport and distribution of energy structures, should evolve from a model based on large production centres, towards new local energy generation and consumption on site, which increasingly involves renewable energy.

The guarantee of supply and setting up a system of infrastructures for the transformation, transport and distribution of efficient energy which respects the environment are this programme’s foundations.

Action line “To guarantee a quality energy supply to all Andalusian people and promote a system of infrastructures that are efficient, clean and distributed all over Andalusia, which promotes economic development and always maintains the premise of respect and conservation of the environment”

Reference	Measure
MI1	Regulate through a Decree the actions to improve electricity supply to the Andalusian people. This measure intends to develop the regulatory base needed to improve the quality of the electricity supply in Andalusia, develop the legal regime of electrical supplies and regulate the rights and obligations of the users of the electrical service.
Reference	Measure
MI2	Provide piped natural gas to all urban built up areas located on the coast and to regional centres. Take the natural gas network to the capitals of Cádiz and Almería as well as expanding the infrastructure to distribute natural gas to all the coastal areas and regional centres, considering it as a basic infrastructure for its socioeconomic development.
Reference	Measure
MI3	Promoting local networks using Liquefied Natural Gas (LNG) and Liquefied Petroleum Gas (LPG) for territorial areas away from the natural gas network. This is to encourage companies to extend piped gas through LNG satellite plants or LPG to those municipalities, which due to their location in the territory are not likely to be integrated into the national pipeline network due to costs, with a particular impact on Networks of Rural Settlements as set out in POTA.



Reference	Measure
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MI14 To undertake an approach Programme of natural gas infrastructures to take it to Andalusian production areas.

The feasibility of taking natural gas to locations where there are production sectors with a high energy demand within the framework of this Programme will be analysed.

Action line “Knowledge for the efficient management of the infrastructure system”

Reference	Measure
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MI15 Expansion of the Andalusian Energy Information System.

This deals with improving and extending the information and management tool of the Energy Assessment and Monitoring Centre, integrating the energy subsectors that operate in Andalusia in its subsequent stages.

Reference	Measure
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MI16 To set up collaboration agreements with energy companies for disclosure of inventory data, measurements, network states, system capacities, incidents, action plans and emergency plans.

The measure’s aim is to get to know the energy system better to serve as a base for the development of infrastructures and finally improve and ensure energy supply in the region.

Reference	Measure
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MI17 Maintain and improve monitoring and analysis of electrical supply incidents in Andalusia.

The measure hopes to achieve detailed knowledge of the power supply situation in Andalusia, as well as detect deficiencies to improve the quality of supply.

Reference	Measure
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MI18 Develop an on-line information system on the generation of electricity under Special Regime in Andalusia.

This measure’s aim is to know in real time the coverage in electrical demand in Andalusia from renewable sources and efficient technologies found under the Special Regime.

Reference	Measure
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MI19 Promote the creation in Andalusia of control centres to monitor Special Regime generation.

This measure intends to attract the installation of control centres to monitor the generation under the Special Regime as obliged by the Royal Decree 661/2007.

8





The Plan’s Impact

This Plan is distinguished by its innovative character. A cycle change in energy history is occurring and Andalusia has the opportunity to star in a new model to meet its current and future energy needs and try to make the most of them by triggering deep changing events in its role in the international context.

This new model is based on assessing the feasibility of the new energy demands and in adapting the whole system to the specific conditions of Andalusia, in the environmental as well as the territorial field.

In the different sections the potential positive and negative effects of the various actions scheduled in the Plan are seen, although the overall impact the implementation of rationalisation and modernisation measures of the energy system will have in line with the implementation of the new energy model is clearly positive.

The impact of these actions on different sectors can be summarised as set out in the following table.

The implementation of rationalisation and modernisation measures in an energy system will be very positive

Chart 27

SECTOR	RATIONALISATION	NEW ENERGY MODEL
AGRICULTURE	Optimisation of transport Greater social recognition	Supply of biomass for thermal or electrical use
	Rationalization of consumption in the climate control of greenhouses and reduction of greenhouse gases	Biofuel energy crops
INDUSTRY	Greater energy self-sufficiency. Cogeneration	Innovation in processes and products adapted to the region's climate
	Reducing the effect of greenhouse gases (especially cement and brick works)	Development of the Andalusian energy conglomerate for new materials
	Greater social recognition. Energy certificates	
URBANISM AND BUILDING	Greater energy self-sufficiency. Renewable energy	Energy feasibility in non-endogenous urban developments
	General improvement in quality due to the increase of distributed generation	Development of the city model adapted to the region's weather
	Improvement of costs through energy savings and efficiency in building	Innovation in processes and products adapted to the region's climate
		Recovery of the compact city model
SERVICES	Improvement of costs through energy savings and efficiency in shops and the catering industry	Innovation in processes and products adapted to the region's climate
TRANSPORT	Improvement of costs through energy savings and efficiency in vehicles and mobile material	Urban planning with less mobility
	Improvement of the general efficiency of urban transport by supporting public transport	Substitution of car fuel by endogenous sources. Biofuels Non motorised transport
	Reduction of greenhouse gases	
DOMESTIC	Reduction of family's costs by changing saving and efficiency habits	Greater efficiency in energy use
	Greater energy self-sufficiency. Renewable energy	

The Plan's impact can also be seen in the following manner:

Chart 28

	LINES	ACTIONS
Consolidated energy policy	Reduction of external energy	Promotion of renewable energy
	Contribution to the reduction of emissions	Promotion of energy savings and efficiency
		Substituting conventional thermals for combined cycle
	Improving the quality of service	Promotion of gasification
		Reduction in losses
	Demonstration effect by the public administration	Support of energy management improvements in municipal services
		Optimisation of the autonomic administration
New energy policy	Control of non-viable demands	Urban planning and large consumers
		Inclusion of energy assessment in urban plans and infrastructure projects. Sustainability Report
	Reduction of greenhouse gas emissions	Substitution of fossil fuels. Capture and storage of CO ₂
	Incorporation of the control in car consumption	Promotion of biofuels
	Social recognition of optimising management	Energy certificate
	Promotion of a productive Conglomerate	Strategic policy
	Greater spatial correspondence between production and consumption	Distributed generation, regional networks
	Convergence of autonomic policies	Territorial plans, environmental assessment, productive promotion
	Adapting management	Design of a system with greater flexibility
		Monitoring systems for basic processes, early warning
	Consolidation of the public sector as promoter and diffuser of the new energy model	Development of the Andalusian Regional Government Energy Network
		Incorporation of energy savings and efficiency in urban planning and mobility, in buying goods or contracting services



8.1. GENERAL IMPACT ON ECONOMIC AND BUSINESS DEVELOPMENT

The Plan's implementation will mean a great activation of the business sector in Andalusia, encouraged by an incipient rearrangement in the market of companies related to the energy sector.

In the coming years, the implementation of the various lines of action set out in the different Programmes that shape energy planning in Andalusia over the next seven years, as well as the legal context in which the energy sector will be developed, will lead to an expected increase in demand for energy services by different consumer sectors as well as new market opportunities.

The creation of the mandatory Energy Certificate for consumer centres with a certain level of primary energy consumption, derived from the Law to promote renewable energy and energy savings and efficiency of Andalusia, along with energy audits, plans requiring preventive maintenance of equipment, processes and facilities or the introduction of new regulatory procedures and control systems and hot water generation with renewable energy; the energy certificate for buildings such as included in the Directive regarding the Energy Efficiency of Buildings, which sets out the regular inspection of boilers and air conditioning systems; obligations to limit emissions in the activities covered by the trade for emission rights, etc., will generate large investments in energy actions.

In this scenario the promotion of a wide range of quality energy services will in turn create an increased demand for them. This will create a business conglomerate that includes the design and production of energy-efficient technologies and equipment, developing its own ways and adapted to produce renewable energy by making the most of the comparative energy advantages of Andalusia, the financing of investments in energy projects and providing services in final energy use.

The consolidation of this energy market based on the creation of a sound network between the business sector and potential clients in the energy field will offer added value to all the agents in the Andalusian energy market, promoting a healthy business competition that favours the quality of the energy services.

As the stronghold of this competition is the development of the technological and the R+D+i offer. Energy companies will take on new responsibilities and will redirect their marketing strategies, maintaining the advantages that could be yielded from the boost in innovation and technological development in the energy efficiency field and the diversification of energy through renewable sources.

A healthy business competitiveness will be promoted that will develop the technological R+D+i offer

The consolidation of a cluster of companies with these characteristics will create an excellent improvement opportunity for Andalusian business competitiveness, contributing to economic growth and creation of jobs.

Andalusia has already successfully achieved the implementation of a network of installation companies in the solar energy sector. For this, the Andalusian administration played an important role in the consolidation of this sector. The creation of a Network for Companies in the Energy sector, under the framework of the portal of the Ministry of Innovation, Science and Enterprise, will be created as a dynamising instrument of the energy sector, this is the first step, which will then be followed by the design and set up of a cluster of energy companies.

The commitment by Andalusian companies for innovative energy efficiency, as well as the reduction in the energy bill as a consequence of the rationalisation of energy consumption, will mean an increase in production caused by the acquisition of more technologically advanced equipment, which will make a favourable impact on the balance sheets of these companies. So, the declining trend for energy intensity, predictable in Andalusian companies with the Plan's creation, will be established as an implicit stimulus to boost companies in the search and acquisition of efficient equipment and machinery. The multiplier effect of this impact will consolidate an energy attitude of companies according to sustainable development criteria.

8.2. IMPACT ON THE ENVIRONMENT

The links between economic development, ecosystems, global change and energy policies, are the basic aim of a proper strategy or planning in environmental matters. This principle framework is developed in agreements such as the EU Strategy for Sustainable Development which was agreed by the European Council that took place in Gothenburg (Sweden) in June 2001 and that was taken to the World Summit on Sustainable Development in Johannesburg (South Africa) in 2002. This international commitment in support of the inclusion of the environmental dimension in the social and economic field, has special relevance in the field of energy in the Strategy, which defends the need to prevent, confront, control and revert the problems derived from global warming and degradation of the natural systems. Hence we should consider the urgent need to stop climate change and strengthen generation using renewable energy sources as a specific measure.



The justification to incorporate a new energy culture is supported by the change of the model for generation and energy consumption, in a new direction in terms of mobility and transport, in an in-depth analysis of the urban plan for built up areas (both in the territorial development model as in the construction techniques employed), and the design of new management methods for natural resources, based on a better understanding and predictability capacity of the impacts and effects exerted on the environment, especially on a global scale.

In the Environmental Prevention field, the Andalusian Regional Government approved Law 7/2007, of 9th June, on Integrated Management of Environmental Quality. It proposes to update the control on the incidences and impacts on projects and infrastructures in the energy sector in the light of developments in the sector, new technologies and international constraints. As stated in its section, in the Statement of Purpose, the Law "... attempts to answer the three dimensions of the sustainable development concept - environmental, social and economic- overcoming the original sectoral rules for the protection of a clean environment, which are insufficient today."

8.2.1 Effects on the environment and public health

This plan was created under the principle of sustainability and therefore, it is totally filled with the need to guarantee the highest level of contribution to the energy system from renewable resources and minimize the harmful effects on the environment and public health.

With regards to the sustainability principle, PASENER promotes renewable resources and helps the natural environment and public health



CO2 emissions avoided

Energy saving and efficiency measures and greater generation with renewable energy will avoid the emission into the atmosphere of an important amount of greenhouse gases in the Andalusian Community.

The CO2 avoided due to the Plan until 2013 will rise to 11 million tons²⁴. During the years the Plan is in force, the CO2 avoided due to annual savings in actions and assumptions of new installed capacity in renewable energy and power generation with this source, as well as the anticipated demand from renewable sources for thermal end use, is included in the following tables:

Chart 29
Thousands of tons of CO2 avoided per year - energy savings and efficiency

2007	2008	2009	2010	2011	2012	2013
704	522	485	483	491	487	490

Chart 30
Thousands of tons of CO2 avoided per year -renewable energy

2007	2008	2009	2010	2011	2012	2013
1,648	675	1,257	865	1,262	546	972

SOURCE:
Andalusian Energy Agency

NOTE:
CO2 emissions avoided, calculated based on the annual increases in demand planned for 2007 to 2013 for final thermal use and to produce electricity with renewable sources.

Total CO2 emissions avoided due to carrying out the annual energy savings and efficiency measures and the actions planned for renewables are listed in the following table:

Chart 31
Thousands of tons of CO2 avoided per year

2007	2008	2009	2010	2011	2012	2013
2,352	1,198	1,742	1,348	1,753	1,033	1,462

Chart 32
Thousands of accumulated tons of CO2 avoided

2007	2008	2009	2010	2011	2012	2013
2,352	3,549	5,292	6,640	8,393	9,426	10,888

SOURCE:
Andalusian Energy Agency.

24 Emission factors considered in the calculation for thermal uses are taken from the GHG Inventory Report 1990-2004 (May 2006) (Table A8.2. - Commission Decision 2004/156/EC guidelines for monitoring and reporting), sent by Spain to communicate to the United Nations Secretariat of the Framework Convention on Climate Change. In electricity generation CO2 emissions avoided are calculated comparing them to those with a combined cycle with natural gas, excepting those that are calculated with generation in a coal fired power station.



Reduction of other gases

The increase in the implementation of renewable energy, energy savings and efficiency measures, the gradual substitution of coal with gas in new combined cycle power plants together with the construction of hydrodesulfurization plants, will mean reducing other gases related to fossil origin related sources, mainly coal and oil. These reductions will be particularly important in the cases of SO₂ and NO_x.

To contribute to reducing emissions is a firm commitment of the Plan

The reduction in the emission of other precursor gases of tropospheric ozone formation (CH₄, NO₂, COVNM, and CO), could mean a considerable improvement in the air quality indexes in those areas where these events more frequently occur, large urban crowds, grouping of certain industries, etc.

City traffic in large Andalusian cities counts for around 83% of all the CO₂ emissions and 57% of NO₂ ones. It is therefore in this diffuse sector, due to the complexity in regulation and control, and the inter-administrative coordination that it demands, where one should concentrate the greatest efforts in the redeployment of measures aimed at reducing emissions. With regards to gases responsible for acid rain, the measures adopted by the automotive industry in recent years linked to the effect of the Renewal Plan have been effective in terms of cutting down the production of these.

Industrial facilities are responsible for 90% of SO₂ emissions and 37% of NO_x, and within these, two activity sectors are the origin of 70% of them: the energy sector (40%) and

A cleaner and more
efficient energy
system benefits the
environment, public
health and cultural
heritage

petrochemical industry (31%).²⁵ Besides these two sectors there are other sectors that present problems with these types of emissions such as: metallurgy, paper, cement or agribusiness. The urban phenomenon that the Community has experienced, has raised emissions linked to mineral processing industry, quarrying and construction materials (bricks, tiles, ceramics, etc.) considerably.

Law 16/2002 on Integrated Prevention and Control of Pollution, together with the detailed rules regulating limit values, thresholds for warnings and information, supported by the Automatic Measurement of Emissions Network, currently means there is a set of management tools for the Andalusian Regional Government, on whose basis specific plans and strategies to reduce emissions can be drawn up.

Effects on public health

The interactions between climate change and human health are multiple and complex. The effects derived from climate change²⁶ could be summarised as: changes in morbidity-mortality relating to temperature (effects of heat waves, particularly in children and those over 65 years old, geographic extension of sub-tropical disease vectors, etc.), effects on health relating to extreme weather events, atmospheric pollution and the increase in associated health effects, such as usual episodes of tropospheric ozone concentration in the urban environment, diseases transmitted through food and water and diseases transmitted through infectious vectors or rodents.

The concentration of facilities generating electricity in port areas that are accessible to supplies of raw materials (coal and fuel) have led to air quality situations of risk. Despite the reassuring findings of epidemiological studies conducted in some of these areas, there is no doubt that it is clearly preferable to eliminate the risk or reduce it significantly.

The measures taken in this Plan to support the reduction of private car use, or the substitution of conventional fuel with biofuels in cars, should result in the reduction of air pollution in the large cities of Andalusia and reduce the different conditions that affect public health arising from this situation.

²⁵ Source: Environmental Plan 2004-2010

²⁶ According to the classification in the National Plan to Adapt to Climate Change, from the Spanish Office for Climate Change, Ministry of the Environment.



It is especially important when referring to public health, the control and limitation of particles in suspension, with many sources of origin (natural, building, sub-products of fuel motors, wear and tear from tyres, etc).

Effects on the Andalusian natural environment and on cultural and historic heritage

The increase in the exploitation of renewable energy resources such as wind, are linked to a greater risk of affecting the natural heritage, due to the need of them being implemented in non-urbanised areas. The procedures which are taken into consideration more and more are criteria for integration into the environment of the large aerogenerators, due to their possible effect on the birdlife, as well as affecting clearings and landfills, and in the case of marine wind power, through effects to the environment that are less known (the effect on benthic communities, fish fauna, cetacean populations, etc).

The implementation of photovoltaic and thermo-electric solar parks requires an extensive occupation of land. In the majority of cases, the best locations for these types of installations are on agricultural type land, where the associated impacts are of little relevance. The requirement for flat land and the need to have environmental studies undertaken, explains the trend to dismiss forest type locations.

The transport and distribution lines for electricity have given rise to one of the main effects to the bird population, due to the risk of electrocution and collision in the old installations. The existing regulations on this matter have significantly reduced the mortality of birds.

Power lines also have a series of effects on the vegetation. The layout of the power lines require land clearing, which can have a significant negative impact on lines that cross sensitive areas of special value. Furthermore, the presence of power lines is associated with increased risk of forest fires, which on the other hand justifies the clearing of vegetation required for its installation.

However, we should note a positive effect on the natural environment resulting from the development of forestry and agricultural land due to the exploitation of biomass and the increase of energy crops (biomass, biofuels), which will allow us to correct the negative effects of abandonment of cultivation in marginal lands, contributing to an important role in soil conservation and erosion control. Particular attention should also be paid to the strategies that promote an internal Andalusian biomass market so that this resource is not charged with the economic and environmental costs (emissions) associated to logistics (transport and distribution).



The protection of natural wealth is as important as the protection of the valuable historic and cultural heritage of Andalusia. Any action promoted from this Plan should include the analysis of how heritage sites are affected. It is probable that these effects will have a positive impact, in particular on the urban environment as the energy system, energy saving and efficiency strategies or those for mobility are closely linked to air quality which is a key factor to consider when dealing with the conservation of historic sites and heritage properties.

As listed in the targets set out in the Strategic Plan for Culture in Andalusia (PECA) or the Defensive Architecture Plan of Andalusia (PADA), it is necessary to establish new types of protection which link Heritage and Planning, complete the known inventory of historic buildings, determine their actual and updated conservation status, establishing measures and priorities for action and intervention, setting lines to protect property and its environments, lines of research, diffusion lines and lines of cooperation on this important heritage. It is therefore particularly important to consider all this in light of the objectives of the planned expansion of transport networks for infrastructures and energy distribution all over the regional territory. The continuity of different heritage elements in a specific



territory, their interaction with the landscape and ways of life is a new outlook that should be faced from research viewpoint and also from the new ways to protect it.

The adoption of the PASENER 2007-2013 proposals must bear in mind the new boost that must be given to territorial planning on Cultural Heritage and the cooperation among agents acting on the territory, and it is therefore essential to develop integrated action policies to maximize synergies and stimulate sustainable development of our society.

8.3 EFFECTS ON OTHER PUBLIC POLICIES

The Plan's impact is expressed on two very different levels: the immediate effects on the environment, already mentioned in the previous section, on employment and income, on innovation and urban planning, on the one hand; and the effects on the economic-territorial structure of Andalusia and the welfare of the Andalusian people on the other.

LEVELS	MATTER	EFFECTS
IMMEDIATE	Employment	Employment associated to investment. Employment associated to exploitation.
	Added value	In investment. In exploitation.
	Environment	Greenhouse Gases (GHG).
		Other emissions.
	Environment	Environment: birdlife and habitat.
	Public health	Recovery of atmospheric conditions in saturated areas.
STRUCTURAL	Research and development	New implantable and exportable processes.
		New implantable and exportable products.
	Land Use Planning	Rationalisation of new developments.
	Competitiveness	Strengthening the robustness of the productive system.
		Differentiation of goods and services.
		Opportunity for the Andalusian energy conglomerate based on the new energy model.
	Welfare	Reduction of vulnerability and dependence.
		Strengthening of identity.
	Safety of the energy system	Greater level of self-sufficiency.
		Increase in response capacity.
	Territorial structure	Balance of use and exploitation.

Chart 33

To innovate is an essential requirement to evolve towards a sustainable energy model that is adapted to Andalusia's specific conditions

Effects on innovation

With regards to innovation, the Plan generates a range of benefits, either direct type, such as obtaining patents or rights of various types of usables in business opportunities, as well as indirect ones related to the renewal of organisational processes and the incorporation of differentiator elements.

The energy sector is one of the Andalusian economic sectors where R+D+i holds the greatest importance and stands out. The largest part of the innovative activity in the energy sector is in the field of renewable energy.

Energy innovation means that at the same time there is a challenge and future opportunity for Andalusia. To innovate is an essential requirement to evolve towards a sustainable energy model adapted to Andalusia's specific conditions. In the field of new energy technologies Andalusia starts off with certain competitive advantages, but still must overcome a number of obstacles for energy innovation to reach the enormous potential it has in Andalusia, to which the relationship between investment in R+D+i together with commercially exploitable competitive advantages would be a strong supporting factor.

This Plan's pledge for innovation and the apparent uniqueness of the energy model are going to contribute in establishing Andalusia as a reference region in the fields of new sustainable energy technologies, achieving a high degree of technological independence in the use of autochthonous energy resources and turning this activity into a pillar of intense, sustainable and fair progress.

Effects on urban planning

This Plan's impact on Andalusian urban planning is probably one of its main innovations. Among the effects that have been identified, those that contribute directly to the fulfilment and development of the Andalusian Urban Planning Plan's objectives (POTA) and other types of specific effects that are not directly linked to this Plan, must be characterised. The effects are the following:



POTA's OBJECTIVES	PASENER's EFFECTS
<div>1. Consolidate a Town System in Andalusia that is functional and territorially balanced as a basis to improve the region's global competitiveness, the development and dissemination of access that is equal to facilities and services.</div> <div>2. Define a coherent regional framework for plans and programmes with urban impact, providing criteria for the inclusion of spatial variables to the objectives of these plans and programmes.</div> <div>3. Contribute with urban policies to generate sustainability of the system.</div> <div>4. Favour social cohesion and quality of life in Andalusian cities.</div>	<div>• Contribute to the Andalusian energy system with the interrelation of the Andalusian urban system.</div> <div>• Adding the dimension of energy sustainability in spatial planning in the region.</div> <div>• Improvement of energy accessibility and reinforcement of the strength of welfare supported by a better adaptation to specific conditions in Andalusia.</div>
44.3. Improve the ecological balance of towns regarding the cycles of consumption and processing of natural resources (water, land, energy and materials).	Energy feasibility of non-endogenous urban developments.
53.g) Sizing the offer and use of tourism space in response to the load capacity of the territories and actual access to scarce natural resources, particularly water. The new developments should justify and guarantee the necessary amounts of water and energy.	Energy feasibility of non-endogenous urban developments and water desalination.
OTHER TERRITORIAL EFFECTS	
Recovery of agricultural land thanks to planting up of large surface areas with energy crops.	
Increase in value of biomass and generation of new activities in rural areas.	

Chart 34

Effects on employment

As a consequence of the measures proposed in the Plan, the Andalusian Regional Government will make its own investments, will induce business investment and will promote the emergence of new activities in generation, transport, distribution and maintenance of facilities. Likewise it will contribute to generating employment and added value in research and development of processes and products in the advanced technological services field.

Achieving these objectives in renewable energy will mean important investments will be made, new companies will be created and there will be specialisation of others, which currently devote themselves to other activities, as well as the creation of jobs that are technologically very advanced. What stands out in this regard is the case of solar thermal energy; due to the obligation represented by the inclusion of these installations in buildings (as listed in the Technical Building Code) this will induce the creation of new businesses to meet future demand.

On the other hand, the promotion made from the Plan for biomass for thermal uses will mean an important opportunity for installer companies as well as service and maintenance companies, which will be created and consolidated to cover the offer due to the increase in electric energy from biomass.

The Plan will positively affect the economy and employment, which will have a stable and distributed technological component



The building of planned wind power plants in Andalusia will require the presence of assembly and later maintenance companies. These activities represent opportunities for local companies. It will also give an opportunity to other types of companies who deal with the manufacture of parts for aero-generators and the development of control systems. There is a similar situation in photovoltaic installations as in wind power ones.

Thermal facilities allow Andalusia to be at the forefront of this technology due to developments that have been made, especially with the existence of the Solar Platform of Almería. This research centre has allowed this type of energy to take off and enjoys recognition all over the world.

The agricultural sector will also be favoured by the boost of renewable energy. The production of biofuels will especially be of influence, as they require large amounts of raw materials (generally oilseeds, cereals and biomass). The production of energy crops has become the focus that will allow the increase and achievement of the objectives pointed out for biomass technologies (electrical, thermal and biofuels).

The employment that will be created will generally present characteristics with a high technological component, which is stable and above all distributed among rural and urban areas. During the plan's total term, it is anticipated that 105,000 jobs will be created.

In renewable energy labour activity, two types of jobs are distinguished: those that are permanent due to the operation of the plants, normal facilities, equipment sales, manufacturing, etc. and others which are temporary as occurs with the large civil works that must be undertaken (for example in the case of wind power, biomass power, biofuels or thermo solar). Out of the total employment generated 23% belongs to permanent employment and 77% to temporary.



Wind power, due to the need to undertake large works for its installation, will take up 68% of the staff, reducing the number of staff for this activity at the end of the period and therefore to the corresponding overall employment in renewable energy.

Moreover, the revitalization of the business network as a result of increased demand for energy services, which will mean the development and optimization of energy and demand management, will entail a negligible boost to job creation and consolidation, which is primarily regional. Energy companies will require a lot of qualified staff to be able to face the new horizon that is perceived in the energy sector as the actions identified in the Plan are undertaken.

In Andalusia there are precedents in the energy field of job creation and consolidation. Thus, conducting Energy Optimization Plans (POE) in many Andalusian towns has consolidated the creation of a large number of energy service and equipment companies that provide their services in the local area.

The role that applying the European Directive 2002/91/EC from the European Parliament and Council, of 16th December 2002 will have on the building sector should also be highlighted, as it establishes the obligation of all European Union member countries to have an energy certificate available to all buyers and users of a building, this is recognised by the Administration, and informs on its energy efficiency, as well as reporting on the periodic inspection of boilers and air conditioning systems.

As well as the generation of employment associated to this process, many companies specialising in energy for buildings will be created, companies which presently there are a lack of. Only in Andalusia, according to the research undertaken by the Andalusian Energy Agency, the implementation of the Directive could generate up to 4,000 direct quality jobs (qualified workers).

According to estimates from the European Commission (SAVE Programme) the creation of between 10 and 20 new jobs for each million Euros of the total investment in energy efficiency are anticipated. The investments derived from this Plan, with government support, will therefore result in the creation of between 2,500 and 5,000 new jobs.

8.4. STRUCTURAL EFFECTS

There will be a series of effects from the application of the Andalusian Sustainable Energy Plan, which will contribute to a substantial change in the economic-territorial structure of Andalusia. These effects will refer to the following issues:

The Plan will encourage the creation of many companies that specialise in energy for buildings

It is essential to innovate
with new materials
to generate energy
effectively and efficiently

a) Improvement in competitiveness

The Plan examines a complete series of measures aimed at innovating the Andalusian production system, providing the greatest level of dissociation of energy inputs in products and processes, on the one hand, and undertaking a particular effort in adapting to specific conditions of Andalusia, either in weather, water or materials. This way there will be a reduction in the cost structure of production units, but above all there will be a strengthening in the robustness of the production system that will result in an improvement in the company competitiveness.

On the other hand, the innovation measures directed at adapting to the specificity of Andalusia and the adaptation of the Energy System itself will contribute to the differentiation in the region's goods and services.

The Plan examines a complete series of measures linked to the configuration of a new energy model. Not only must we develop technology to generate energy effectively and efficiently with the Andalusian conditions, but we must innovate in new materials which are better adapted to these conditions and the way of using these. The development of valid technological solutions for this approach, the acquisition of new abilities to provide technological services and generally forming a complex and connected nucleus of companies put together to provide goods and services of this kind, creates an excellent opportunity for the Andalusian energy conglomerate, not only for its consolidation in the region, but also in taking up a leadership position in the climate field and in other areas in the world which have similar conditions (Central America, South America and Africa.) In the new energy model, Andalusia must stop being an importer region of fossil fuel resources and become an exporter area of knowledge and technologies to exploit renewable resources and the efficient use of energy.

b) Improve the Andalusian people's welfare

The growing association between welfare and energy consumption generates a risk position for the Andalusian people, when faced with a potential hardening of energy consumption conditions. Measures that tend to reduce the vulnerability and dependence of welfare with regards to energy consumption are adopted in the Plan's framework. The increase in energy self-sufficiency in homes, the improved adaptation of estates and buildings to the region's weather conditions, together with the introduction of a compact city model and change in habits, especially regarding mobility, should result in a perception of welfare which is less linked to growing energy consumptions.



In a socioeconomic and cultural environment, characterised by the tendency towards global homogeneity parameters in behaviour and consumption, the effect that this Plan can have on strengthening the Andalusian identity based on the identification of its own satisfaction vectors (different forms consuming or moving around) which come from the determination to adapt to energy, should be outlined.

c) Increase in the Andalusian Energy System's safety

All the Plan's measures will unquestionably have a positive effect in obtaining a greater level of self-sufficiency in the Andalusian energy system, not only through the incorporation of renewable energy, but also due to the improvements in savings and efficiency and especially through the gradual adaptation to the region's surrounding conditions. Self-sufficiency results in a lesser dependency in having a guaranteed external supply and a reduction in the consequences that come from the possible hardening of the access conditions to raw materials for energy.

Secondly, the measures aimed at achieving a more distributed energy model will contribute to strengthening the energy system's safety, whilst at the same time improving the network's management, should be remembered.

Thirdly, the Plan's anticipated effect in the improvement of the Andalusian energy system's response capacity to disturbances and adversities that could occur should be stated. This group of measures should have an effect on this aspect, but especially in adaptive management, which intends to give strength to the system along with the flexibility and agility to the changes it will have as the final effect to responsiveness and adaptation.

d) Improvement of territorial cohesion

For the most direct and immediate effects on land use, primarily related to its contribution in complying with POTA's objectives and findings, a general structural effect on improving territorial cohesion through the Plan's measures must be incorporated to provide a better balance of uses and exploitation, thanks to the exploitation of renewable energies related to the rural environment and the restraining effect on the destabilising urbanisation process due to promoting housing for climate immigrants and the proliferation of second homes.

In short, PASENER 2007-2013 tries to take another step forward in the path started by the PLEAN 2003-2006, towards an energy model for Andalusia from a sustainable development viewpoint.

9





Economic budget

This chapter presents the financial framework needed for the proper development of the different actions that make up the Andalusian Sustainable Energy Plan. This framework lists public support, both from the Andalusian Regional Government as well as from other administrations.

To define this financial framework the source of funds and their destination are distinguished. The source of funds is divided into headings provided by the Administration of the Andalusian Regional Government and those made by the Central Government, through the Institute for Energy Diversification and Saving (IDAE).

The funding from the Central Government is part of two large state programmes “Action Plan 2005-2007 of the Strategy for Energy Savings and Efficiency (E4) 2004-2012” and the “Renewable Energy Plan for Spain (PER) 2005-2010”. Currently under development is the “Action Plan 2008-2012 of the Strategy for Energy Savings and Efficiency (E4) 2004-2012”, which completes the framework for action by the E4.

The IDAE, as public entity attached to the Ministry of Industry, Tourism and Trade will coordinate and jointly manage, with the Andalusian Energy Agency, funding for the two Plans mentioned.

The destination of the funds differs in four major areas: Renewable Energy, Energy Savings and Efficiency, Diffusion and Promotion and Infrastructures. A breakdown has been undertaken to be able to monitor and redistribute, if applicable, the resources, so as to achieve the planned objectives.

The following table shows the headings foreseen, broken down according to the four large groups and by source of funds:



Chart 35

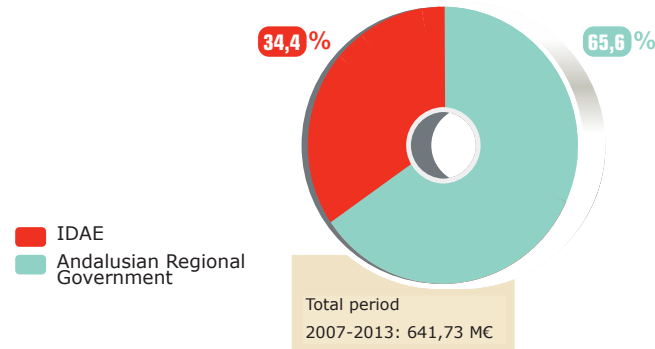
UNIT:
Thousands of euros

AREA	ORIGIN OF THE FUNDS	2007	2008	2009	2010	2011	2012	2013	TOTAL
Renewable energy	Andalusian Regional Government	30,390.0	31,853.7	33,254.5	34,965.9	37,038.2	39,293.8	41,557.1	248,353.2
	I.D.A.E.	4,507.3	4,642.6	4,781.8	4,925.3	5,073.1	5,225.2	5,382.0	34,537.3
	Total	34,897.3	36,496.3	38,036.3	39,891.2	42,111.3	44,519.0	46,939.1	282,890.5
Energy Savings and Efficiency	Andalusian Regional Government	8,549.3	9,220.2	9,794.6	10,572.5	11,403.9	12,249.0	13,227.8	75,017.4
	I.D.A.E.	23,937.8	24,225.1	24,515.8	24,810.0	25,107.7	25,409.0	25,713.9	173,719.2
	Total	32,487.1	33,445.3	34,310.4	35,382.5	36,511.6	37,658.0	38,941.7	248,736.6
Diffusion and Promotion	Andalusian Regional Government	0.0	3,625.0	4,195.0	4,700.0	5,100.0	5,580.0	6,235.0	29,435.0
	I.D.A.E.	1,709.8	1,730.3	1,751.1	1,772.1	1,793.4	1,814.9	1,836.7	12,408.5
	Total	1,709.8	5,355.3	5,946.1	6,472.1	6,893.4	7,394.9	8,071.7	41,843.5
Infrastructures	Andalusian Regional Government	10,219.9	7,953.0	8,829.3	9,478.5	10,056.2	10,608.6	11,112.5	68,258.0
	I.D.A.E.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	10,219.9	7,953.0	8,829.3	9,478.5	10,056.2	10,608.6	11,112.5	68,258.0
TOTAL Andalusian Regional Government		49,159.1	52,651.9	56,073.4	59,716.9	63,598.3	67,731.4	72,132.4	421,063.6
TOTAL I.D.A.E.		30,155.0	30,598.0	31,048.7	31,507.4	31,974.2	32,449.1	32,932.6	220,665.0
TOTAL		79,314.1	83,249.9	87,122.1	91,224.3	95,572.5	100,180.5	105,065.0	641,728.6

65.6% of the funds will correspond to a contribution from the Andalusian Regional Government and the remaining 34.4% from the Central Government.

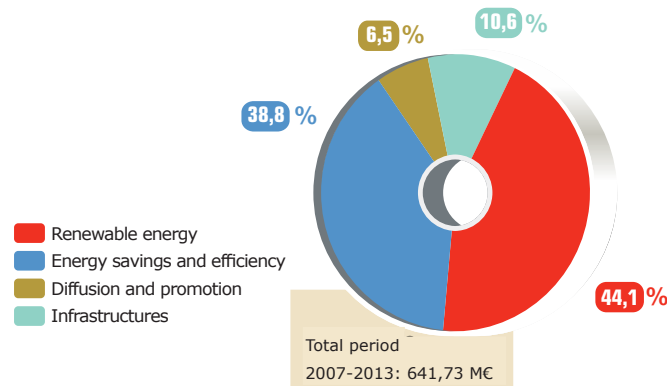
Graph 23

Source of the funding

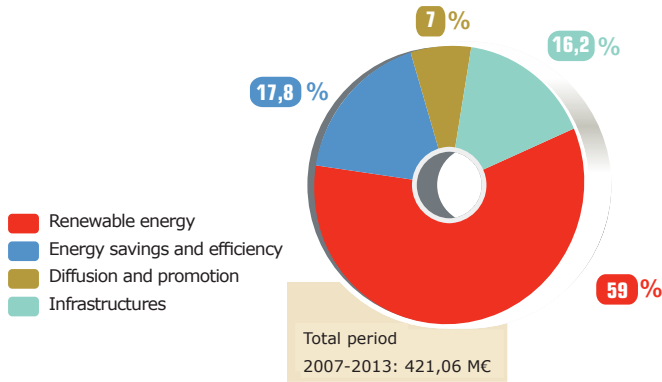


Graph 24

Breakdown of public investment

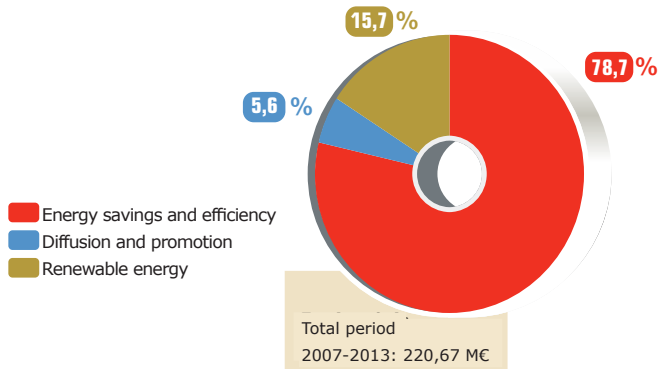


The overall amount of investments by the Andalusian Regional Government rises to 421.06 M€, with an accumulated increase of 46.7% in the period 2007-2013, and an average annual increase of 6.6%. The breakdown by lines is set out in the following graph:



Graph 25
Distribution of the investments corresponding to the Andalusian Regional Government

The investments corresponding to the Central Government rise to 220.67 M€. The average annual growth of the investments is foreseen to be 1.5% with a total increase in the period of 9.21%.



Graph 26
Distribution of the investments corresponding to IDAE

10





Monitoring and assessment

So as to ensure that this Plan effectively contributes to the attainment of a much more sustainable energy system based on savings, efficiency and renewable energy resources, and given that, to reach this aim resources that come from public funding must be used, a systematic, effective and transparent mechanism to monitor and assess must be established.

This new plan has wanted to pay special attention to the preparation of a proper system of indicators considered to be essential information tools for reporting on the status of both the Andalusian energy system in general as well as the adequacy of the policies adopted to correct deviations that are detected, incorporating the environmental variable in the decision making process.

The creation of a proper system of indicators helps in the regular review of the progress undertaken in relation to the objectives and measures set out, it allows the assessment of funds invested to see if they are being used properly for these objectives and in short, measures and allows the results to be disseminated to those in charge of these policies as well as to the general public. The analysis of the reports derived from this system of indicators will facilitate the work of confirming that they are on the right track for the decisions being taken, together with their correction or redirection, if they are found to be inefficient or can be improved in order to comply with the objectives set.

10.1 MONITORING METHODOLOGY AND PROPOSED ASSESSMENT

The process for monitoring and assessing PASENER 2007-2013 will be connected to the base of the objectives reflected in chapter 5 (The Plan's Objectives), under the following outline:

Analysis of the preliminary assumptions

a. Renewable energy

Based on the trend for each renewable energy production and the horizontal values contained in this Plan, a starting point (2007), an intermediate (2010) and final one (2013) have been taken into account, on which there will be a monitoring of the



adjustment/deviation, both in regard to parametric objectives (estimated installed power, planned collector surface area, etc.) as well as the degree of implementation of the economic investment set out.

However, with regards to these assumptions, the following considerations should be taken into account:

- Specific promotional measures have not been carried out for all tabulated renewable technologies as it is assumed that they have their own economic interest and profitability in the current framework to be able to achieve the planned objectives.
- The parametric values are not a direct and exclusive reflection of the public fund investment envisaged for them in the Plan, as involvement from private capital is needed.

To conclude, the starting assumptions are undoubtedly subject to swings in the socio-economic situation, from legislation and regulations, and from the energy sector's general position at a national and transnational level.



b. Sectorial energy savings

The savings forecasts have been individualised by sectors and valued by energy in a single parameter: tons equivalent to oil (ktoe). Likewise the planned investments every year have been quantified so that the expenses undertaken annually can be monitored.

Analysis of the objectives

11 objectives have been chosen and grouped into 4 categories: renewable energy, energy savings and efficiency, infrastructures and CO2 emissions. In this case we have provided only the fulfilment of these objectives to 2013 and not the interim targets, as set out below.

Renewable energy category

Indicator	Objective to 2013
Contribution of renewable energy/primary energy consumed	18.3%
Installed electric power with renewable energy/total installed power	39.1%
Contribution of renewable energy/final energy consumed	27.7%
Production of electricity from renewable sources/net electricity consumption of the Andalusian people	32.2%
Consumption of biofuels/fuel consumption	8.5%

Energy savings and efficiency category

Indicator	Objective to 2013
Primary energy consumption/GDP	-1% in the period 2007-2013
Savings in primary energy/consumption of primary energy in 2006	8%

Energy infrastructures category

Indicator	Objective to 2013
SAIDI	urban area 0.86 hours, semi-urban area 1.37 hours, concentrated rural area 2.89 hours and disperse rural area in 3.81 hours.
Percentage of residents with access to a natural gas supply in populations of between 10,000 and 20,000	80%

CO2 emission category

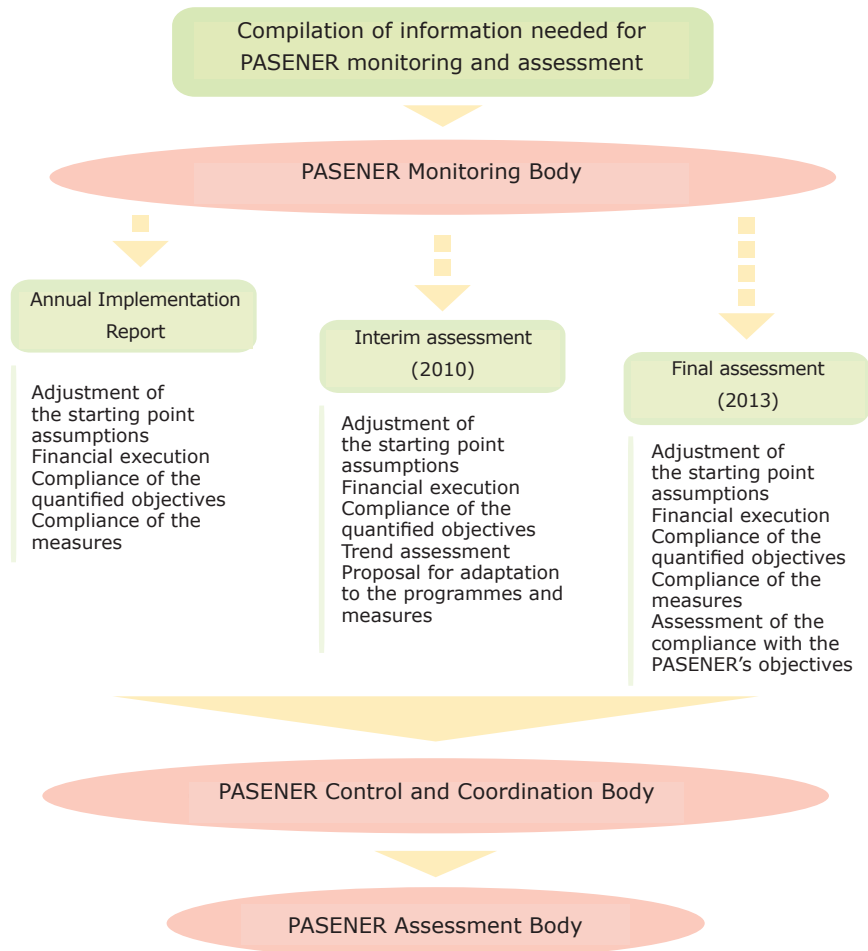
Indicator	Objective to 2013
Reduction of CO2 emissions per unit of electricity generated	20%
CO2 emissions avoided	11 Mt

10.2. MONITORING AND CONTROL BODIES

For there to be a proper monitoring process of the Plan, there must be a good set of indicators as well as a proper collection process, analysis, evaluation and reformulation of the anticipated targets. For this a configuration and start up of an organic and functional body for monitoring based on three working groups or Bodies has been planned:

- PASENER Monitoring Body
- PASENER Control and Coordination Body
- PASENER Assessment Body

We can graphically show the PASENER's monitoring and assessment structure in the following manner:





PASENER Monitoring Body

This body will safeguard that the following tasks are undertaken:

- Compiling and processing of the information provided by the indicator system.
- Carry out an analysis of them.
- Disseminate data with the preparation of quarterly monitoring reports, the annual implementation report and interim and final assessments of the Plan.

These actions are assigned to the Andalusian Energy Agency.

The preparation of the reports will be in accordance with the following diagram:

- Preparing quarterly monitoring reports and an **Annual Implementation Report**, as a partial report, which will check the parth of the assumptions and degree of compliance with the objectives for 2013.
- The annual report for the year that has covered half the operating period of the Plan (2010) will be classed as the **Interim Assessment** and will list a specific comparison of the historical evolution with reference to previous years. In accordance with the results of this assessment, if considered appropriate, so as to better obtain the planned targets, an intensification of measures and budget on those that show the greatest deviation will be proposed.
- Finally, a **Final Assessment** of the Plan must be undertaken during the year that the implemented current term ends and that comprehensively and precisely displays the level at which the overall budget has been undertaken, the targets achieved, the suitability of the Programmes planned for it, as well as the effects that the development of the PASENER 2007-2013 has had on the region.

PASENER Control and Coordination Body

The functions of this body are:

- Undertake an analysis of the Plan's monitoring reports, annual reports and interim and final assessments.



- Set out annual public budgets aimed at the Plan.
- Coordinate with other Administrations, Ministries and private companies about undertaking the Plan.
- Specify, if applicable, the necessary actions to correct the potential deviations from the anticipated objectives.
- Define or modify, if necessary, the objectives so as to be able to attain them.

These actions are assigned to the Directorate General of Industry, Energy and Mines.

PASENER Assessment Body

This body will assess the results and actions undertaken by the two previous levels.

The assessment body will be formed by the Working Group of the Andalusian Sustainable Energy Plan 2007-2013 set out in the 6th Social Partnership Agreement of Andalusia.

The Working Group will be made up by 26 members, namely:

- 10 Representatives from the Andalusian Regional Government
- 8 Representatives from CEA
- 4 Representatives from CCOO-A
- 4 Representatives from UGT-A

The 10 representatives from the Andalusian Regional Government will be:

- The Secretary General of Industrial Development and Energy of the Ministry of Innovation, Science and Business.
- The Director General of Industry, Energy and Mines of the Ministry of Innovation, Science and Business.



- The Director General of the Andalusian Energy Agency.
- A representative from the following Regional Ministries, with at least rank of Director General:

Governing Council.

Ministry of Economy and Finance

Ministry of Public Works and Transport

Ministry of Employment

Ministry of Agriculture and Fisheries

Ministry of Health

Ministry of the Environment

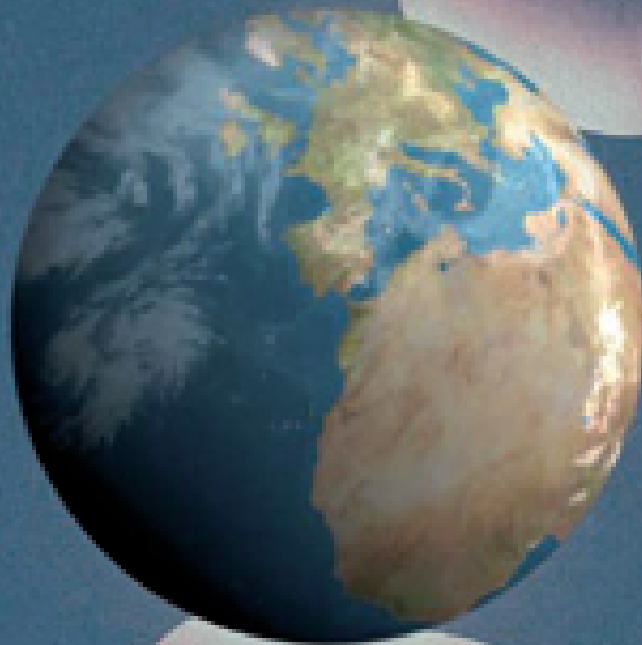
The duties of the assessment body shall be as follows:

- Know about and assess the progress reports and annual reports on the Plan's implementation.
- Know about and assess the action proposals planned to potentially correct the deviations detected in certain objectives.
- Propose, if applicable, actions to correct the potential deviations of the objectives pursued.
- Know about and assess the annual budgets relating to PASENER 2007-2013.
- Know about and assess the regulatory projects related to the Plan.
- Propose, if any, actions to achieve regulatory compliance of PASENER 2007-2013.
- Understand and assess the interim and final assessments of the Plan.

The assessment body shall meet quarterly, according to the monitoring reports and annual implementation report.

The analysis and discussion of the Final Assessment Report by the assessment body will serve to profile and perfect public planning instruments in the following editions.

Annex





The Plan's Scenarios

The energy sector is currently facing a context of strong fluctuations and uncertainties associated to different kinds of phenomena that can affect the system's good functioning. Due to this, it is particularly important to try to establish the framework within which to develop the response to the Andalusian energy system over the coming years.

- Determine the likely trend in energy demand in Andalusia for 2007-2013 and its possible coverage in terms of energy supply provided by the different agents that make up the energy market.
- Assess the effects on this forecast from the basic action lines in the Andalusian energy policy, designed and consolidated with 2003-2006 PLEAN, mainly concerning energy efficiency and renewable energy.
- Assess the response capacity of the Andalusian energy system, identify its possible limits and set up measures to facilitate a good operation of the different energy infrastructures needed according to the supply and demand of energy forecast during the Plan's term.

A.1. COMPONENTS OF THE EVOLUTION OF THE DEMAND

Demographic growth

The first factor to consider is the evolution forecast of energy demand associated with population growth. This component already shows an upward trend, above the endogenous growth characteristics that are typical of the population.

Year	Population	Year	Population
2007	7,800,138	2011	8,072,842
2008	7,874,080	2012	8,134,603
2009	7,943,952	2013	8,195,197
2010	8,010,213	-	-

Chart 36
Projections for population in Andalusia

UNIT:
Inhabitants

SOURCE:
National Statistics Institute.



Although these predictions were published in May 2005, current population figures already surpass those predicted.²⁷ These differences between the recorded and predicted population respond to the phenomena of labour immigration, since immigrants entries associated to job opportunities are gradually being registered in the statistics and will have an increasing influence on the demographic evolution.

We must remember that these figures only include the population that is registered, and as previously mentioned, Andalusia is recording new phenomena in acquiring a stable population (climate immigrants) and who are not recorded in the statistics.

Production growth

The predictions for economic growth over the next few years are maintaining the current situation with some real rate increases of GVA in Andalusia, which are greater than the Spanish or European Community average.

Chart 37
Forecast of GVA economic growth

SOURCE:
HISPALINK, February 2007
Growth rates of the corresponding
chain volume index. Base 2000

AREAS	SECTORS	2006	2007	2008
Andalusia		3.7	3.4	3.0
	Agriculture	2.8	1.2	1.8
	Industry	1.8	2.4	1.2
	Construction	5.4	4.3	3.4
	Services	3.8	3.6	3.3
Spain		3.6	3.3	3.0

The forecasts for 2007 and 2008 seem quite favourable, although they show a certain slowing down trend for economic growth. Once again, Andalusia’s dynamism stands out as it is at the forefront of regional economic growth, after Madrid, Murcia, Aragón and Castilla la Mancha.

In 2006, growth is maintained, just as for 2005, in Construction (5.4%), Services (3.8%) and the Energy field (3.0%), and to this are added Agriculture (2.8%) after two years of negative rates. The forecast for the total GVA in 2007 is a tenth more than the national average, highlighting the positive contribution of Industry (2.4%) together with the

27 Andalusia’s population as at 1st January 2006 was 7,935,074 inhabitants.



remaining sectors. In 2008 the forecasts pointed to a total GVA growth of around 3.0%, due to the slowdown in growth expected in all sectors, especially Industry (1.2%). For the following years (2009-2013) an average annual growth of 3% is expected.

In sectors with a greater impact on energy demand a fall in the short term is forecast for Intermediate Goods with rates of actual change of 1.8% in 2006, 2.4% in 2007 and 1.1% in 2008; in Capital Goods a growth of 2.1%, 3.2% and 1.5% is forecasted for those years; and a small increase in Consumer Goods of 0.9%, 1.8% and 1.2% in 2006, 2007 and 2008 respectively. Overall, the growth rate of the Andalusian industrial sector expected in 2008 is 1.2%, even though the present circumstances and available information should only be taken as a tentative forecast.

The evolution of the services will be of a slight slowdown in growth in both tourism and the transport associated to it, just as in the commercial sector. However, the annual increase figures for those in employment show a strong effect on the occupation of families and a significant effect on the incorporation of immigrants into the labour market, both of which affect domestic energy demand.

Despite the strong impact of services on generating employment, the sector which most boosts employment and GVA in Andalusia is construction. Property development shows some slow down behaviour, whilst maintaining the momentum of recent years. This upward trend is fed by property development and that of holiday homes and developments aimed at new European residents.

Changing patterns of energy consumption: the European path

The Andalusian people are at this time at a stage of final consumption and own savings in a European region which is in a position of transition towards the higher levels of continental development. The current level of income and welfare is high in absolute terms, and much more if compared to the surroundings or a global outlook. However, there has been an observation of a socioeconomic evolution following patterns governed by the wish for more and greater levels of wealth and welfare.

All this seems to indicate that Andalusia is going to continue in the path of economic development and this will mean acquiring consumption habits and buying capacity that are similar to those shown by residents in other European areas. This economic and social transformation will result in a strong tendency to approach the levels of energy consumption per capita, housing consumption and per unit energy consumption associated with mobility, recorded in northern European countries. The current consumption differential



per home (Andalusia is near to half of the European average) and in mobility (motorisation in Andalusia is 75% of the European one).

The pace of convergence between unit consumption indicators in Andalusia and Europe will continue in the coming years, although there will be a logical slowdown as the differences become smaller. The increase in energy consumption in the domestic sector and in mobility derived exclusively from the change in patterns could reach a value of 40% at the end of the term.

New phenomena that are occurring

In Andalusia there are new phenomena occurring that may have serious implications on the Andalusian energy system's balance within a few years. The two most prominent are undoubtedly the introduction of desalination plants to satisfy the water deficit there is in Andalusia and the arrival of large numbers of new residents from the north of the country and other European countries (climate immigrants).

With regard to the water desalination for different uses, there are no proper forecasts because the intervention proposals for these have not yet been formalised. However, one must consider that only the water balance in the Southern Mediterranean Basin, made up with data from more than ten years ago, showed a shortfall of almost 200 hm³-year and that the current policy is to address this deficit through desalination.

A plant with a treatment capacity of 40 hm³-year consumes about 160,000 MWh /year.²⁸ If we installed, for example, some ten plants of this kind in Andalusia by 2013, electricity demand could increase by 1,600 GWh/year, which would result in an additional request from the energy system of around 300 ktoe of primary energy.

The impact of climate immigrants, in turn, on energy demand is due to two factors: their large number and their patterns of energy conduct. With regards to the latter we should remember that they come from European areas where energy consumption per home is about 1.74 toe per home (Andalusia is 0.7 toe per home) and there is a greater tendency for mobility. Even though their tendency for mobility may be reduced due to a lesser need for heating, it is highly likely that they keep higher consumption guidelines than the average Andalusian ones, in energy consumption in the home as well as in mobility.

²⁸ Source: Ministry of the Environment 2004 Technical Advances in Water Desalination.



It is estimated that a million homes for climate immigrants could need an extra energy consumption of 1,800 ktoe per year (domestic, municipal services and private associated ones and mobility). This increase in demand could mean that in electricity to be precise, this would be an increase of nearly 20% in consumption, when taking into account that the water demanded would be through desalination.

The joint action of these factors puts complying with the Kyoto commitments into serious danger with regard to greenhouse gas emissions; it dilutes the effort renewable energy and energy savings and considerably increases energy dependency in the region.





Uncertainties: climate and the international context of external sources

The operation of the Andalusian energy system in the coming years is subject to other factors with a more uncertain influence than the aforementioned. One of them is indisputably linked to the Andalusian region: the variability of the climate and the emergence of natural disturbances.

The variations in temperature, which are typical of the Andalusian climate, increasingly influence the operating of the energy system due to progressive air conditioning in buildings and the consequent appearance of greater annual consumptions and peaks during holiday periods. The swings due to this variation factor in consumption are not insignificant.

In recent years, rising and volatile prices of energy commodities and the effect they have on the economy and the behaviour of different consumers make forecasting analysis difficult, although in the short term a change in the upward trend in demand is not expected although we do expect a moderation of this depending on the level reached by prices and their stability over time, and what seems certain is that price levels existing before crude oil started climbing will never return.

According to International Organisations, the offer there is in the short term will be enough to cover world oil demand at the present rate of growth, despite the existing pressures on markets that come from the strong price increase in crude oil and the greater need for investments to increase the capacity for extraction.

The price of natural gas, indexed to oil, is expected to remain stable as the existing reserves will be enough to meet the anticipated global demand in the planning time period. On the other hand, the price of coal will remain lower than crude oil and natural gas.

However, the current energy framework is in a period of instability and uncertainty that accentuates the difficulty associated to all energy forecast exercises. This could result in significant changes in the assumptions on which to base the probable trend scenario, slowing or driving demand for energy in Andalusia.

A resurgence of the ongoing conflicts between producer countries, marketers and consumers of energy sources, in a context of growing demand, would accentuate current escalating prices and the consequent impact on the economy, the purchasing power of Andalusian people and habits of consumption thereof.



A.2. THE PLAN'S SCENARIOS

The factors discussed previously make up the basic variables of the scenario, whose variability in time and the fact of having demands whose future estimate or projection is extremely difficult in many cases, make forecast analysis difficult and determine their validity during the term of the Plan.

The study of the past situation and the analysis of the future evolution of the main variables that influence energy demand in Andalusia, a combination of past socioeconomic and energy trends, economic growth effects, population, evolution of the energy markets and organisations and companies consulted (distributors, retailers and other operators), as well as the possible implications that other policies could have on energy demand, outline the energy **trend scenario** for the period 2007-2013 in Andalusia.

The trend scenario is made up of the reference framework in which to assess the effects that the energy savings foreseen will have as a result of the different measures proposed in administration, companies, citizens and infrastructures. We would therefore get a new scenario, the **savings scenario**.²⁹

Both scenarios share population projections, forecasts for economic growth and evolution of the energy markets, as well as complying with the directives of the international policy framework.

The latter scenario entails a greater social commitment derived from a demand management policy and the introduction into Andalusian society of a new energy culture that involves greater awareness among different agents involved - governments, businesses and citizens in general - when choosing renewable energy sources compared to fossil fuels and more rational consumption based on the optimisation of the energy demand.

²⁹The energy balances have been carried out following the instructions given by the Statistical Office of the European Community, methodology EUROSTAT. These balances are of the type called "final energy", where all the energy flows - production, foreign trade, stock movements, transformations, consumption- are expressed by taking into account the real energy content of each source of energy.



A.2.1. TREND SCENARIO

Evolution of final energy demand

In this scenario we anticipate that final energy demand will be 18,317 ktoe in 2013 -including non-energy uses-, growing at an average of 3.6% between 2007 and 2013. This would mean a growth of 28.3% during the whole period, 4,040 ktoe.

Chart 38
Final energy demand in the trend scenario

SOURCE:
Andalusian Energy Agency
(Non energy uses are included)

ktoe			Average annual growth (%) 2007-2013
2006	2010	2013	
14,276	16,460	18,317	3.6

The coverage in final energy demand by sources is shown in the following table:

Chart 39
Final energy demand by sources in the trend scenario

SOURCE:
Andalusian Energy Agency.

	2006		2010		2013		Average annual growth (%) 2007-2013
	ktoe	Structure (%)	ktoe	Structure (%)	ktoe	Structure (%)	
Coal	35	0.2	80	0.5	80	0.4	18.9
Oil products	8,903	62.4	9,527	57.9	10,165	55.5	1.9
Natural gas	1,819	12.7	2,127	12.9	2,342	12.8	3.7
Renewable energy	480	3.4	898	5.5	1,217	6.6	14.6
Electric energy	3,039	21.3	3,828	23.2	4,512	24.6	5.8
Total	14,276	100	16,460	100	18,317	100	3.6

Coal

Coal will maintain its importance in the final demand structure, covering 0.4% of the total final energy.

The demand of this energy source will continue being concentrated mainly in the cement industry and in steel and foundries to a lesser extent.

Oil products

Despite the growing evolution of demand in the transport sector, we envisage that its consumption will increase around 1.9% per year in the period 2007-2013, below other



sources of energy, losing importance within the final demand structure although being 55.5% in 2013 it will continue to be the main source of energy.

In 2013 the demand for oil derivatives could reach 10,165 ktoe, 14.2% more than at the start of the Plan's term, which in absolute terms would mean an increase of 1,262 ktoe in these years, 31% of the total increase in final energy demand in those seven years.

The demand for fuel oils in industry will fall as a consequence of being substituted by other cleaner fossil fuels, mainly natural gas. Given the progressive Andalusian dieselisation of cars, the evolution for demand in petrol stations will go down, whilst diesel for cars will grow at a lesser rate than in past years.

As for the demand for fuel oil in the residential and service sectors, this is expected to be reduced, together with the demand for liquefied petroleum gas, LPG, as a consequence of the widespread arrival of the natural gas network.

A diesel for the primary sector, which has a growing demand, will present a more moderate evolution than in previous years.

Natural gas

The expansion of the natural gas network in the Andalusian Community will allow the diversification and substitution of other fossil fuels by this source of energy, given its better performance and lesser environmental impact that its consumption has compared to the former, especially in industry.

Its easier and cleaner use will make the arrival of natural gas to places that do not have a supply and the increase in demand in areas already supplied, increasing the demand for this fuel in the residential or service sectors.

Thus between 2007 and 2013 the demand for natural gas will grow 3.7% average per year, going from 1,819 ktoe at the start of 2007 to 2,342 ktoe at the end of the Plan, which means an increase of 28.8%. This growing trend will be more significant in the first years of the term coinciding with the arrival of gas to areas with no previous supply, whilst in the latter years there will be a stabilisation of demand, with more moderate growths.



With all of this, predictions point to natural gas covering 12.8% of the Andalusian final demand in 2013.

Renewable energy

The increase experienced by the demand in renewable energy resources between 2007 and 2013 will be 153.4%, increasing an average of 14.6% per year, reaching 1,217 ktoe at the end of the Plan. In 2013 the demand for renewable energy will make up 6.6% of the total final energy demand, including non-energy uses.

Electric energy

The general use of air conditioning equipment and office automation in residential and service sectors, as well as larger electrical appliances with a higher average consumption in Andalusian homes, makes us anticipate that the demand for electricity over the next few years will have an average rate of growth of 5.8% per year at 4,512 ktoe in 2013, 48.5% more than at the beginning of 2007.

At the end of the Plan’s term electricity will cover 24.6% of the total final energy demand.

The final energy demand by sectors is listed in the following table:

Chart 40
Final energy demand by
sectors in the
trend scenario

	2006		2010		2013		Average annual growth (%) 2007-2013
	ktoe	Structure (%)	ktoe	Structure (%)	ktoe	Structure (%)	
Industry	4,669	32.7	5,304	32.2	5,641	30.8	2.8
Transport	5,514	38.6	6,292	38.2	7,057	38.6	3.6
Primary	1,152	8.1	1,226	7.4	1,385	7.6	2.8
Services	1,131	7.9	1,485	9.0	1,765	9.6	6.6
Residential	1,810	12.7	2,153	13.1	2,468	13.5	4.5
Total	14,276	100	16,460	100	18,317	100	3.6

SOURCE:
Andalusian Energy Agency.

Evolution of primary energy demand

Primary energy demand in this scenario is conditioned not just by the increase experienced by energy demand in the final consumer sectors, but also through greater electricity generation with renewable energy. This will substantially modify the supply structure of primary energy by sources during the Plan’s term, where the displacement of coal and oil derivatives in favour of gas and renewable sources will be seen.

In accordance with the aforementioned, primary energy demand in 2013 will be 26,109 ktoe, increasing at an annual average of 3.9% between 2007 and 2013. This would mean a growth of 30.8% during the whole period, 6,151 ktoe.

ktoe			Average annual growth (%) 2007-2013
2006	2010	2013	
19,958	23,013	26,109	3.9

Chart 41
Primary energy demand in the trend scenario

SOURCE:
Andalusian Energy Agency.

The coverage in primary energy demand by sources is shown in the following table:

	2006		2010		2013		Average annual growth (%) 2007-2013
	ktoe	Structure (%)	ktoe	Structure (%)	ktoe	Structure (%)	
Coal	2,792	14.0	2,638	11.5	2,547	9.8	-1.3
Oil	10,055	50.3	10,639	46.2	11,280	43.2	1.7
Natural gas	6,249	31.3	7,624	33.1	8,465	32.4	4.5
Renewable energy	830	4.2	2,591	11.3	4,282	16.4	27.5
Electric balance*	32	0.2	-478	-2.1	-464	-1.8	-
Total	19,958	100	23,013	100	26,109	100	3.9

Chart 42
Primary energy demand by sources in the trend scenario

*Imports - exports

SOURCE:
Andalusian Energy Agency.

Chart 43

	Power (MW)		
	2006	2010	2013
Total Ordinary Regime	8,936.2	9,087	9,887
Hydraulic power	464.2	476	476
Pumping	570	570	570
CCTT coal (1)	2,051	2,051	2,051
CCTT biofuels	1,061	0	0
Combined cycle	4,790	5,990	6,790
Total Special Regime	1,869.6	6,113	7,858
Wind power	607.9	4,000	4,800
Hydraulic power	129.8	137.8	148
Cogeneration (2)	903.5	1,244.5	1,400.2
Biomass (3)	149.3	209.9	256
Biogas (4)	15.2	17.1	20.1
Residues (5)	31.7	33.7	33.7
Solar photovoltaic	21.2	220	400
Thermosolar	11	250	800
Total OR + SR	10,805.7	15,200	17,745

(1) The power foreseen by co-firing with biomass is included
(2) Does not include biomass
(3) Includes generation and cogeneration
(4) EDAR and RSU
(5) Industrial residues and gas residue

SOURCE:
Andalusian Energy Agency.

Coal

The consumption of coal will practically all be concentrated in the thermal power plants situated in the Andalusian Community. Greater generation of electricity using gas and the implications that the production could have on the environmental determinants will make coal have less importance in the primary energy supply structure, decreasing its demand by about 1.3% per year until reaching 2,547 ktoe in 2013. That year coal will cover 9.8% of the total, below the remaining sources of energy.

Oil

The demand for oil will be around 11,280 ktoe in 2013, and although it will be the energy source with the greatest demand with a share of 43.2%, it will lose importance within the structure by growing at an average annual rate of 1.7%, below the total primary demand.

This will be mainly due to a lesser final demand of oil derivatives and less importance of these in the electricity generation structure.

Natural gas

Natural gas together with renewable energy will be the primary energy source that will experience the greatest growth during the period of 2007-2013 with 35.5%, positioning itself at 8,465 ktoe in this last year, reaching an importance in the supply structure of 32.4%.

Greater generation of electricity with this source of energy and the expansion of the gas pipeline network through the Andalusian territory will make primary demand for natural gas increase around 4.5% per year.

Renewable energy

In accordance with the forecasts of this scenario, renewable energy, excluding pumping, will provide around 4,282 ktoe in 2013. This will mean a contribution of 16.4% to the total demand for primary energy, a rate that will rise to 17.6% if non energy uses are not considered.

A.2.2. Savings scenario

Once the trend scenario has been analysed we will see the effect that the development of measures in favour of energy savings and efficiency will have.

Evolution of final energy demand

The undertaking of measures listed in the Plan aimed at the improvement of efficiency and the promotion of energy saving will have an impact on the reduction in final energy demand with regards to the trend scenario of 5.8% in 2013, reaching 17,257 ktoe. This would mean an increase of 20.9% during the whole period, 2,980.6 ktoe.

ktoe			Average annual growth (%) 2007-2013
2006	2010	2013	
14,276	15,832	17,257	2.7

Chart 44
Final energy demand in the savings scenario

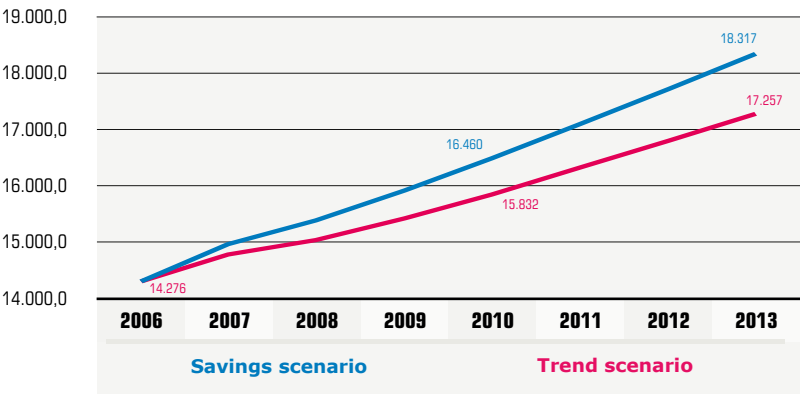
SOURCE:
Andalusian Energy Agency
(Non energy uses are included)





Graph 27
Evolution of final energy demand in the trend scenarios and savings in Andalusia

UNIT:
Ktoe
SOURCE:
Andalusian Energy Agency.



The coverage in final energy demand by sources in the savings scenario is shown in the following table:

Chart 45
Final energy demand by sources in the savings scenario

SOURCE:
Andalusian Energy Agency.

	2006		2010		2013		Average annual growth (%) 2007-2013
	ktoe	Structure (%)	ktoe	Structure (%)	ktoe	Structure (%)	
Coal	35	0.2	77	0.5	74	0.4	17.6
Oil products	8,903	62.4	9,084	57.4	9,419	54.6	0.8
Natural gas	1,819	12.7	2,064	13.0	2,223	12.9	2.9
Renewable energy	480	3.4	898	5.7	1,217	7.1	14.6
Electric energy	3,039	21.3	3,709	23.4	4,324	25.1	5.2
Total	14,276	100	15,832	100	17,257	100	2.7

Coal

The demand for coal will be reduced by about 7.1% with respect to the trend scenario, with an importance in the final demand structure of 0.4% of the total final energy in 2013.

Oil products

Oil products will be the source that records the greatest savings during the planning period, as a result of putting planned energy savings and efficiency measures into practice from 2007 to 2013. Thus, the savings accumulated in oil products during those seven years will rise to 742 ktoe, representing 70% of the total savings in final energy accumulated in 2013.



This is mainly due to greater savings in the transport sector, which will be reflected in a lesser demand in petrol and diesel for cars, around 583 ktoe during the whole period. The rest will come from actions undertaken from the remaining sectors.

With all of this, the final demand from oil derivatives will reach 9,419 ktoe in 2013, 7.3% less than the trend scenario, resulting in a 5.8% increase during the whole period, with an average annual growth rate of 0.8%.

Its importance in the final demand structure will decrease to 54.6% in 2013. This loss of the participation share of oil products will be an important step in reducing the dependence on this energy source from which the Community has traditionally relied more on, but still maintain its big difference from the other energy sources.

Natural gas

Energy savings and efficiency actions envisage a saving in natural gas derived from a reduction in demand in the corresponding sectors, taking into account the greater consumption derived from the power installed with cogeneration, listed as 110 ktoe, which would mean a reduction in final demand of this source in 2013 of 5.1% with respect to the trend scenario, putting it at 2,223 ktoe this year, 22.2% less than at the start of the period. The participation of natural gas in the final demand structure would rise in 2013 to 12.9%.

Renewable energy

Renewable energy maintains its demand with respect to the trend scenario. However due to the reduction in total final energy during these years its share rate rises to 7.1% in 2013, including non energy uses.

Electric energy

Electricity will maintain its high growth rate even though this is more moderate due to the putting into practice of the energy savings and efficiency measures. These measures would mean a saving of 189 ktoe in all industry, residential and services sectors between 2007 and 2013, representing a total saving in accumulated final energy of 17.8% at the end of the term.



Final demand of electricity will be about 4,324 ktoe in 2013, 4.2% less than the trend scenario, resulting in a 42.3% increase during the whole period, with an average annual growth rate of 5.2%.

The share loss in oil products and the greater increase in demand for electricity will mean that the latter will increase its importance with relation to the final demand structure to 25.1% in 2013.

In relation with the final consumption sectors, the following table lists the forecasted demand for each of them.

Chart 46
Final energy demand by sectors in the savings scenario

	2006		2010		2013		Average annual growth (%) 2007-2013
	ktoe	Structure (%)	ktoe	Structure (%)	ktoe	Structure (%)	
Industry	4,669	32.7	5,166	32.6	5,396	31.3	2.1
Transport	5,514	38.6	5,950	37.6	6,473	37.5	2.3
Primary	1,152	8.1	1,202	7.6	1,346	7.8	2.3
Services	1,131	7.9	1,401	8.8	1,629	9.4	5.4
Residential	1,810	12.7	2,113	13.3	2,412	14.0	4.2
Total	14,276	100	15,832	100	17,257	100	2.7

SOURCE:
Andalusian Energy Agency.

Evolution of primary energy demand

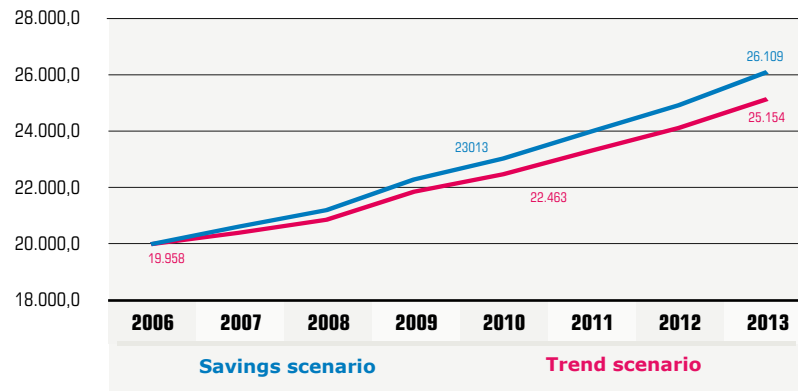
The reduction in final energy demand together with the energy savings and efficiency measures in the transformer sector will make the demand for primary energy to be reduced with respect to the trend scenario by 3.7% in 2013, being 25,154³⁰ ktoe. This represents a growth of 26% in 2007 to 2013, an average annual rate of 3.4%.

Chart 47
Primary energy demand in the savings scenario

ktoe			Average annual growth (%) 2007-2013
2006	2010	2013	
19,958	22,463	25,154	3.4

SOURCE:
Andalusian Energy Agency
(Non energy uses are included)

30 Lower demand for electricity derived from savings measures will result in an increased electricity export balance for the Andalusian Community, by maintaining production under the Ordinary Regime and increasing the Special Regime due to greater power installed in cogeneration. This means that the savings achieved with savings measures differ from the figure obtained in the presentation of the energy balance for 2013, because according to the methodology used, Eurostat, the power balance is attributed in terms of electricity generated, regardless of performance or efficiency with which it was generated, while the savings figures are calculated based on a mix of generation, in terms of primary energy.



Graph 28
Evolution of primary energy demand in the trend and savings scenarios in Andalusia

SOURCE:
Andalusian Energy Agency.

UNIT:
ktoe

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The coverage in primary energy demand by sources is shown in the following table:

	2006		2010		2013		Average annual growth (%) 2007-2013
	ktoe	Structure (%)	ktoe	Structure (%)	ktoe	Structure (%)	
Coal	2,792	14.0	2,633	11.7	2,539	10.1	-1.3
Oil products	10,055	50.3	10,174	45.3	10,499	41.7	0.6
Natural gas	6,249	31.3	7,829	34.9	8,731	34.7	5.0
Renewable energy	830	4.2	2,591	11.5	4,282	17.0	27.5
Electric energy	32	0.2	-764	-3.4	-896	-3.6	-
Total	19,958	100	22,463	100	25,154	100	3.4

Chart 48
Primary energy demand by sources in the savings scenario

*Imports - exports

SOURCE:
Andalusian Energy Agency.

Coal

The brunt of the electricity generation with coal in total primary energy demand from this source will mean it will hardly vary with respect to the trend scenario, although its relative importance will do so in the primary demand structure, being 10.1% in 2013.

Oil

Oil is the primary energy source that faces the largest decrease compared to the trend scenario, mainly due to more rational use in transport through the actions undertaken in this sector. Thus, the accumulated oil savings between 2007 and 2013 will be 777 ktoe, 53% of the total savings in primary energy accumulated in 2013 (1,465 ktoe).



The demand at the end of the planning period will be about 10,499 ktoe, less than 7% to that registered in the trend scenario, resulting in an increase of 4.4% over these seven years at around 0.6% of the average annual variation.

The greater savings will result in smaller oil share in primary energy demand, going from 50.3% in 2006 to 41.7% in 2013. This loss of nearly eight points in the share rate of oil derivatives will be an important step in reducing dependence of this energy source from which the Community has traditionally relied more on, but still maintain its big difference from the other energy sources.

Natural gas

The energy savings and efficiency actions envisage a saving in natural gas that comes from a reduction in demand in the corresponding sectors, to which we must add a greater demand coming from the diversification of sources and new power installed in cogeneration. This would mean an increase in the final demand of this source in 2013 of 3.1% with respect to the trend scenario, placing it that year at 8,731 ktoe, 39.7% more than at the start of the period. The participation of natural gas in the primary demand structure would rise in 2013 to 34.7%.

Renewable energy

Renewable energy maintains its demand with respect to the trend scenario. However due to the reduction in total final energy during these years, its share rate rises from 4.2% in 2006 to 17% in 2013, including non energy uses, 18.3% if these are excluded.

The following tables list the forecasts for energy demand for both primary and final demand at the end of the Plan, for the two previous scenarios:

Trend scenario (TS)			Savings scenario (SS)		SS / TS
By sources	Demand (ktoe)	Structure (%)	Demand (ktoe)	Structure (%)	Variation in demand (%)
Coal	80	0.4	74	0.4	-7.1
Oil products	10,165	55.5	9,419	54.6	-7.3
Natural gas	2,342	12.8	2,223	12.9	-5.1
Renewable energy	1,217	6.6	1,217	7.1	0.0
Electric energy	4,512	24.6	4,324	25.1	-4.2
By sectors	Demand (ktoe)	Structure (%)	Demand (ktoe)	Structure (%)	Variation in demand (%)
Industry	5,641	30.8	5,396	31.3	-4.3
Transport	7,057	38.6	6,473	37.5	-8.3
Primary	1,385	7.6	1,346	7.8	-2.8
Services	1,765	9.6	1,629	9.4	-7.7
Residential	2,468	13.5	2,412	14.0	-2.3
Total	18,317	100	17,257	100	-5.8

Chart 49
Final Energy Demand
(2013)

Trend scenario (TS)			Savings scenario (SS)		SS / TS
By sources	Demand (ktoe)	Structure (%)	Demand (ktoe)	Structure (%)	Variation in demand (%)
Coal	2,547	9.8	2,539	10.1	-0.3
Oil products	11,280	43.2	10,499	41.7	-6.9
Natural gas	8,465	32.4	8,731	34.7	3.1
Renewable energy	4,282	16.4	4,282	17.0	0.0
Electric energy	-464	-1.8	-896	-3.6	-
Total	26,109	100	25,154	100	-3.7

Chart 50
Primary Energy Demand
(2013)



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