SUSTAINABLE ENERGY ACTION PLAN

PORTO SANTO ISLAND

March, 2012

Sustainable Energy Action Plan of Porto Santo Island

Developed under the Pact of Islands, to which the Autonomous Region of Madeira joined in April 12, 2011.

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ACIF – Associação Comercial e Industrial do Funchal

ACIPS – Associação de Comércio e Indústria do Porto Santo

AIE – Atlantic Islands Electricity Madeira, S.A.

AMRAM – Associação de Municípios da Região Autónoma da Madeira

ASSICOM – Associação da Indústria – Associação da Construção – Região Autónoma da Madeira

BANIF – Banco Internacional do Funchal, S.A.

DRAmb – Direcção Regional do Ambiente

DRCIE – Direcção Regional do Comércio, Indústria e Energia

EEM – Empresa de Electricidade da Madeira, S.A.

ENEREEM – Energias Renováveis, Lda.

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GALP Madeira – Distribuição e Comercialização de Combustíveis e Lubrificantes, Lda.

HF – Horários do Funchal, Transportes Públicos, S.A.

IDE-RAM – Instituto de Desenvolvimento Empresarial

IDR – Instituto de Desenvolvimento Regional

IGA – Investimentos e Gestão da Água, S.A.

INTELSOL – Projectos e Instalações Eléctricas, Lda.

IPM – Iluminação Pública da Madeira – Associação de Municípios

LREC – Laboratório Regional de Engenharia Civil

Ordem dos Arquitectos – Delegação da Madeira

Ordem dos Economistas – Delegação Regional da Madeira

Ordem dos Engenheiros – Secção Regional da Madeira

SPELTA – Produtos Petrolíferos, Unipessoal, Lda.

SRTT – Secretaria Regional do Turismo e Transportes

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EEM – Empresa de Electricidade da Madeira, S.A.

AREAM – Agência Regional da Energia e Ambiente da Região Autónoma da Madeira

Executive summary

The first regional energy plan was approved by the Autonomous Region of Madeira in 1989, and later updated in 1992 and 2002. The Energy Policy Plan of the Autonomous Region of Madeira constitutes, to the present day, a planning instrument which has guided the adopted strategy of valorising endogenous resources and promoting energy efficiency.

As a vision for the future, the energy policy is oriented to ensure energy supply guarantee, economic and environmental sustainability of the sector and quality of energy services, and to contribute to job creation, regional added value and competitiveness of the regional economy.

Objectives, targets and expected results

In this plan, for Porto Santo Island, objectives and targets were set for the year 2020 and sustainable energy actions were studied to achieve these targets. The objectives, targets and expected results for the year 2020, through the implementation of the plan's actions, are presented in the following table.

Objectives, targets and expected results for 2020

Objectives		Targets	Expected results
1.	Improve energy supply guarantee	Increase by 20% the number of days of autonomy of primary energy storage in comparison to 2005.	>20%
2.	Reduce energy dependence from abroad.	Increase to 20% the use of renewable energy resources in primary energy demand.	28%
		Increase to 50% the use of renewable energy resources in electricity production.	52%
3.	Reduce energy intensity in Gross Domestic Product.	Reduce by 20% the energy intensity in Gross Domestic Product (primary energy/Gross Domestic Product) compared to 2005.	>20%
4.	Reduce carbon dioxide emissions.	Reduce CO_2 by 20% in comparison to 2005.	44%

In macroeconomic terms, the implementation of the action plan will provide a 1,8 million Euros per year saving from the supply of fossil fuels, in 2020, at import prices of 2009. With the oil prices rising in international markets, at a rate higher than inflation, it is probable that this saving will be more significant in the future.

Budget

The overall investment foreseen to implement the Sustainable Energy Action Plan of Madeira Island is 41,67 million Euros, to be carried out until 2020. Around 55% to 60% of this investment will be for local human resources, income of companies located in the Region and tax revenue for Local and Regional Administration, while the remaining 40% to 45% will be for importation of goods and services, including renewable energy technologies, energy efficient equipment and specialized services.

It is found that 61,0% of the investment for the implementation of the action plan is aimed at the secondary energy production sector, which includes fundamentally the use of renewable energy for electricity production and a storage and dynamic stabilization system to enable greater penetration of renewable energy in the electricity grid. The transport and residential sectors follow in terms of investment.

Analysing the investments per promoter, 52,9% is carried out by public companies in actions aimed mostly at the use of renewable sources for electricity production. Citizens follow with 26,7% and private companies and organizations with 16,0%. The Regional Government and the municipality represent each 2,2% of the investment.

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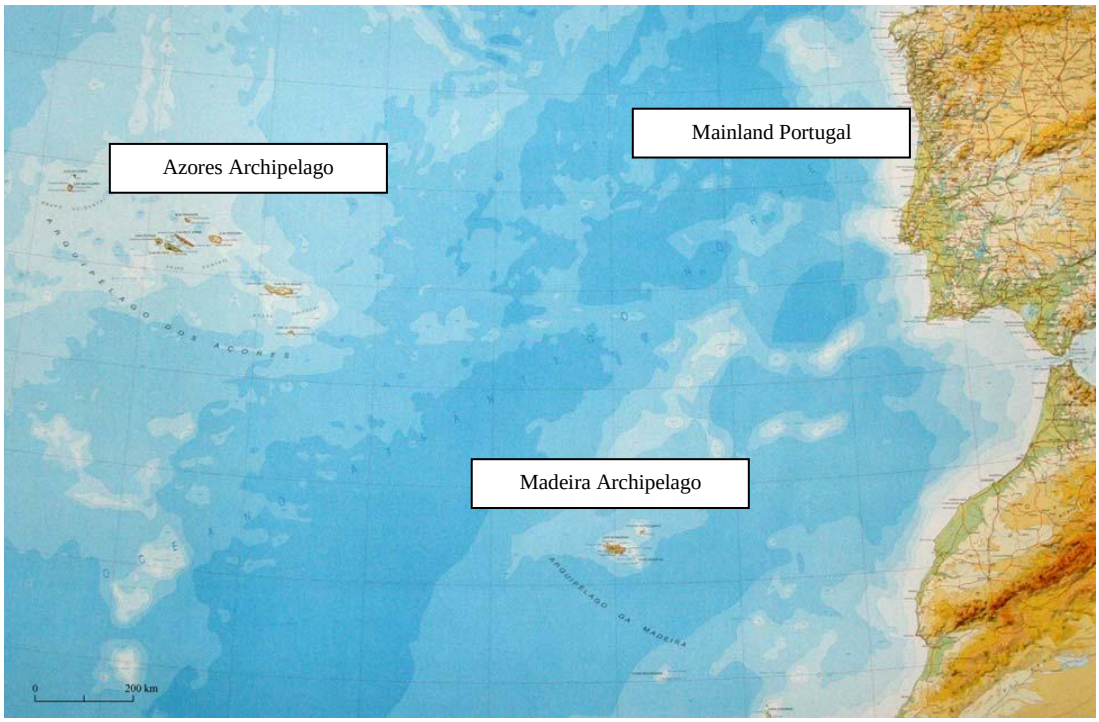
1. CONTEXT

1.1. Geography and territory

Porto Santo Island is the smaller of the two inhabited islands of the Madeira archipelago, one of the seven outermost regions of the European Union, situated in the North Atlantic ocean, between the parallels of 32º 59' 40" N and 33º 07' 35" N latitude and between the meridians of 16º 16' 35" W and 16º 24' 35" W longitude.

Porto Santo Island lies approximately 500 miles from the Azores archipelago and from mainland Portugal (about 900 km from the Lisbon capital) and 28 miles northeast of Madeira Island, the largest inhabited island of the Madeira archipelago. The nearest territories are the Canary Islands, with the island of Tenerife lying approximately 500 km from Porto Santo Island, and Casablanca, Morocco, in the African coast, lying about 800 k from Porto Santo Island.

Figure 1: Madeira Archipelago and the nearest territories



Source: Chart of mainland Portugal and Autonomous Regions, IGP, 2003.

The land area of Porto Santo Island is 42,5 km^2, with a maximum length of 11 km from West to East and with a maximum width of 6 km, from North to South. Porto Santo Island has a milder orography than Madeira Island, being its highest points, *Pico do Facho* (517 m) and *Pico Branco* (450 m) in the northeast sector and *Ana Ferreira* (283 m) and *Espigão* (270 m) in the southwest. About 40% of the island's area is less than 50 m of altitude and most of the area (54%) is between 50 m and 200 m of altitude, which corresponds approximately to 23 km^2. The coastline is very rocky with jagged cliffs on the north side, being more exposed to the action of the sea and predominant winds from the North, and has a long, narrow sandy beach on the south side, sheltered from the wind and action of the sea.

About 10% of the land is used for agriculture, and 15% of the total area is occupied by exotic forest. The population is concentrated along the south coast where the beach occupies the coastline and where the majority of hotels is situated.

1.2. Demography

According to preliminary data from the 2011 Census, the resident population of the Autonomous Region of Madeira was comprised of 267 785 inhabitants, of which, 5 483 reside in Porto Santo Island, representing 2% of the archipelago's population. The population density of Porto Santo Island is 129 inhabitants/km^2.

In Porto Santo, due to its peak tourism in summer, the non-resident population may increase three-fold.

Table 1: Resident Population in Porto Santo Island

	1981	1991	2001	2011
Porto Santo	4 376	4 706	4 474	5 483

Source: *INE* (Statistics of Portugal) – 1991 Census, 2001 Census, 2011 Census (provisional results).

The growth of the resident population of Porto Santo Island has not always been regular. In 2001, this indicator fell in relation to previous decades, but in 2011, shows again an increase, which can be explained mainly by the rectification of the 2001 Census results.

1.3. Economy

Considering the official figures published from the Regional Accounts, the following table shows the progress of the Gross Value Added (GVA) over the last years of the Autonomous Region of Madeira, not existing specific data for Porto Santo Island.

Table 2: Distribution of GVA per economic activity in Autonomous Region of Madeira

Economic Activity	2000	2005	2008p	2009p	
	[Meuro]	[Meuro]	[Meuro]	[Meuro]	[%]
Agriculture, livestock-breeding, hunting, forestry and fishing	59	75	79	81	2%
Extractive industry; manufacturing; production and distribution of electricity, gas, steam and air-conditioning; water supply, sewerage, waste management and remediation activities	207	270	322	320	7%
Construction	314	387	395	369	8%
Wholesale and retail trade; repair of motor vehicles and motorcycles; transport and storage; accommodation and food service activities	933	1 214	1 371	1 342	30%
Information and communication	55	83	98	96	2%
Financial and insurance activities	202	160	273	230	5%
Real estate activities	186	248	319	320	7%
Consulting, scientific and technical activities; administrative and support services	361	419	682	626	14%
Public administration and defence; compulsory social security; education, human health and social work activities	541	893	956	1 024	23%
Arts and entertainment activities; repair of household goods and other services	67	81	96	130	3%
TOTAL	**2 924**	**3 832**	**4 590**	**4 539**	**100%**

Source: *INE* (Statistics of Portugal), Regional Accounts, base year 2006, 1995 – 2009p.

The largest contribution to the GVA in the Autonomous Region of Madeira comes from tertiary sector activities (83% from GVA and 69% from employment in 2009), with a strong presence from activities connected to tourism and commerce.

The annual average growth rate of the Gross Domestic Product (GDP) in the Autonomous Region of Madeira between 2000 and 2009 was 5,1% (national average rate 3,2%). In 2009, the Autonomous Region of Madeira had the second largest GDP per capita in Portugal, situated above the European average: 20 761 € in 2009 (131,4 – Portugal index=100; 105 – EU27=100). The growth trend of the GDP in the Autonomous Region of Madeira inverted in 2009, as can be seen in the following table.

Table 3: Progress of GDP in Autonomous Region of Madeira at market prices

	2005	2006	2007	2008	2009
GDP [Meuro]	4 433	4 942	5 044	5 287	5 134
GDP per capita [euro]	18 133	20 130	20 483	21 410	20 761

Source*: INE* (Statistics of Portugal).

The "Employment Statistics of the Autonomous Region of Madeira – 1st Quarter of 2011" conducted by the Regional Directorate of Statistics, indicate an estimate of the Region's active population of 131 551 individuals for this quarter which represents 53,1% of the total population and confirms positive growth of the active population in relation to the 2001 Census.

In Porto Santo Island, regarding the distribution of the population by activity sectors, the primary sector recorded a substantial decrease since 1991, against the increase of the secondary sector and especially of the tertiary sector, which results from the dynamics of development in the island in recent years, especially in the tourism and services sector and from the gradual abandonment of agricultural activity.

1.4. Political and administrative structures

The Autonomous Region of Madeira is an autonomous region of the Republic of Portugal, endowed with an Administrative-Political Statute and self-ruling governmental bodies. Its political, administrative, financial, economic and fiscal autonomy is exercised in the framework of the Portuguese Constitution and of the Political-Administrative Statute of the Autonomous Region of Madeira.

While a Portuguese territory, the Region falls under the community's and Portuguese legislation, in particular, regarding European Union commitments on energy and climate, being the legislation adapted to the regional legal regime, according to regional specificities, namely political-administrative.

For the purpose of defining legislative powers or legislative initiative for the Region, as well as grounds for mandatory consultation by the organs of sovereignty, the Political-Administrative Statute of the Autonomous Region of Madeira defines the specific regional matters of interest, for example local energy production, on which the Region has the authority to define regional policies and to legislate.

The formulation and the implementation of the energy policy falls under the competence of the Regional Government, although other actors also deserve to be mentioned, namely private actors that have a relevant intervention in the energy sector.

1.4.1. Regional Government

The Regional Government of Madeira is responsible, in general terms and amidst other duties, for guiding the Region's policy and taking the necessary measures to promote economic and social development and meeting regional community needs. In this perspective, it is up to the Regional Government to also direct, coordinate, supervise and inspect its services, its public institutes, and its public and nationalized companies that exercise their activity exclusively or predominantly in the Region.

Vice-Presidency of the Regional Government

The governmental body with relevant responsibilities in the energy field is the Vice-Presidency of the Regional Government. It has the power to define and implement the necessary actions to be complied with the regional policy in the energy sector. In addition to these powers, it is the responsibility of the Vice-Presidency to oversee some public and government subsidized companies operating in the energy sector.

It is the responsibility of the Vice-Presidency to define policies and respective action plans, to control and supervise the implementation of those plans, to prepare the necessary legislation, to license and set taxes and tariffs.

Integrating the Vice-Presidency, the Regional Directorate of Commerce, Industry and Energy (DRCIE) is responsible for supporting the Regional Government in the elaboration and implementation of the energy policy for the energy sector, and also to support other areas under its competence.

This regional directorate has competences to approve projects of the energy sector and to license facilities and equipments that produce, use, transport or store energy products, in conjunction with other organisms, and promote and collaborate in the preparation or adaptation of regulations and technical specifications suited to the Region. It also has the responsibility to develop and propose measures that encourage the reduction of energy dependence from abroad and to tackle situations of interference in the normal supply of energy products. It is also up to this regional directorate to analyse and participate in the formulation of energy prices and tariff systems, especially for the electricity sector. Amongst its competences, this regional directorate is the supervising entity, in the energy area, of the National Energy Certification and Indoor Air Quality in Buildings (SCE), which implements the Community Directive 2002/91/CE on the energy performance in buildings.

The Directorate of Energy Services, which is a service of the Regional Directorate of Commerce, Industry and Energy, is split into three divisions: Electricity Division, Fuel Division and Rational Use of Energy Division, all having technical and specific responsibilities in their areas of intervention, in the scope of the competences of the regional directorate, namely referring to inspection, licensing, collection and dissemination of information and the development of studies and of other actions in the energy field.

The Regional Civil Engineering Laboratory (LREC), overseen by the Vice-Presidency of the Regional Government, has as its main duty, in the energy field, through the Department of Hydraulics and Energy Technology, to evaluate endogenous energy resources. In addition, this laboratory has expertise in providing construction solutions for buildings, relevant to their energy performance.

Regional Secretariat of Environment and Natural Resources

The Regional Secretariat of Environment and Natural Resources (SRA) has the responsibility to define and coordinate the regional policy on environment, water, basic sanitation, forestry, nature conservation, botanical garden, fishing, agriculture and livestock breeding. Presently, the competences of this regional secretariat in the fields of environment, water, basic sanitation and

forestry are of relevance to the energy sector. The competences in the water management policy have great influence on the hydro-electric use of water. Similarly, the policies on solid waste management and on forest resources may potentiate better use of the endogenous energy resources.

In the environmental domain, depending on the size and characteristics of new energy facilities, it is up to the Regional Directorate of Environment (DRAmb) to provide opinions required by the respective licensing authorities.

1.4.2. Electricity Company of Madeira

The *Empresa de Electricidade da Madeira, S.A.* (EEM) is a public limited company with exclusive public capital. In order to safeguard public interest and valorisation of regional economic potential, the shares of the EEM belong to the Autonomous Region of Madeira and may only be transferred to public entities. The Region's rights as a shareholder of the company are exercised by the Regional Government of Madeira, through the Vice-Presidency, that oversees the energy sector.

The mission of the EEM is the production, transport and distribution of electricity, in agreement with the regional policy for the sector under the supervision of the Vice-Presidency. EEM is also responsible for the management of Madeira's and Porto Santo's electricity systems, the carrying out of the necessary investments to meet the energy needs and to guarantee the quality of electricity supply services.

Regarding the transport and distribution of electricity, the Electricity Company has exclusive rights to the services, while, for the production, the system is open to independent producers, namely private, that provide the network with the energy produced.

1.4.3. Regional Agency for Energy and Environment in the Autonomous Region of Madeira

AREAM - Agência Regional da Energia e Ambiente da Região Autónoma da Madeira is a private, non-profit association, recognised as public utility, with the mission to investigate, innovate, promote and disseminate information in the energy and environment domains.

In the scope of carrying out its objectives, AREAM supports the Regional Government in the formulation and implementation of the regional energy and environmental policies, as well as, the economic agents to promote the use of efficient technologies compatible with sustainable development. AREAM studies, promotes and disseminates measures and technologies suited to the implementation of the energy and environmental policies, mostly regarding the reduction of energy dependence from abroad and protection of the environment. AREAM also carries out projects regarding energy efficiency and the use of renewable energy, innovation and inter-regional cooperation, especially with other insular and outermost regions.

Besides these functions, AREAM ensures the technical management of the implementation of the National Energy Certification and Indoor Air Quality in Buildings which implements the European Directive 2002/91/CE on energy performance in buildings.

1.4.4. Energy Services Regulatory Authority

The *Entidade Reguladora dos Serviços Energéticos* (ERSE) is a public corporate body with administrative and financial independence and possesses its own assets and is responsible for regulating the electricity and natural gas sectors. The competences of ERSE were extended to the Autonomous Regions of Madeira and Azores regarding the regulation on the electricity sector.

In the scope of its public service mission, ERSE is given a range of powers by law and its Statutes. These powers include: to protect consumer's rights and interests as regards prices, services and service quality; to implement the liberalization of the electricity sector, to prepare the liberalization of the natural gas sector and to promote competitiveness in order to improve efficiency of activities subject to its regulation; to guarantee impartiality of regulation rules and transparency of commercial ties between operators and between operators and consumers; and to contribute to the progressive improvement of technical, economical, and environmental conditions in the regulated sectors, encouraging, namely, the adoption of practices that promote efficient use of electricity and of natural gas and the existence of adequate standards of service quality and environmental protection.

The extension of ERSE's regulatory competences to the Autonomous Regions derives from the principle of sharing benefits from the convergence of the national electricity systems and has as finality to contribute to the correction of inequalities in these autonomous regions, given the constraints resulting from insularity and being outermost regions.

1.4.5. Other Entities

Besides the entities mentioned above, there exist other entities whose intervention influence the energy sector, namely:

- Companies that import and distribute petroleum-based products – These companies have an important role in ensuring the quality and supply of petroleum-based products for power generation and for end-users, as well as in setting the selling prices of some fuels.
- Independent producers of electricity – There are some wind and solar photovoltaic plants promoted by independent producers meaning an important contribution in the use of endogenous energy resources. The energy production is supplied to the electric grid, according to the applicable legislation.
- Installers of renewable energy systems – These companies supply and install systems to use solar thermal energy for water heating and solar photovoltaic and wind energy for electricity production under micro and mini-production regimes. Their involvement is critical for the promotion of renewable energy amongst the final consumers and small investors.
- Energy Service Companies – The Energy Service Companies (ESCOs) play a key role in financing and promoting energy efficiency, including needs assessment, implementation, monitoring and technical assistance.

2. GLOBAL STRATEGY

2.1. Current framework and vision for the future

Energy constitutes a strategic factor for the development of the Autonomous Region of Madeira, as it bears all the economic and social activities and has a significant weight in the imports and in the economy, with repercussions on the competitiveness, employment and quality of life.

Primary energy demand has doubled over the last 20 years and the specificities of an insular, outermost region, distant from the large continental energy networks, imply higher costs for energy supply and conversion, due to the transport and smaller sized markets and infrastructures. These additional costs mean that energy efficiency measures and valorisation of renewable energy sources become more interesting from an economic standpoint, in addition to the environmental and social benefits.

In this sense, the Autonomous Region of Madeira has followed an energy policy which aims to reduce energy dependence from abroad and to minimize the negative environmental impacts associated with fossil fuels.

The first energy plan was approved by the Region in 1989 and later updated in 1992 and 2002. The Energy Policy Plan of the Autonomous Region of Madeira constitutes, to the present, a planning instrument which has guided the adopted strategy of valorising endogenous resources and promoting energy efficiency.

In sequence to the strategy that has been followed, the actual situation and future perspectives for socio-economic development and growth of the energy sector require a sustainable energy policy based on efficiency and valorisation of local resources, as described in the objectives set by the European Union on Energy and Climate.

As a vision for the future, the energy policy is oriented to ensure energy supply guarantee, economic and environmental sustainability of the sector and quality of energy services, and to contribute to job creation, regional added value and economic competitiveness.

2.2. Objectives and targets

The specific main objectives of the strategy for sustainable energy in Porto Santo Island are to:

1. Improve security of energy supply.
2. Reduce energy dependence from abroad.
3. Reduce energy intensity in Gross Domestic Product.
4. Reduce carbon dioxide emissions.

The targets to achieve in 2020, in Porto Santo Island, for each objective set, are presented in the following table.

Table 4: Targets for 2020

Objectives		Targets
1.	Improve energy supply guarantee.	Increase by 20% the number of days of autonomy of primary energy storage in comparison to 2005.
2.	Reduce energy dependence from abroad.	Increase to 20% the use of renewable energy resources in primary energy demand.
		Increase to 40% the use of renewable energy resources in electricity production.
3.	Reduce energy intensity in Gross Domestic Product.	Reduce by 20% the energy intensity in Gross Domestic Product (primary energy/Gross Domestic Product) compared to 2005.
4.	Reduce carbon dioxide emissions.	Reduce CO_2 by 20% compared to 2005.

The 20% CO_2 emission reduction target, in comparison to 2005 reference year, is a confirmed commitment of Porto Santo Island with its voluntary entry to the Pact of Islands.

2.3. Strategic guidelines

In order to fulfil each specific objective, and taking into account the targets for 2020, five strategic guidelines are established, that aim to guide the implementation of sustainable energy actions in Porto Santo Island:

1. Improve efficiency in energy conversion and use.
2. Increase the contribution of renewable energy resources.
3. Diversify energy sources.
4. Increase the capacity of energy storage infrastructures.
5. Promote energy products and services that encourage economic development, regional added value and skilled labour.

The strategic guidelines contribute to the objectives established, as can be seen in the following table.

Table 5: Strategic guidelines per objective

Objectives		Strategic guidelines
1.	Improve energy supply guarantee.	• Improve efficiency in energy conversion and use. • Increase the contribution of renewable energy resources. • Diversify energy sources. • Increase the capacity of energy storage infrastructures.
2.	Reduce energy dependence from abroad.	• Improve efficiency in energy conversion and use. • Increase the contribution of renewable energy resources.
3.	Reduce energy intensity in Gross Domestic Product.	• Improve efficiency in energy conversion and use. • Increase the contribution of renewable energy resources. • Promote energy products and services that encourage economic development, regional added value and skilled labour.
4.	Reduce carbon dioxide emissions.	• Improve efficiency in energy conversion and use. • Increase the contribution of renewable energy resources.

The improvement of efficiency in energy conversion and energy use, as well as, the increase of the contribution of renewable energy resources in primary energy demand, are common strategic orientations to all objectives, which constitute fundamental aspects in the regional policy and in the actions to be implemented.

3. ENERGY BALANCE AND EMISSION INVENTORY

3.1. Baseline situation

The baseline situation of the action plan reflects the state of energy demand and of carbon dioxide emissions (CO_2) before the preparation of the plan and constitutes the reference basis for 2020 scenario drafting and setting of objectives and targets.

The baseline year, for the elaboration of energy demand scenarios, is 2009, which is the most recent year with detailed data available. For the carbon dioxide emissions, in order to keep in line with the objectives set for the European Union and with the criteria established in the scope of the Pact of Islands, the year 2005 was adopted as the baseline year.

For the characterization of the baseline situation, a survey on the energy demand per energy carrier and per activity sector, as well as on energy conversion per product and per source, was answered by respective suppliers and producers. In addition, a questionnaire was conducted to a sample of 43 families for the residential sector and direct consultations made to relevant users and installers of renewable energy systems, to bridge some information gaps.

Based on the information gathered, an energy balance for 2009 was drawn up, taking into consideration the final energy demand, energy conversion for heat and electricity production, and primary energy demand. The carbon dioxide emission inventory was determined for the years 2005 and 2009.

3.1.1. Final energy demand

The final energy demand, per energy carrier and per sector, in Porto Santo Island, in 2009, is presented in the following table and figures.

Table 6: Final energy demand in 2009

Energy carriers		Residential [MWh]	Primary sector [MWh]	Secondary sector [MWh]	Tertiary sector [MWh]	Transports [MWh]	TOTAL [MWh]
Centralized energy services	Electricity	7 439	137	8 097	19 279		34 953
Fossil fuels	Diesel		103		2 173	20 123	22 399
	Gasoline					11 688	11 688
	LPG	4 275			652		4 927
	Subtotal	4 275	103		2 825	31 811	39 014
Renewable energy sources	Solar	102			14		116
	Biomass	111					111
	Subtotal	213			14		227
TOTAL		**11 927**	**240**	**8 097**	**22 118**	**31 811**	**74 194**

Figure 2: Final energy demand per sector in 2009

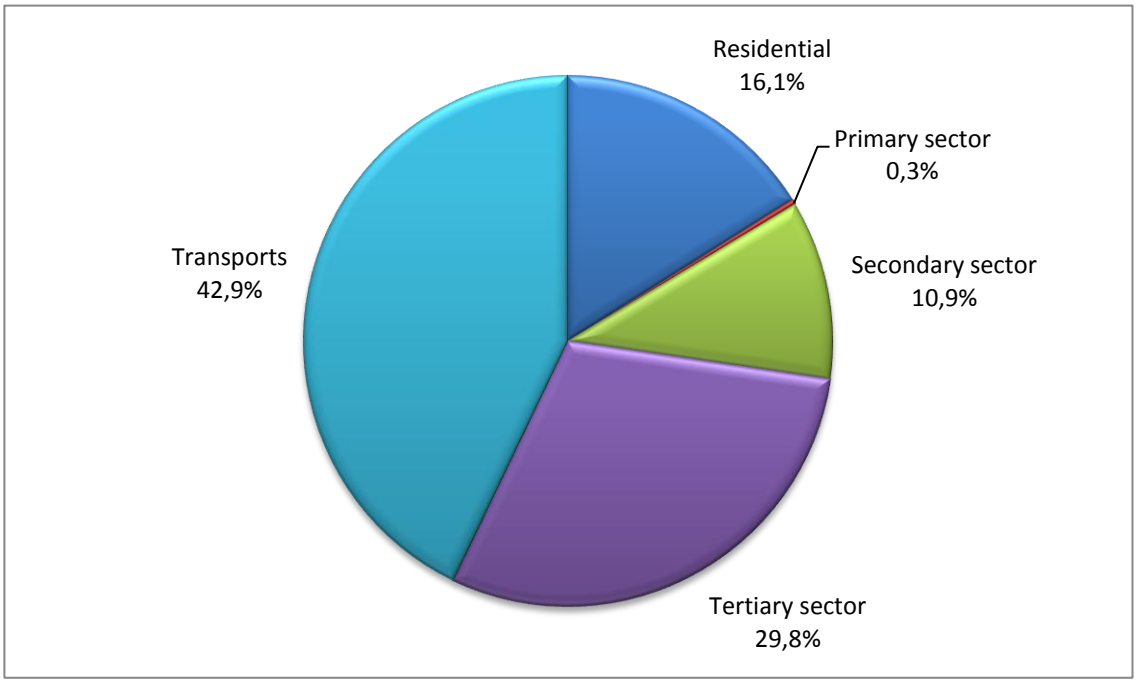
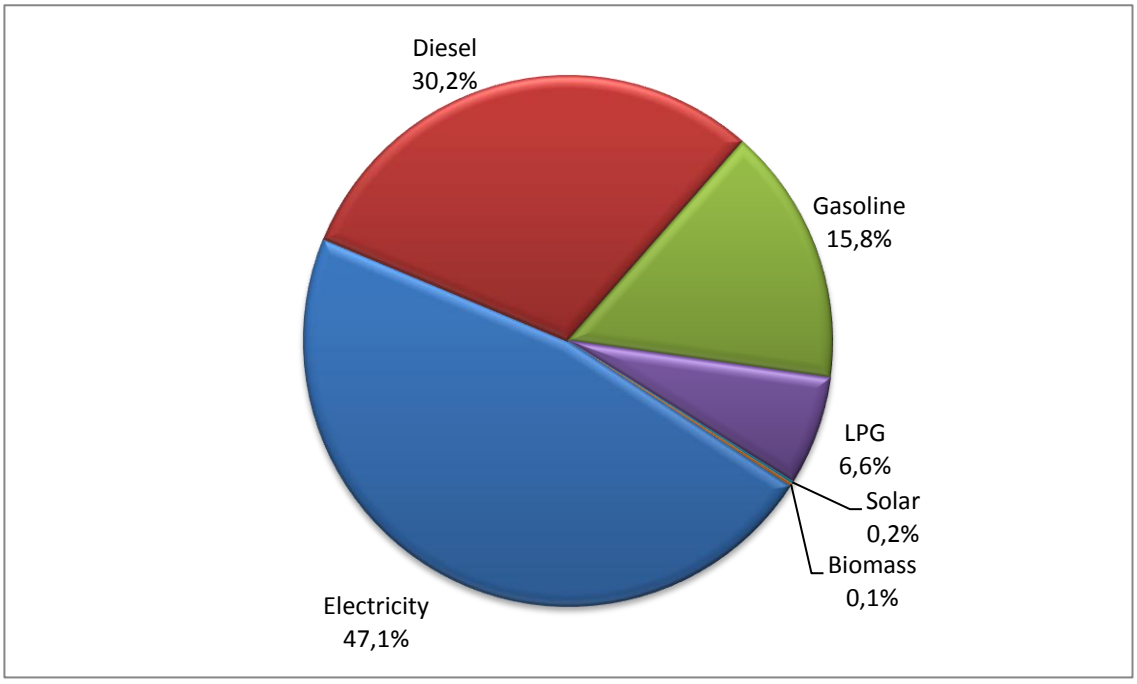


Figure 3: Final energy demand per energy carrier in 2009



From the analysis of the final energy demand, it's worthy to note the significant weight of the land transport sector, with a 42,9% contribution, followed by the tertiary sector, which includes hotels, commerce, services (public and private) and street lighting, contributing with 29,8%, the residential sector with 16,1%, and the secondary sector, which includes desalination, with 10,9%.

The share of renewable energy resources accounted for only 0,3% of the final energy demand in 2009. Considering the contribution of renewable energy in electricity production, the total renewable component corresponds to 2,8% of the final energy demand.

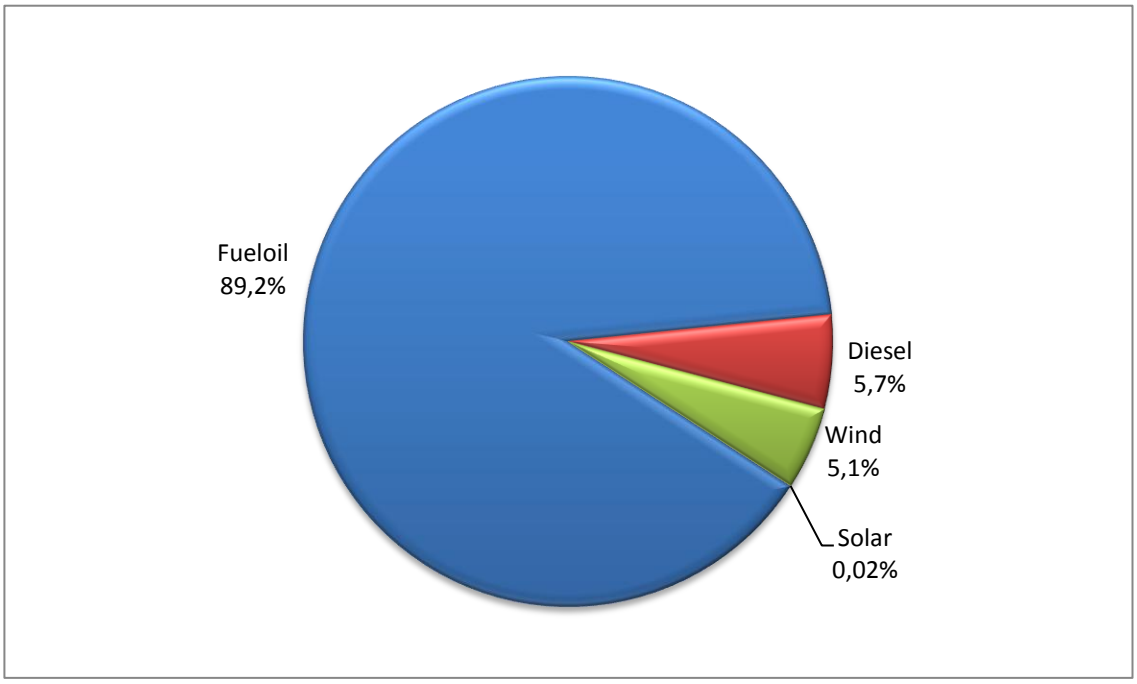
3.1.2. Energy conversion

In Porto Santo Island, energy conversion refers exclusively to electricity production for the Public Service Electricity System of the Autonomous Region of Madeira, because there is no heat distribution network.

Table 7: Energy conversion in 2009

Energy carriers		Electricity production [MWh]
Fossil fuels	Fueloil	32 169
	Diesel	2 057
	Subtotal	34 226
Renewable energy sources	Wind	1 821
	Solar	7
	Subtotal	1 827
TOTAL		**36 053**
Distribution losses and self-consumption		1 100

Figure 4: Electricity production per energy source in 2009



The thermal share of fossil fuels (fueloil and diesel) represented 94,9% of electricity production in 2009. However, in 2010, a new solar photovoltaic park was installed, which contributed to increase the share of renewable energies.

3.1.3. Primary energy demand

The primary energy demand is determined, through an energy balance, by the final energy demand and by the use of energy resources for energy conversion into electricity.

Table 8: Primary energy demand in 2005 and 2009

Energy carriers		2005 [MWh]	2009 [MWh]
Fossil fuels	Fueloil	89 800	93 127
	Diesel	30 272	28 354
	Gasoline	13 022	11 688
	LPG	5 360	4 927
	Subtotal	138 454	138 096
Renewable energy sources	Wind	1 900	1 821
	Solar	82	122
	Biomass	173	111
	Subtotal	2 155	2 054
TOTAL		**140 609**	**140 150**

Figure 5: Primary energy demand in 2005 and 2009

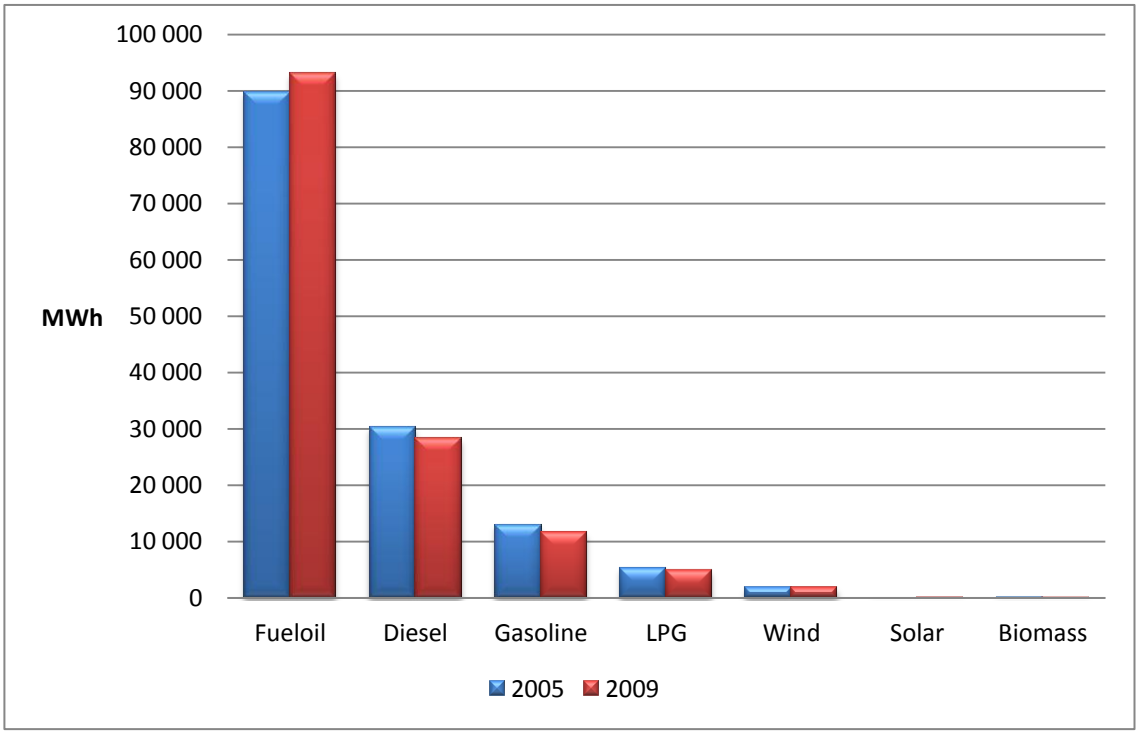
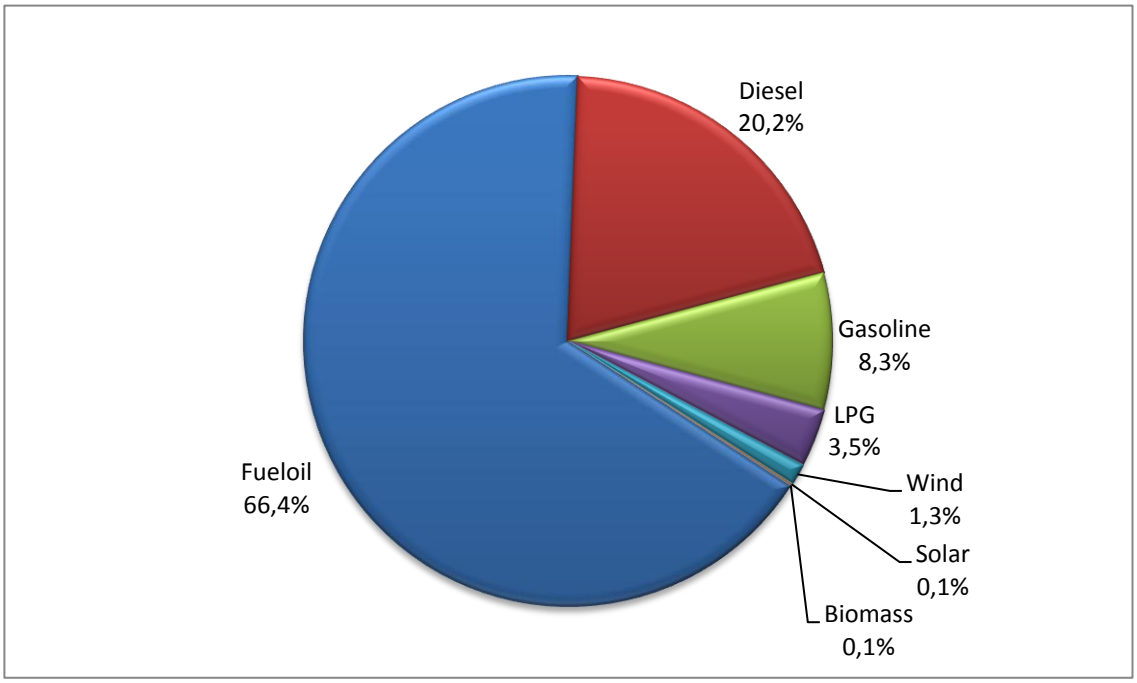


Figure 6: Primary energy demand in 2009



The share of renewable energy resources represented 1,5% of the total primary energy demand in 2005 and in 2009.

3.1.4. Carbon dioxide emissions

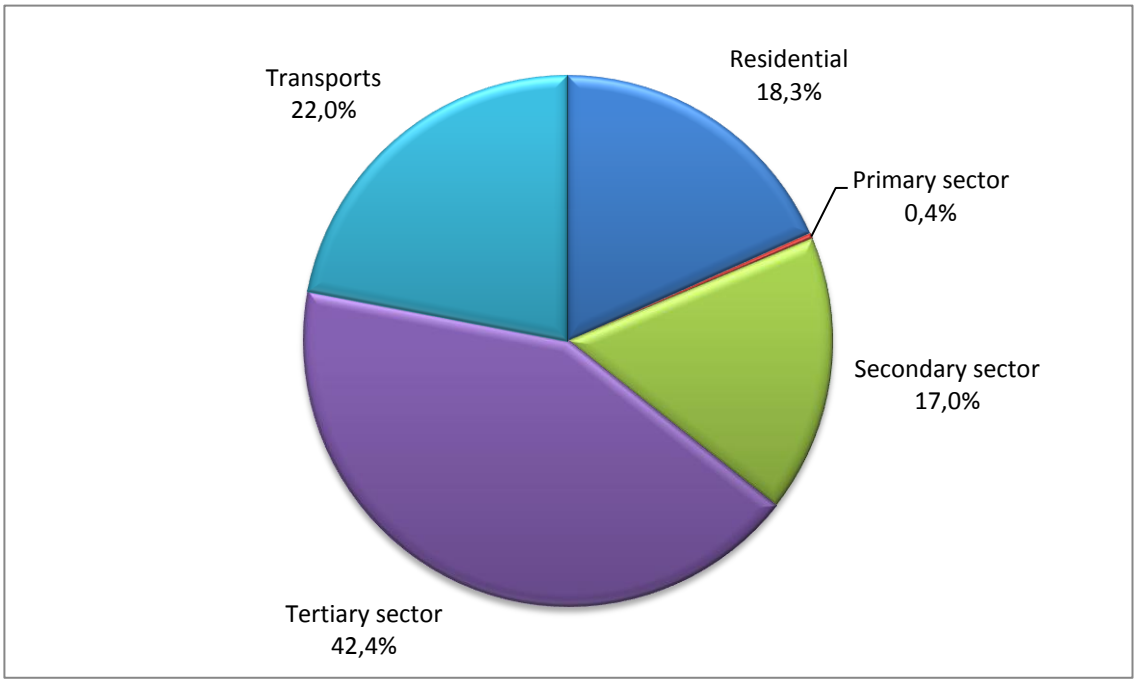
The carbon dioxide emissions were determined according to the IPCC (Intergovernmental Panel on Climate Change) methodology, which considers the carbon content of fuels or non-renewable fractions of energy resources used in the combustion or in electricity production.

Table 9: CO_2 emissions per sector in 2009

Energy carriers		Residential [t]	Primary sector [t]	Secondary sector [t]	Tertiary sector [t]	Transports [t]	TOTAL [t]
Centralized energy services	Electricity	5 869	108	6 387	15 208		27 572
Fossil fuels	Diesel		28		580	5 373	5 981
	Gasoline					2 910	2 910
	LPG	1 026			157		1 182
	Subtotal	1 026	28		737	8 283	10 073
Renewable energy sources	Solar						
	Biomass						
	Subtotal						
TOTAL		**6 895**	**136**	**6 387**	**15 945**	**8 283**	**37 646**

For renewable energy sources, the contribution from wind and solar energy to carbon dioxide emissions was null. For biomass, assuming a sustainable exploitation of the resources, a neutral balance of emissions was considered.

Figure 7: CO_2 emissions per sector in 2009

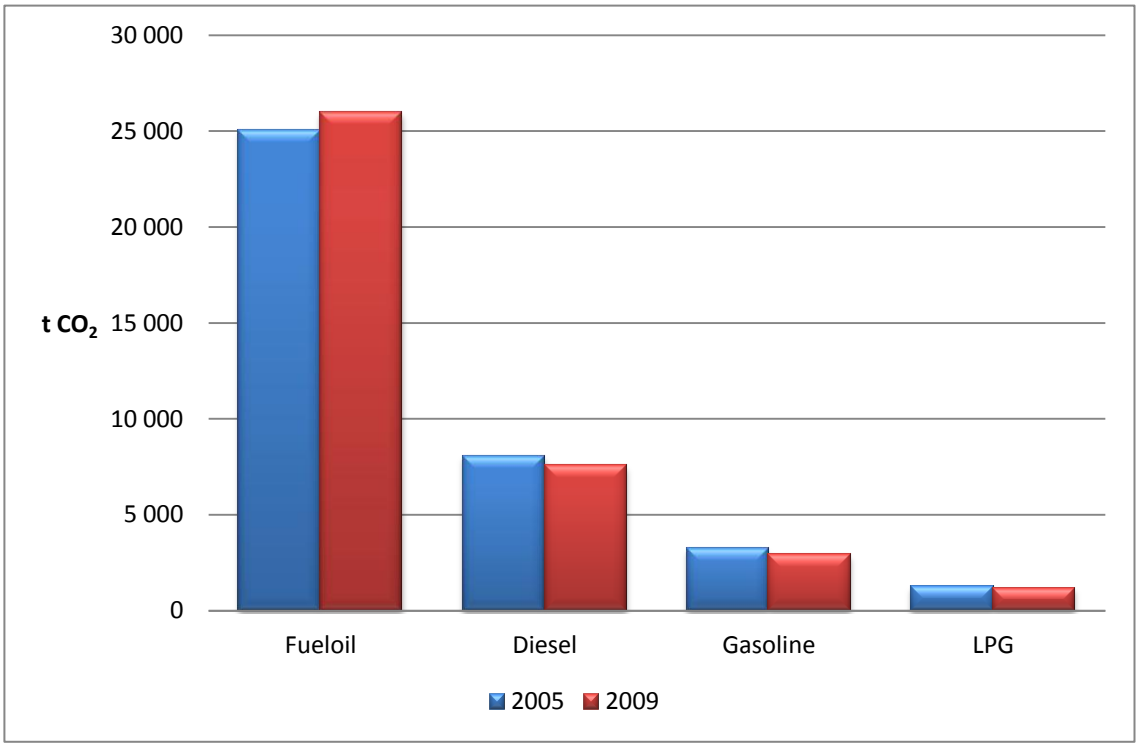


In spite of the transport sector presenting a greater share in the energy demand, the tertiary sector, presents a higher contribution to carbon dioxide emissions (42,4%), by the fact that this sector has a high electricity demand and its production being largely based on fossil energy sources.

Table 10: CO_2 emissions per primary energy carrier in 2005 and 2009

Energy carriers		2005 [t]	2009 [t]
Fossil fuels	Fueloil	25 054	25 982
	Diesel	8 083	7 571
	Gasoline	3 242	2 910
	LPG	1 286	1 182
	Subtotal	37 666	37 646
Renewable energy sources	Wind		
	Solar		
	Biomass		
	Subtotal		
TOTAL		**37 666**	**37 646**

Figure 8: CO_2 emissions per primary energy carrier in 2005 and 2009



A small increase can be verified when comparing the emissions in 2005 and 2009. Despite a slight increase in emissions from fueloil, this was offset by the reduction of diesel, gasoline and LPG.

3.2. Projections for 2020 – Business as usual scenario

The business as usual (BAU) scenario corresponds to the evolution of the energy demand and carbon dioxide emissions until 2020, based on the year 2009, considering that the conditions of the baseline situation are maintained and that the actions advocated in this action plan are not implemented.

The evolution of the energy demand and CO_2 emissions results primarily from socio-economic dynamics and external factors. Thus, for the elaboration of this scenario, the recent evolution of the energy demand in the various sectors, the current macroeconomic environment, the perspectives for development of some relevant activity sectors and the population growth, among other factors, were taken into account.

In this scenario, the evolution of energy efficiency results from the normal acquisition of new equipment and the ageing of existing equipment, therefore it was considered practically constant during the plan's duration. The use of renewable energy by the final consumer follows the energy demand evolution until 2020. As for electricity production from renewable energy sources, the solar photovoltaic park built in 2009 that started producing in early 2010, has already been considered in the BAU scenario, as it was already running when the preparation for the action plan started.

With these presuppositions, the energy balance and the calculations of the carbon dioxide emissions were carried out for each year, until 2020. In the following figures, graphs are presented that reflect the expected evolution of the primary energy demand and emissions until 2020.

Figure 9: Primary energy demand until 2020 – BAU scenario

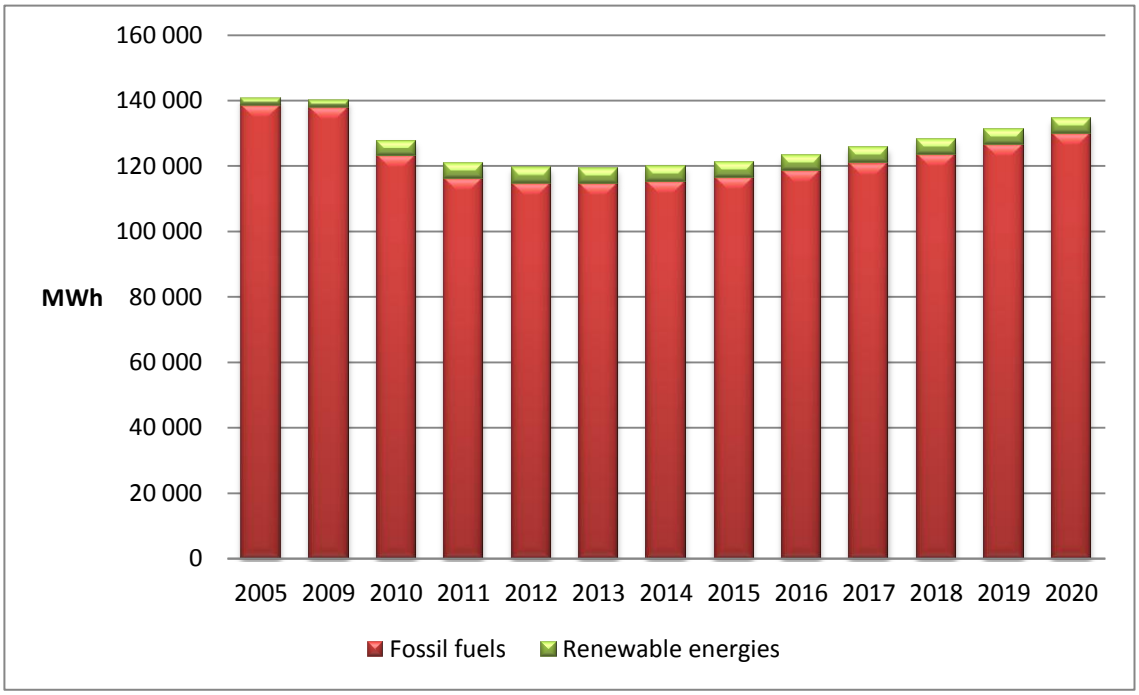
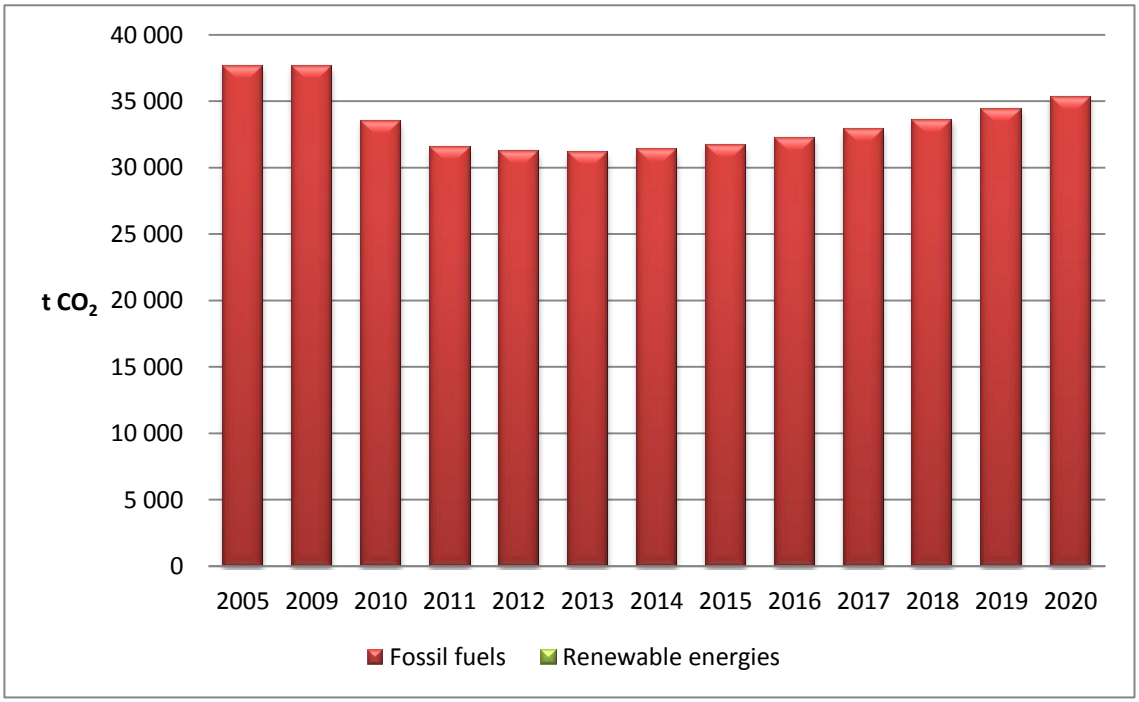


Figure 10: CO_2 emissions until 2020 – BAU scenario



In this scenario, the carbon dioxide emissions decrease by 6%, when the target set, in the scope of the Pact of Islands, points to a reduction of at least 20% of emissions.

3.2.1. Final energy demand

The final energy demand in Porto Santo Island for the BAU scenario, in 2020, per energy carrier and per sector, is presented in the following table and figures.

Table 11: Final energy demand in 2020 – BAU scenario

Energy carriers		Residential [MWh]	Primary sector [MWh]	Secondary sector [MWh]	Tertiary sector [MWh]	Transports [MWh]	TOTAL [MWh]
Centralized energy services	Electricity	7 741	140	8 151	18 037		34 069
Fossil fuels	Diesel		107		2 057	21 309	23 472
	Gasoline					12 468	12 468
	LPG	4 448			617		5 066
	Subtotal	4 448	107		2 675	33 777	41 006
Renewable energy sources	Solar	106			12		119
	Biomass	44					44
	Subtotal	150			12		163
TOTAL		**12 340**	**247**	**8 151**	**20 724**	**33 777**	**75 238**

Figure 11: Final energy demand per sector in 2020 – BAU scenario

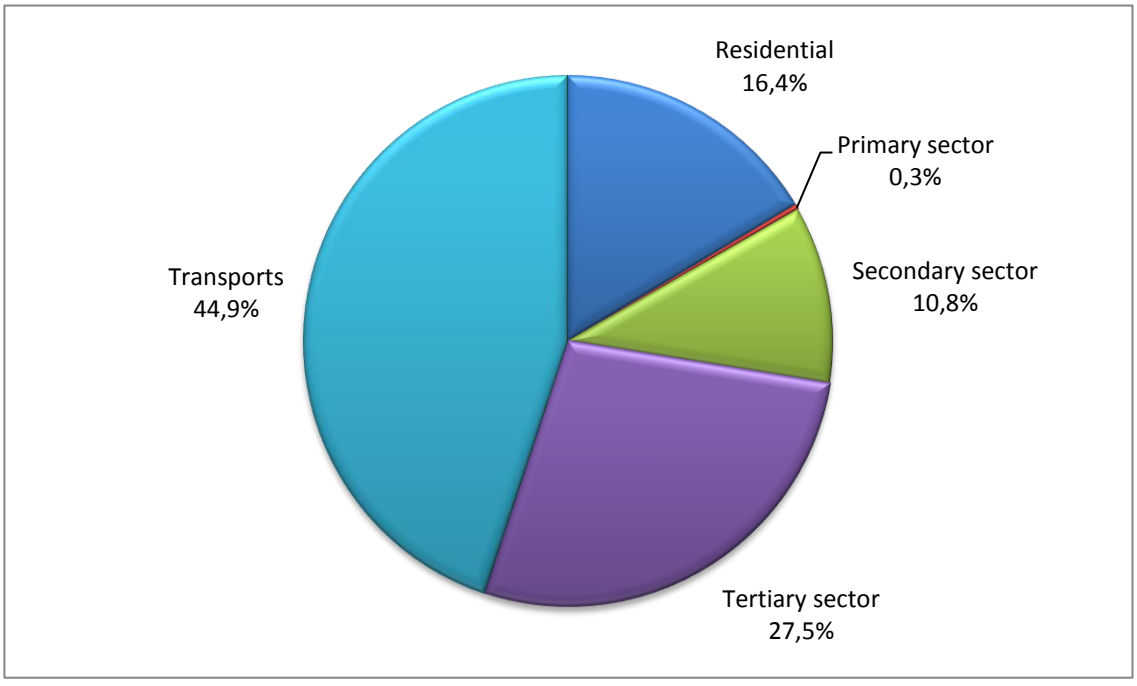
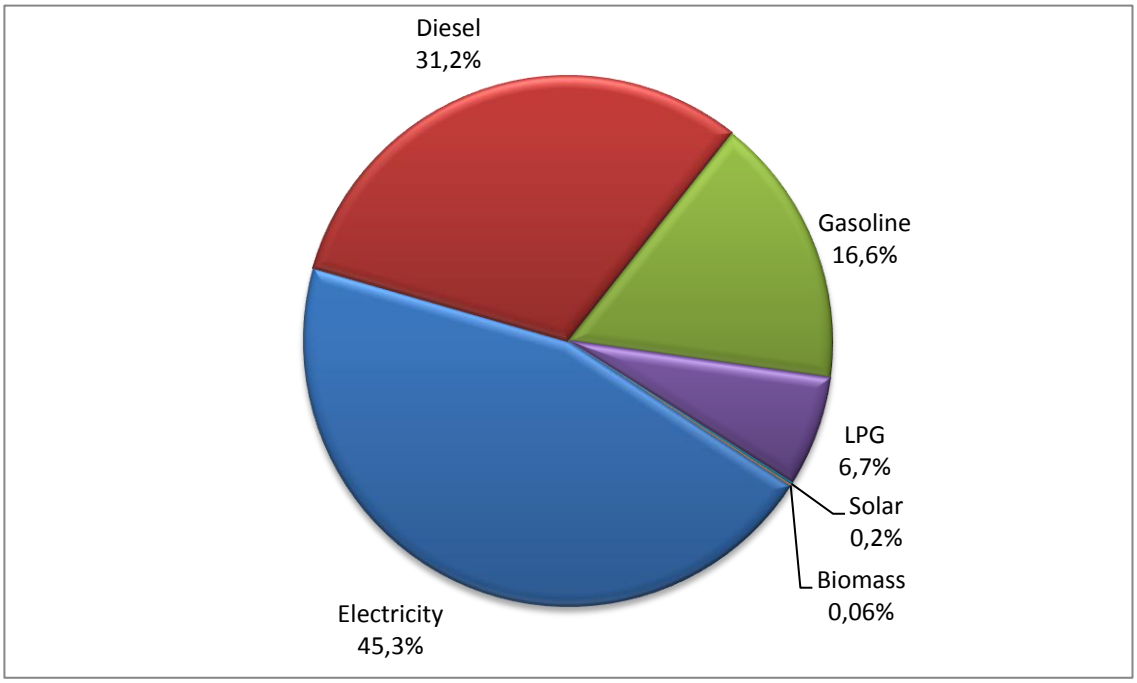


Figure 12: Final energy demand per energy carrier in 2020 – BAU scenario



From the analysis of the final energy demand, it can be highlighted the significant weight of the land transport sector, which increases its contribution compared to the reference year (42,9% in 2009 and 44,9% in 2020), while the tertiary sector reduces slightly (29,8% in 2009 and 27,5% in 2020). The residential sector varies little (16,1% in 2009 and 16,4% in 2020), as well as the secondary sector (10,9% in 2009 e 10,8% in 2020).

Per energy carrier, one can point out the decrease of the electricity demand percentage (47,1% in 2009 and 45,3% in 2020).

The share of renewable energy sources represents, in this scenario, 0,2% of the final energy demand in 2020. Considering the contribution of renewable energy in electricity production, the total renewable share corresponds to 6,0% of the final energy demand.

3.2.2. Energy conversion

In the BAU scenario, regarding the energy conversion for electricity production, it was considered that the demand growth was assured by the increase of the thermal energy share, maintaining the energy production from renewable sources of 2009 until 2020, adding the solar photovoltaic park built in 2009, which started producing energy in early 2010.

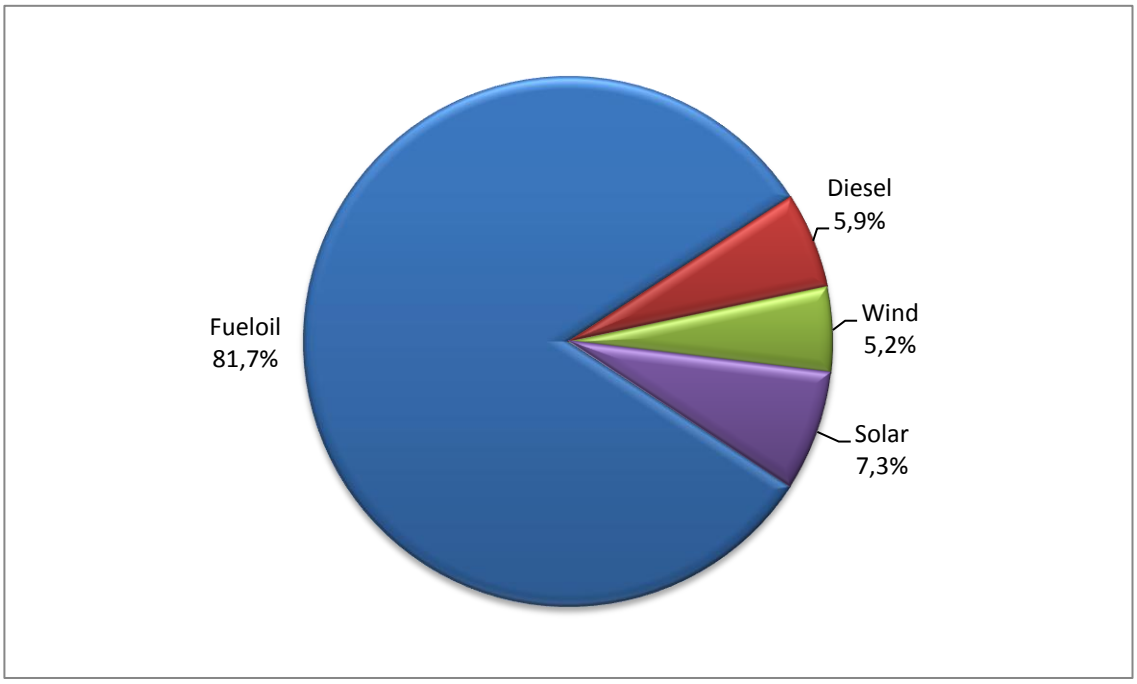
As the most recent projects or under development, such as the production of biofuel for conversion into electricity, are already included in the strategy of the Sustainable Energy Action Plan of Porto Santo Island, they are not considered in the BAU scenario.

In this scenario, as verified in 2009, the energy conversion refers exclusively to electricity production, not existing distribution networks of thermal energy.

Table 12: Energy conversion in 2020 – BAU scenario

Energy carriers		Electricity production [MWh]
Fossil fuels	Fueloil	28 702
	Diesel	2 057
	Subtotal	30 759
Renewable energy sources	Wind	1 821
	Solar	2 562
	Subtotal	4 382
TOTAL		**35 141**
Distribution losses and self-consumption		1 072

Figure 13: Electricity production per energy source in 2020 – BAU scenario



In the production of electricity in 2020, the thermal component of fossil fuels (fueloil and diesel) represents 87,5%, which is a lower percentage than in 2009, due to the new solar photovoltaic park, which started producing energy in 2010.

3.2.3. Primary energy demand

The primary energy demand for the BAU scenario is determined, through an energy balance, by the final energy demand and by the use of energy resources for the conversion into electricity.

Table 13: Primary energy demand in 2005, 2009 and 2020 – BAU scenario

Energy carriers		2005 [MWh]	2009 [MWh]	2020 [MWh]
Fossil fuels	Fueloil	89 800	93 127	82 953
	Diesel	30 272	28 354	29 418
	Gasoline	13 022	11 688	12 468
	LPG	5 360	4 927	5 066
	Subtotal	138 454	138 096	129 905
Renewable energy sources	Wind	1 900	1 821	1 821
	Solar	82	122	2 680
	Biomass	173	111	44
	Subtotal	2 155	2 054	4 545
TOTAL		**140 609**	**140 150**	**134 450**

Figure 14: Primary energy demand in 2005, 2009 and 2020 – BAU scenario

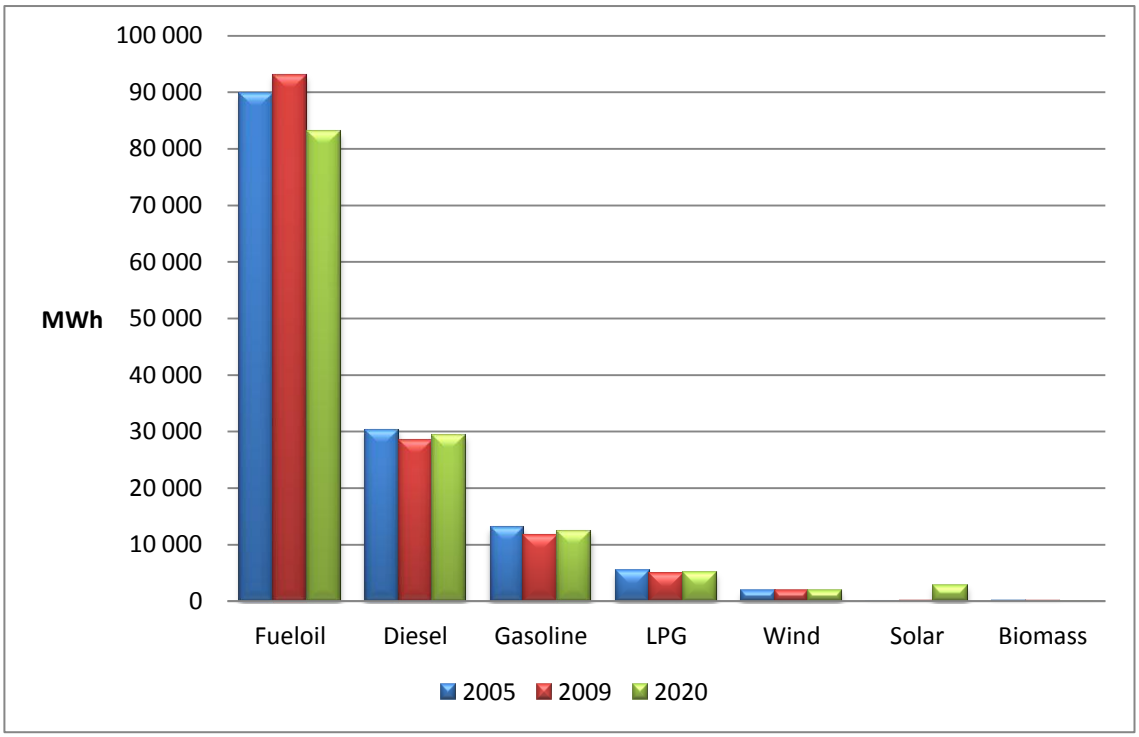
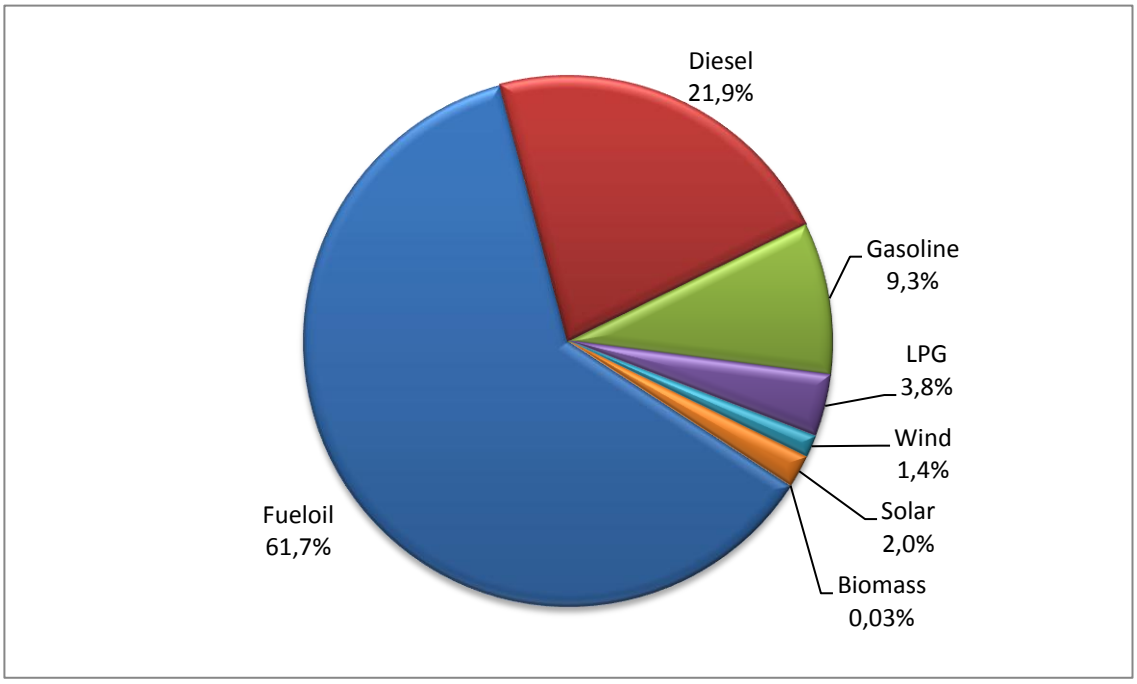


Figure 15: Primary energy demand in 2020 – BAU scenario



The BAU scenario leads to a 4% reduction of primary energy demand until 2020, compared to 2005 and 2009, with a 3,4% share of renewable energy resources, which was 1,5% in 2005 and 2009.

In macroeconomic terms, the supply of fossil fuels in 2020, for this scenario, is equivalent to 5,7 million Euros per year, at 2009 import prices.

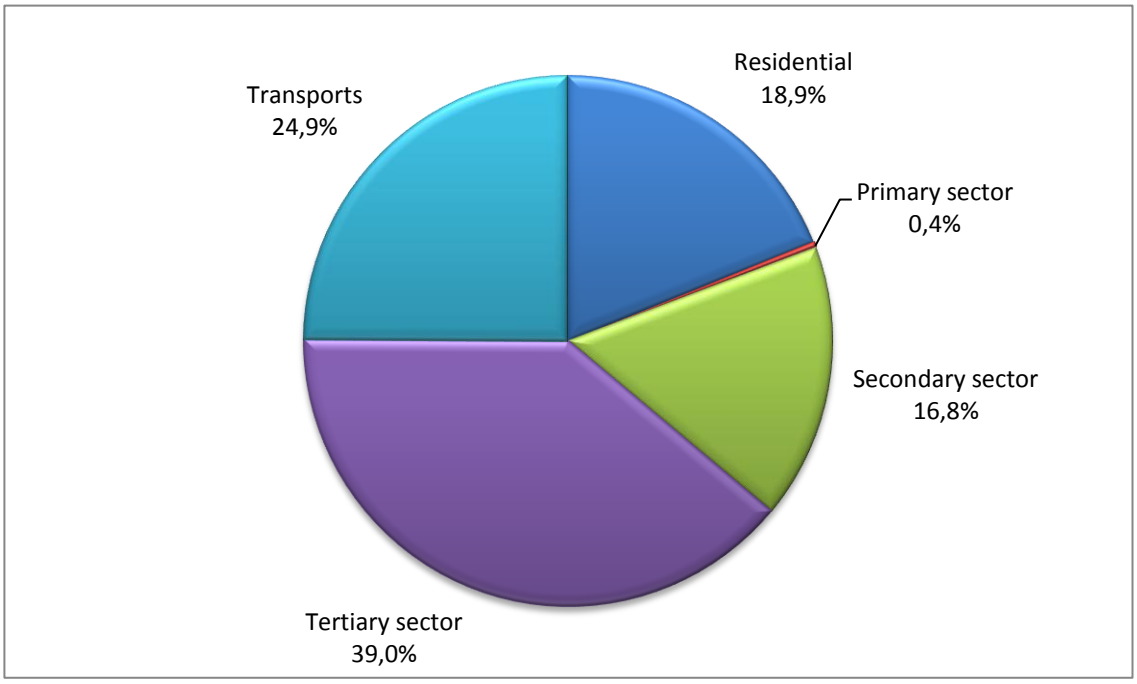
3.2.4. Carbon dioxide emissions

The carbon dioxide emissions are calculated for the year 2020, adopting the same methodology used for the baseline year, from the energy demand projections in the BAU scenario.

Table 14: CO_2 emissions per sector in 2020 – BAU scenario

Energy carriers		Residential [t]	Primary sector [t]	Secondary sector [t]	Tertiary sector [t]	Transports [t]	TOTAL [t]
Centralized energy services	Electricity	5 619	102	5 917	13 093		24 731
Fossil fuels	Diesel		28		549	5 689	6 267
	Gasoline					3 105	3 105
	LPG	1 068			148		1 216
	Subtotal	1 068	28		698	8 794	10 588
Renewable energy sources	Solar						
	Biomass						
	Subtotal						
TOTAL		**6 687**	**130**	**5 917**	**13 791**	**8 794**	**35 319**

Figure 16: CO_2 emissions per sector in 2020 – BAU scenario



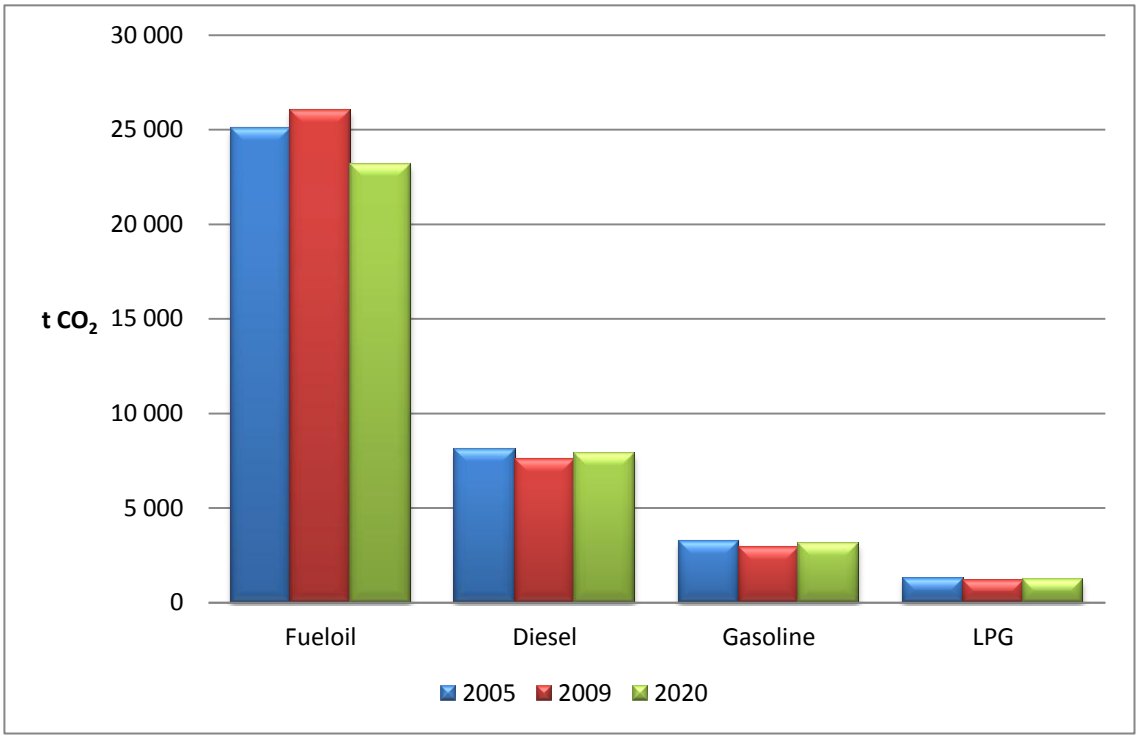
In this scenario, in comparison to 2009, there is a slight increase of emissions in the transport sector and a reduction in the tertiary sector. However, the tertiary sector continues to have the largest portion of emissions, due to the fact that electricity is provided essentially from fossil fuels.

Analysing per energy carrier, there is a slight reduction of carbon dioxide emissions, due to the current trend towards energy demand reduction.

Table 15: CO_2 emissions per primary energy carrier in 2005, 2009 and 2020 – BAU scenario

Energy carriers		2005 [t]	2009 [t]	2020 [t]
Fossil fuels	Fueloil	25 054	25 982	23 144
	Diesel	8 083	7 571	7 854
	Gasoline	3 242	2 910	3 105
	LPG	1 286	1 182	1 216
	Subtotal	37 666	37 646	35 319
Renewable energy sources	Wind			
	Solar			
	Biomass			
	Subtotal			
TOTAL		**37 666**	**37 646**	**35 319**

Figure 17: CO_2 emissions per primary energy carrier in 2005, 2009 and 2020 – BAU scenario



In comparison to the emissions in 2005, a 6% decrease can be noted, being the most significant variation in fueloil for electricity production.

3.3. Projections for 2020 – Action plan scenario

The action plan scenario corresponds to the evolution of the energy demand and carbon dioxide emissions until 2020, based on the year 2009, considering that the actions advocated in the action plan are implemented.

The evolution of the energy demand and CO_2 emissions, result, cumulatively, from the socio-economic dynamics and external factors considered in the BAU scenario and from the implementation of the action plan. Thus, for the preparation of this scenario, the recent development of energy demand in the various sectors, the current macroeconomic context, the perspectives for development of relevant activity sectors and the population growth, among other factors, were taken into consideration, as well as the expected reductions in energy demand and in carbon dioxide emissions from the implementation of the sustainable energy actions of this plan.

In this scenario, the evolution of energy efficiency results mainly from the adoption of more efficient practices and of the acquisition of equipment and systems with better energy performance. The use of renewable energy by the end user has a higher growth than the energy demand evolution until 2020. As for electricity production from renewable energy sources, a significant growth is considered, which associated to the introduction of natural gas, reduces substantially the demand of petroleum-based fuels and carbon dioxide emissions.

With these presuppositions, the energy balance and the calculations of carbon dioxide emissions were carried out, for each year, until 2020. In the following figures, the graphs presented reflect the evolution of primary energy demand and carbon dioxide emissions until 2020.

Figure 18: Primary energy demand until 2020 – Action Plan scenario

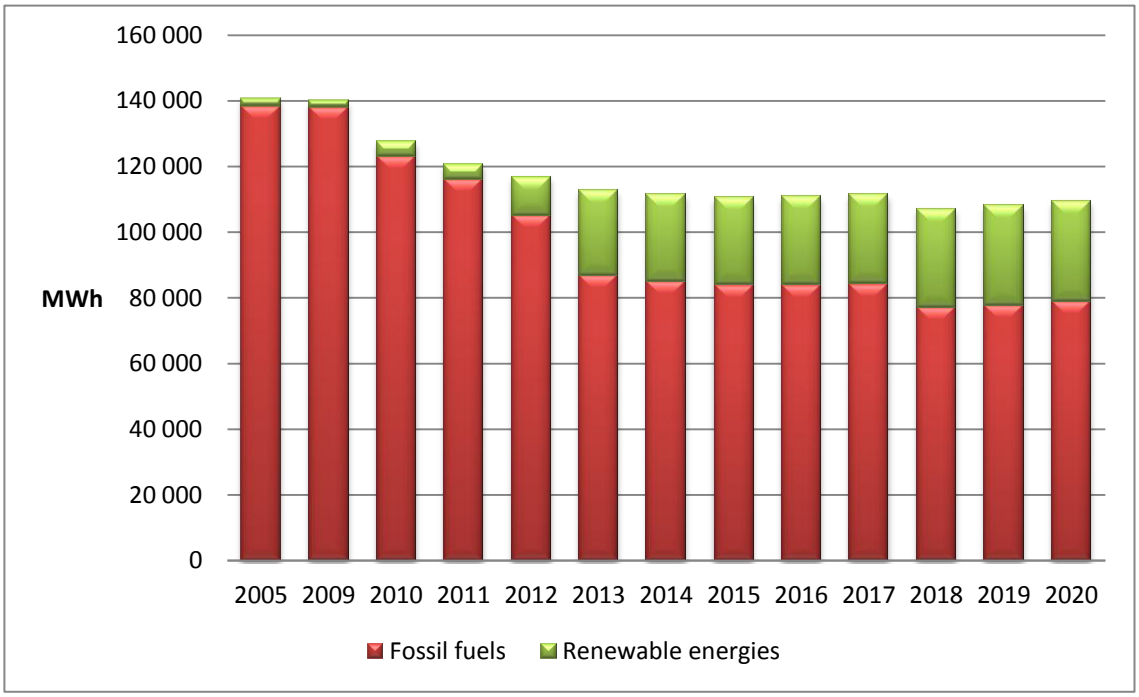
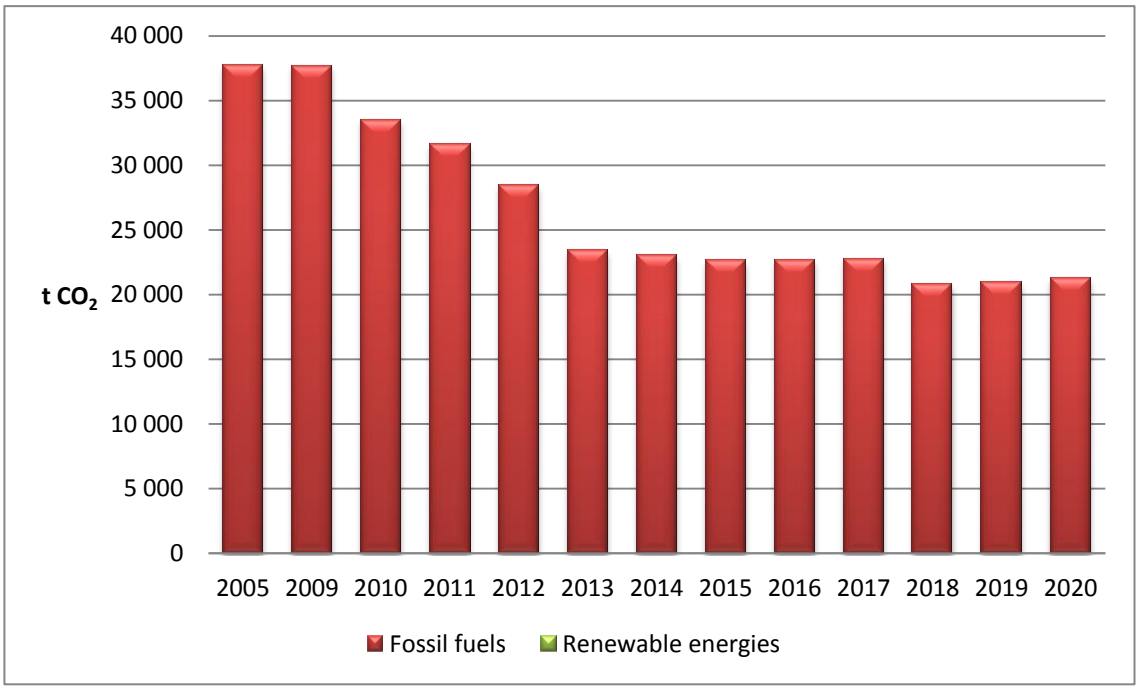


Figure 19: CO_2 emissions until 2020 – Action Plan scenario



In this scenario, the carbon dioxide emissions have a 44% reduction, which is higher than the 20% target set in the Pact of Islands.

3.3.1. Final energy demand

The final energy demand in Porto Santo Island for the action plan scenario, in 2020, per energy carrier and per sector, is presented in the following table and figures.

Table 16: Final energy demand in 2020 – Action Plan scenario

Energy carriers		Residential [MWh]	Primary sector [MWh]	Secondary sector [MWh]	Tertiary sector [MWh]	Transports [MWh]	TOTAL [MWh]
Centralized energy services	Electricity	6 908	140	7 684	15 917	249	30 899
Fossil fuels	Diesel		107		817	19 056	19 979
	Gasoline					10 773	10 773
	LPG	3 725			194		3 919
	Subtotal	3 725	107		1 010	29 829	34 671
Renewable energy sources	Solar	436		45	1 280		1 761
	Biomass	44					44
	Subtotal	480		45	1 280		1 806
TOTAL		**11 114**	**247**	**7 730**	**18 208**	**30 078**	**67 376**

Figure 20: Final energy demand per sector in 2020 – Action Plan scenario

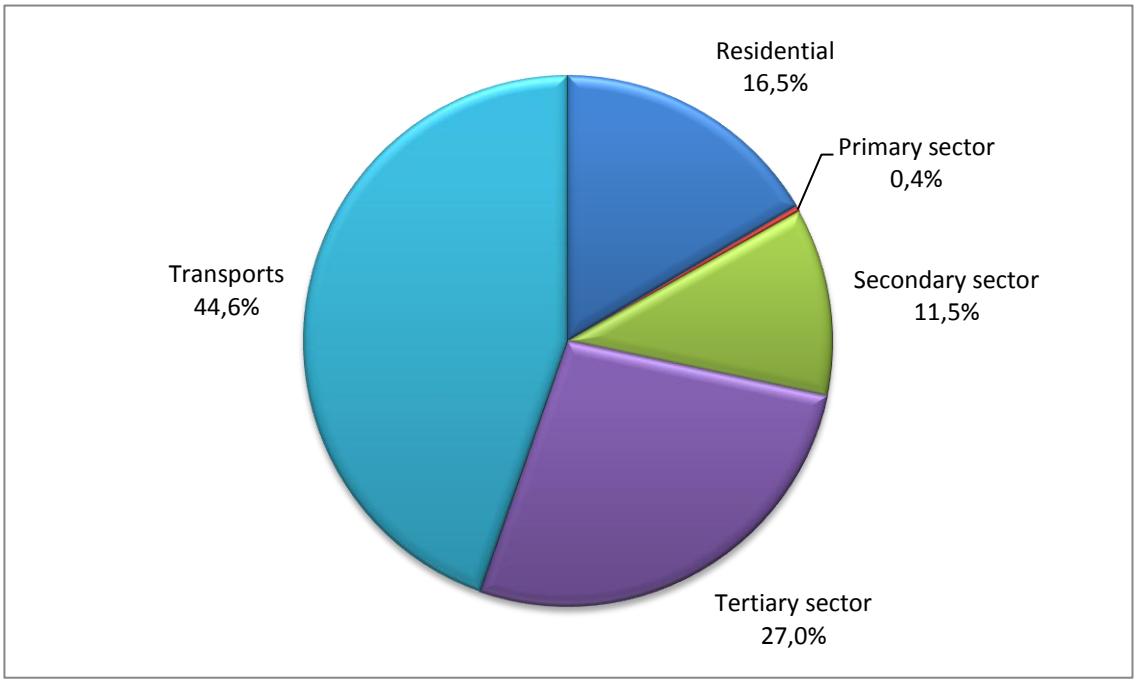
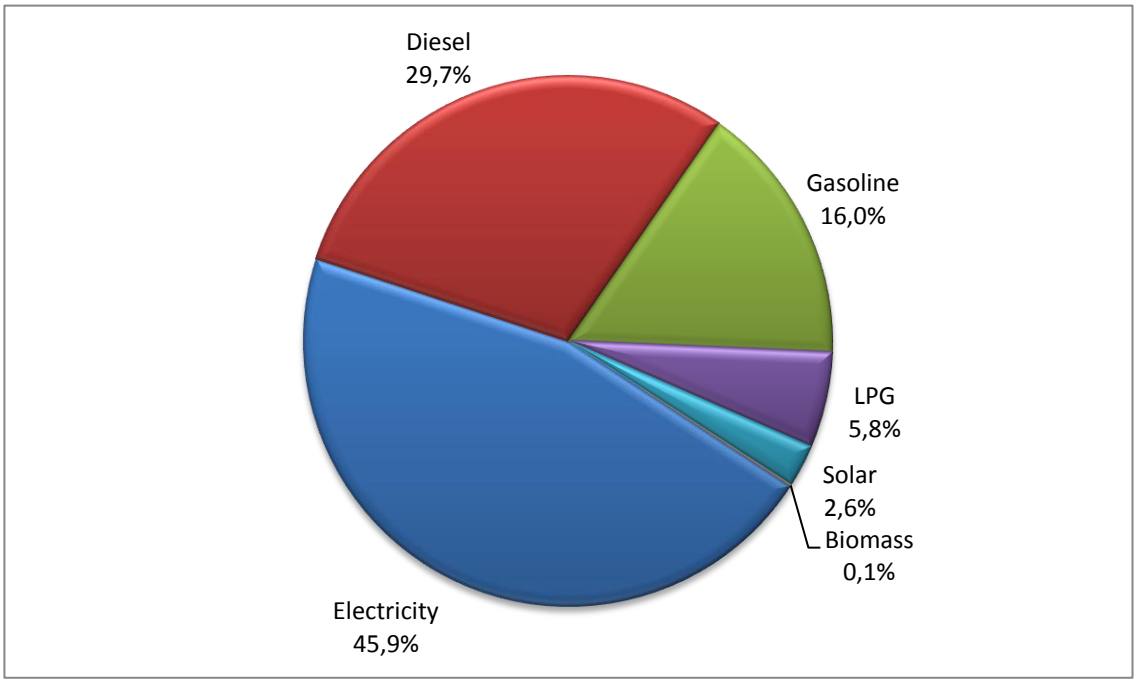


Figure 21: Final energy demand per energy carrier in 2020 – Action Plan scenario



From the analysis of the final energy demand, it can be highlighted the significant weight of the land transport sector, which increases its contribution compared to the year of reference (42,9% in 2009 and 44,6% in 2020), while the tertiary sector reduces slightly (29,8% in 2009 and 27,0% in 2020). The residential sector has a very small variation (16,1% in 2009 and 16,5% in 2020), as well as the secondary sector (10,9% in 2009 and 11,5% in 2020). In comparison with the BAU scenario, the sectorial distribution in percentage terms is similar, but, in absolute value, the reduction of energy demand is substantial (7 862 MWh).

Per energy carrier, one can note a decrease in the electricity demand percentage (47,1% in 2009 and 45,9% in 2020).

The share of renewable energy resources, represents, in this scenario, 2,7% of the final energy demand in 2020. Considering the contribution of renewable energy in electricity production, the total renewable component corresponds to 27,3% of the final energy demand, while in the BAU scenario, this stood around 6,0%.

3.3.2. Energy conversion

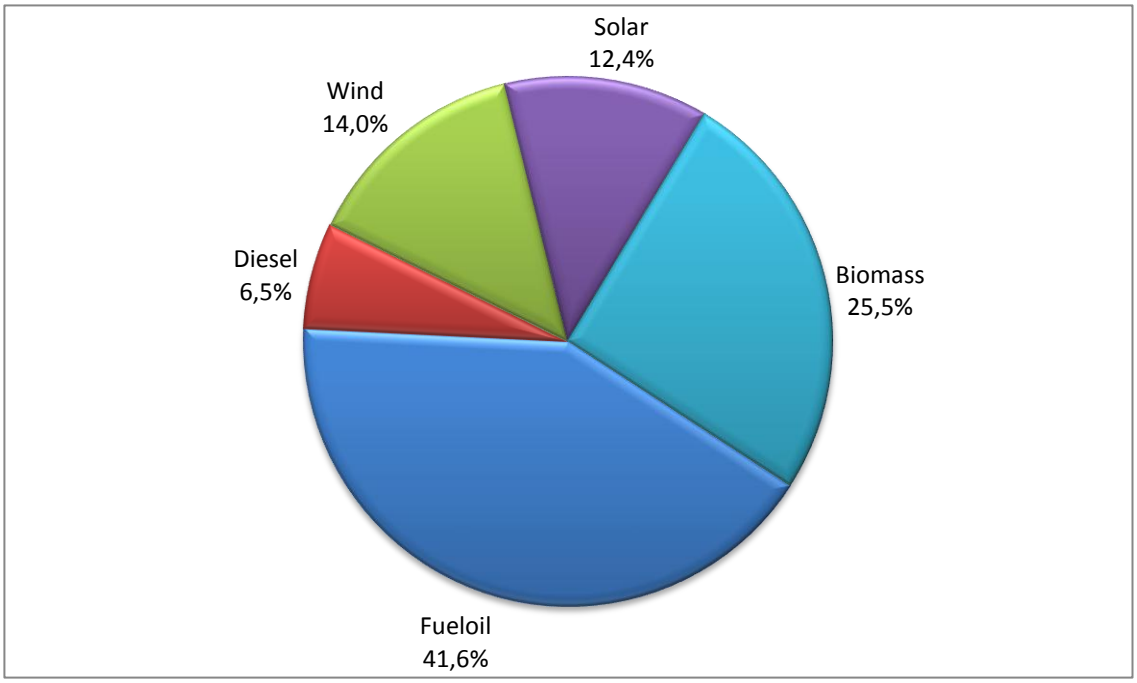
In this scenario, regarding the energy conversion for electricity production, a strong commitment on the use of renewable resources was considered, to substitute fueloil in the production of thermal origin.

In this scenario, as verified in 2009 and in the BAU scenario, energy conversion refers exclusively to electricity production, not being foreseen distribution networks of thermal energy in Porto Santo Island.

Table 17: Energy conversion in 2020 – Action Plan scenario

Energy carriers		Electricity production [MWh]
Fossil fuels	Fueloil	13 259
	Diesel	2 057
	Subtotal	15 316
Renewable energy sources	Wind	4 449
	Solar	3 967
	Biomass	8 140
	Subtotal	16 555
TOTAL		**31 871**
Distribution losses and self-consumption		972

Figure 22: Electricity production per energy source in 2020 – Action Plan scenario



In the electricity production for 2020, a thermal component of fossil fuel (fueloil and diesel) represents 48,1%, being the remaining 51,9% of production from renewable energy sources.

3.3.3. Primary energy demand

The primary energy demand for the present scenario is determined, through an energy balance, by the final energy demand and by the use of energy resources for conversion into electricity.

Table 18: Primary energy demand in 2005, 2009 and 2020 – Action Plan scenario

Energy carriers		2005 [MWh]	2009 [MWh]	2020 [MWh]
Fossil fuels	Fueloil	89 800	93 127	38 321
	Diesel	30 272	28 354	25 924
	Gasoline	13 022	11 688	10 773
	LPG	5 360	4 927	3 919
	Subtotal	138 454	138 096	78 937
Renewable energy sources	Wind	1 900	1 821	4 449
	Solar	82	122	5 728
	Biomass	173	111	20 394
	Subtotal	2 155	2 054	30 571
TOTAL		**140 609**	**140 150**	**109 509**

Figure 23: Primary energy demand in 2005, 2009 and 2020 – Action Plan scenario

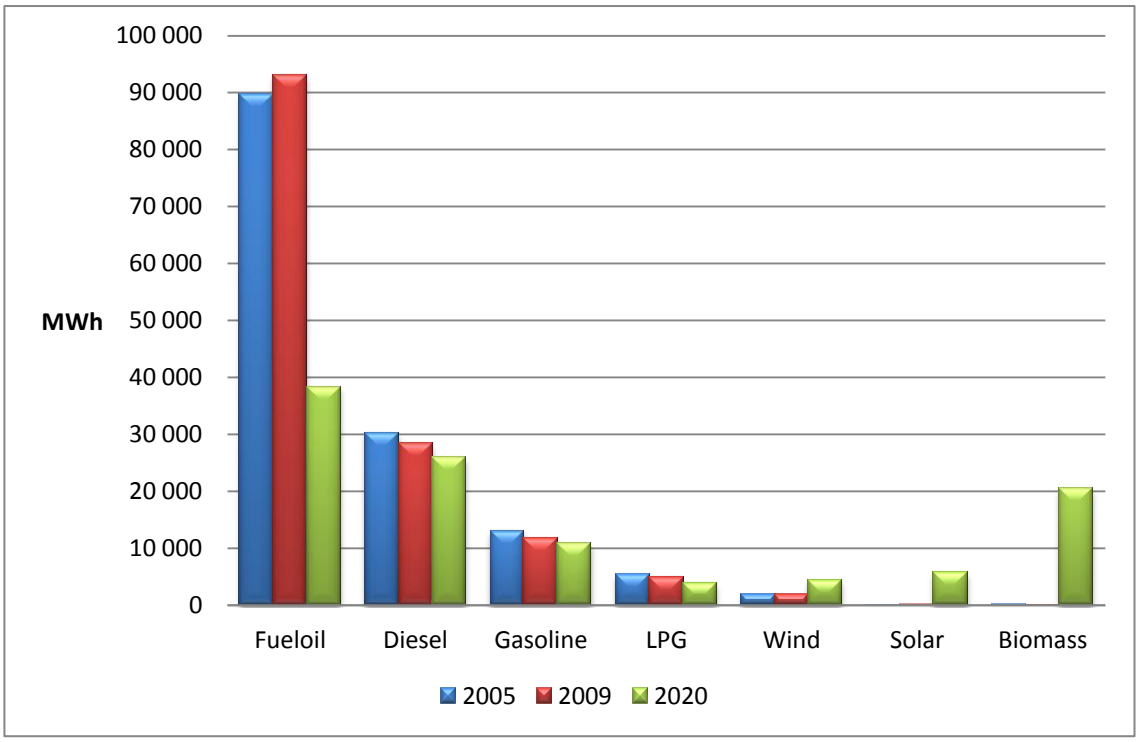
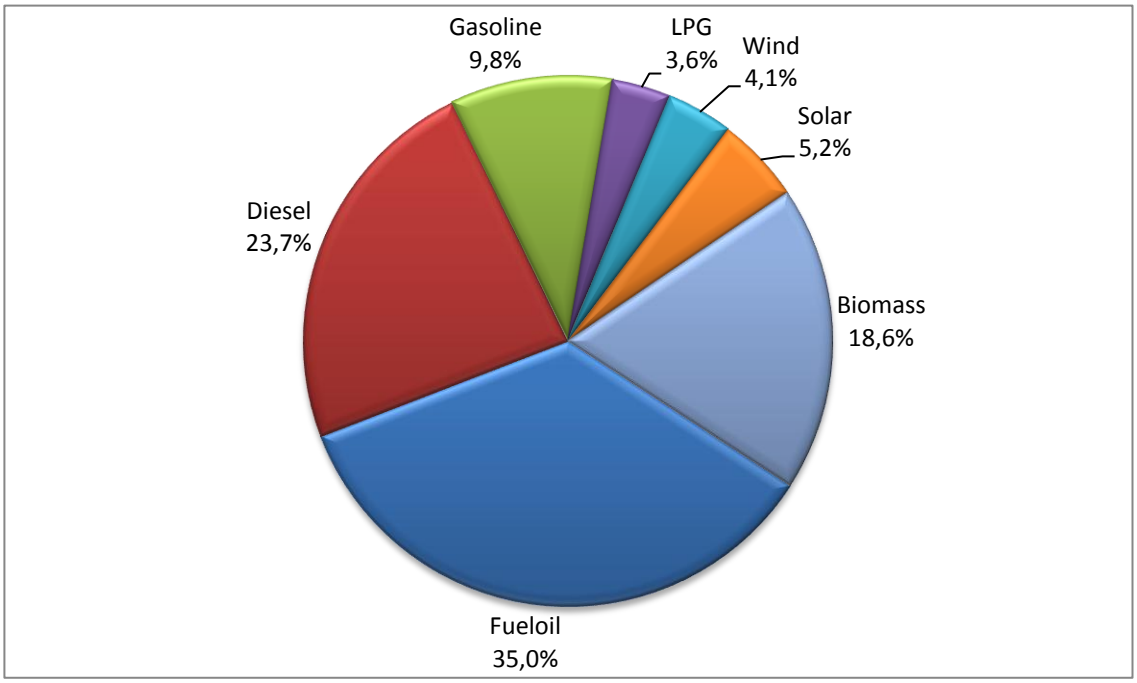


Figure 24: Primary energy demand in 2020 – Action Plan scenario



This scenario leads to a 22% reduction in primary energy demand until 2020 compared to 2005 and 2009. The share of renewable energy resources is 27,9% in the total primary energy demand in 2020, which was 1,5% in 2005 and 2009. In the BAU scenario, this percentage lies at 3,4%.

In macro-economic terms, the use of fossil fuels in 2020, for this scenario, is equivalent to 3,9 million Euros per year, at import prices of 2009, which corresponds to a saving of 1,8 million Euros per year, in relation to the BAU scenario. With the tendency of oil prices increasing in international markets, at a rate higher than inflation, it is probable that this saving be more significant in the future.

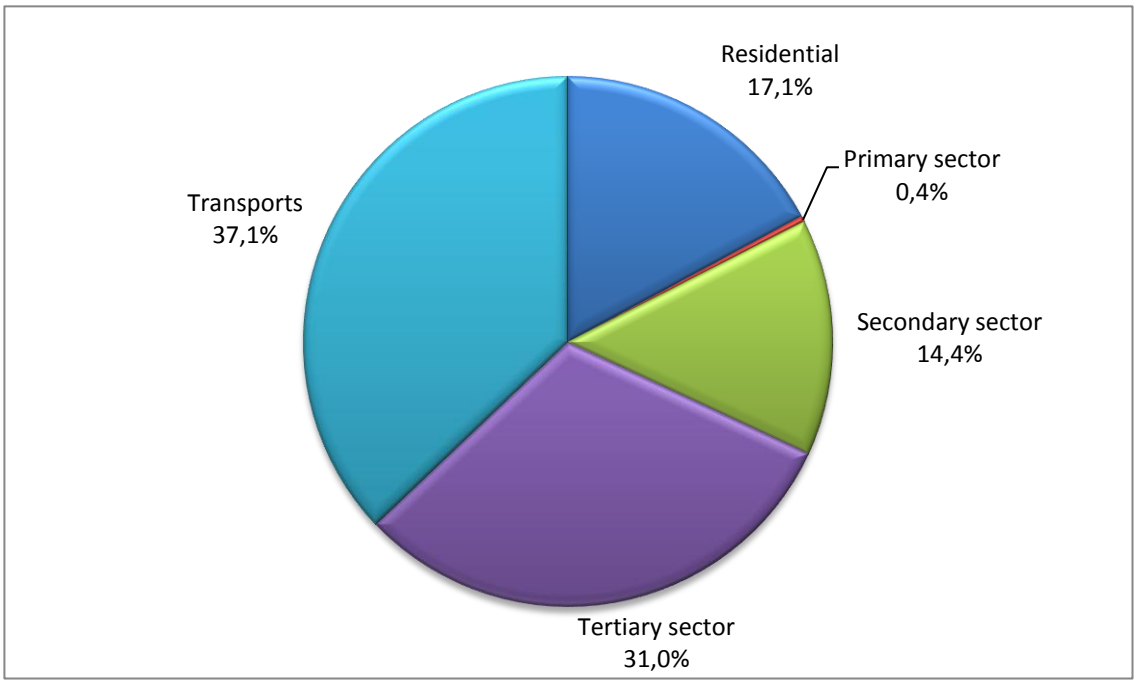
3.3.4. Emissions of carbon dioxide

The carbon dioxide emissions are calculated for the year 2020, adopting the same methodology used for the baseline year and for the BAU scenario, from the energy demand projections in the action plan scenario.

Table 19: CO_2 emissions per sector in 2020 – Action Plan scenario

Energy carriers		**Residential [t]**	**Primary sector [t]**	**Secondary sector [t]**	**Tertiary sector [t]**	**Transports [t]**	**TOTAL [t]**
Centralized energy services	Electricity	2 745	56	3 054	6 325	99	12 279
Fossil fuels	Diesel		28		218	5 088	5 334
	Gasoline					2 683	2 683
	LPG	894			47		941
	Subtotal	894	28		265	7 770	8 957
Renewable energy sources	Solar						
	Biomass						
	Subtotal						
TOTAL		**3 639**	**84**	**3 054**	**6 590**	**7 869**	**21 236**

Figure 25: CO_2 emissions per sector in 2020 – Action Plan scenario



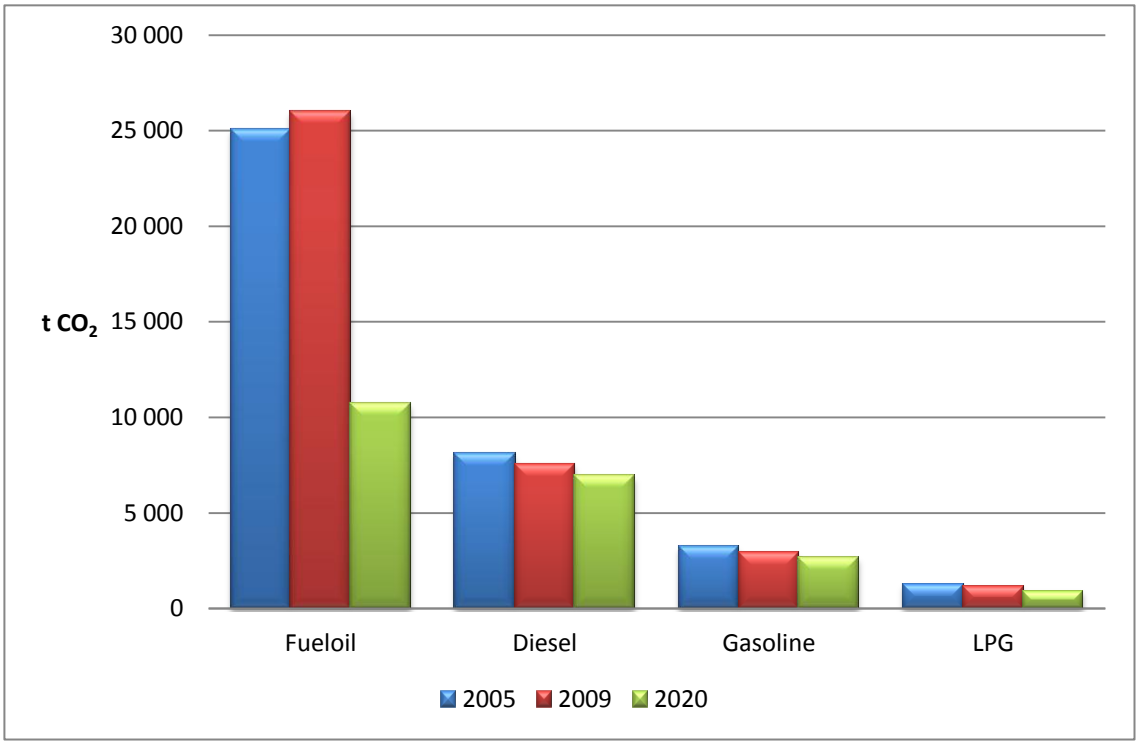
In this scenario, in comparison to 2009, there is a considerable reduction of emissions, namely in the services, transport and residential sectors.

Analysing the emissions per energy carrier, a significant reduction of the emissions from fueloil can be noted, due to the share of renewable energy resources and improvement of energy efficiency.

Table 20: CO_2 emissions per primary energy carrier in 2005, 2009 and 2020 – Action Plan scenario

Energy carriers		2005 [t]	2009 [t]	2020 [t]
Fossil fuels	Fueloil	25 054	25 982	10 692
	Diesel	8 083	7 571	6 922
	Gasoline	3 242	2 910	2 683
	LPG	1 286	1 182	941
	Subtotal	37 666	37 646	21 236
Renewable energy sources	Wind			
	Solar			
	Biomass			
	Subtotal			
TOTAL		**37 666**	**37 646**	**21 236**

Figure 26: CO_2 emissions per primary energy carrier in 2005, 2009 and 2020 – Action Plan scenario



In comparison with the emissions of 2005, a reduction of 44% can be verified, while, in the BAU scenario, the emissions decrease by 6%.

4. ACTIONS

To achieve the targets set in this action plan, actions were studied to improve energy efficiency, encourage the use of renewable energy and alternative less pollutant energy to petroleum-based products and reduce carbon dioxide emissions. The actions are aimed at various sectors and fields of action, which cover the final energy demand, secondary energy production and land-use planning, among other areas, with the intervention of various players, including Local and Regional Administration, organizations and citizens.

The actions were studied through the preparation of scenarios, testing numerous options and simulating the interactions between the various actions, to determine and ensure as best possible the results to be achieved, in view of the objectives and targets for 2020. The actions presented in this chapter result from the analysis of the scenario chosen for the action plan, named in the previous chapter "Action Plan Scenario".

The expected results for the year 2020 with the implementation of the plan's actions, in terms of energy savings, renewable energy increase and reduction of carbon dioxide emissions, are presented in the following table.

Table 21: Expected results in 2020

Sectors and fields of action	Energy savings [MWh/year]	Renewable energy production [MWh/year]	Reduction of CO_2 emissions [ton/year]
Residential	1 205	330	859
Primary sector	-	-	-
Secondary sector	421	46	388
Tertiary sector	2 413	1 269	2 169
Transport	4 156	-	942
Secondary energy production	-	12 173	9 816
Other areas	-	-	-
TOTAL	**8 195**	**13 818**	**14 174**

With these results, the action plan allows to comply with the targets set for 2020, as presented in the following table.

Table 22: Results against targets for 2020

Objectives		Targets	Expected results
1.	Improve energy supply guarantee	Increase by 20% the number of days of autonomy of primary energy storage in comparison to 2005.	>20%
2.	Reduce energy dependence from abroad	Increase to 20% the share of renewable energy resources in primary energy demand.	28%
		Increase to 40% the share of renewable energy resources in electricity production.	52%
3.	Reduce energy intensity in Gross Domestic Product	Reduce by 20% the energy intensity in Gross Domestic Product (primary energy/Gross Domestic Product) in comparison to 2005.	>20%
4.	Reduce carbon dioxide emissions	Reduce by 20% CO_2 emissions in comparison to 2005.	44%

The increase in autonomous storage results mainly from the 43% reduction of primary energy demand from fossil fuels, the construction of storage facilities for biofuels, and the construction of reversible water systems, so, with the implementation of the plan, the increase will exceed the 20% target. The reduction of energy intensity in the Gross Domestic Product (GDP) depends strongly on the regional economy dynamics, but as the imported primary energy demand in 2020 decreases by

43% it is estimated that, by 2020, an effective growth of the GDP will allow to exceed the target of 20% reduction of energy intensity.

4.1. Residential

The actions for the residential sector fall mainly on the acquisition of more energy efficient equipment, installation of systems to use renewable energy and behaviour changes concerning energy use.

Table 23: Actions for the residential sector

Sectors and fields of action	Actions	Responsible for the implementation	Implementation schedule	
			Starting year	Ending year
Hot water	1.1. Installation of solar collectors for water heating (domestic hot water, swimming pools and washing machines).	• Citizens • Companies	2012	2020
	1.2. Purchase of high performance equipment and adoption of more efficient behaviour.	• Citizens	2012	2020
Heating and cooling	1.3. Application of passive measures (thermal insulation in new and existing buildings, sunlight protection, natural ventilation) and adoption of more efficient behaviour.	• Citizens • Companies	2012	2020
Lighting	1.4. Installation of energy efficient lamps, lighting fixtures and control devices, and adoption of more efficient behaviour.	• Citizens	2012	2020
	1.5. Campaigns to provide energy efficient lamps and control devices (light and movement sensors).	• EEM • AREAM • Citizens	2012	2015
Kitchen	1.6. Acquisition of high performance kitchen equipment and adoption of more efficient behaviour.	• Citizens	2012	2020
Refrigerators and freezers	1.7. Acquisition of high performance refrigerators and freezers, and adoption of more efficient behaviour.	• Citizens	2012	2020
Laundry machines and dryers	1.8. Acquisition of high performance washing and drying machines, use of solar heated water and adoption of more efficient behaviour.	• Citizens	2012	2020
Dish washing machines	1.9. Acquisition of high performance dish washing machines, use of solar heated water and adoption of more efficient behaviour.	• Citizens	2012	2020
TV sets	1.10. Acquisition of televisions with less energy consumption and less use of stand-by mode.	• Citizens	2012	2020
Other electric appliances	1.11. Acquisition of electrical appliances (computers, printers, router, sound, etc.) with less energy consumption and less use of stand-by mode.	• Citizens	2012	2020

EXPECTED RESULTS IN 2020		
Energy savings [MWh/year]	**Renewable energy increase [MWh/year]**	**Reduction of CO_2 emissions [ton/year]**
1 205	330	859

4.2. Primary sector

For the primary sector, that includes agriculture, livestock-breeding, hunting, forestry, fishing and mining, for its low level of energy demand, specific actions were not defined, although some cross-cutting actions, namely in electricity production, biofuel production and transport, also cover this sector.

4.3. Secondary sector

For the secondary sector, the actions focus mainly on the installation of renewable energy systems, energy recovery systems and more efficient equipment, as well as other practices that may contribute to a reduction in energy demand.

Table 24: Actions for the secondary sector

Sectors and fields of action	Actions	Responsible for the implementation	Implementation schedule	
			Starting year	Ending year
Manufacturing	2.1. Use of renewable energy, waste heat recovery and other available local resources, installation of more efficient heat production and storage equipment, improvement in insulation of thermal piping and optimizing conditions of use and adoption of more efficient behaviour.	• Companies	2012	2020
Water supply, sewerage, waste management and remediation activities	2.2. Installation of more efficient equipment for pumping stations and waste water treatment.	• IGA	2012	2020

EXPECTED RESULTS IN 2020		
Energy savings [MWh/year]	Renewable energy increase [MWh/year]	Reduction of CO_2 emissions [ton/year]
421	46	388

4.4. Tertiary sector

In the tertiary sector, that covers accommodation, public and private services and street lighting, the strategy focuses mainly on the energy performance of buildings, which includes the efficiency of active systems and the use of renewable energy, and in the adoption of more efficient behaviours. It is important to reduce electricity demand, as its production is associated to the use of fossil fuels

Worth highlighting is the energy efficiency programme in the public services, for its high strategic interest to reduce energy demand and costs in the public sector, and by the multiplying effects for other users, through the acquired technical knowledge and awareness-raising. The programme covers services buildings and street lighting, including the analysis of consumptions, energy efficiency measures and use of renewable energy.

Table 25: Actions for the tertiary sector

Sectors and fields of action	Actions	Responsible for implementation	Implementation schedule	
			Starting year	Ending year
Wholesale and retail trade; repair of motor vehicles and motorcycles	3.1. Installation of efficient lamps and lighting fixtures and control devices	• Companies	2012	2020
	3.2. Monitoring of consumptions and adoption of more efficient behaviour when using heating and cooling systems, lighting and other equipment.	• Companies	2012	2020

Accommodation and food service activities	3.3. Adoption of passive measures in the envelope of buildings and swimming pools (thermal insulation of new and existing buildings, shading, natural ventilation, thermal covers in heated swimming pools).	• Companies	2012	2020
	3.4. Installation of solar collectors for hot water (hot water, swimming pools and washing machines).	• Companies	2012	2020
	3.5. Installation of control (motors, lighting) and energy management systems, and acquisition of efficient heating and cooling systems, hot water, lighting and refrigeration.	• Companies	2012	2020
	3.6. Monitoring of consumptions and adoption of more efficient behaviours when using heating and cooling systems, hot water, lighting, refrigeration and kitchens.	• Companies	2012	2020
General public administration and social security	3.7. Energy efficiency programme in public services – monitoring of consumptions, energy audits, adoption of energy efficiency measures, and use of renewable energies and adoption of more efficient behaviour.	• Regional Government • EEM • AREAM	2013	2020
Defence, justice, police and fire departments	3.8. Energy efficiency programme in public services – monitoring of consumptions, energy audits, adoption of energy efficiency measures, and use of renewable energies and adoption of more efficient behaviour.	• Regional Government • EEM • AREAM	2013	2020
Education	3.9. Energy efficiency programme in public services – monitoring of consumptions, energy audits, adoption of energy efficiency measures, and use of renewable energies and adoption of more efficient behaviour.	• Regional Government • EEM • AREAM	2013	2020
Human health and social work activities	3.10. Energy efficiency programme in public services – monitoring of consumptions, energy audits, adoption of energy efficiency measures, and use of renewable energies and adoption of more efficient behaviour.	• Regional Government • EEM • AREAM	2013	2020
Other services	3.11. Installation of efficient lamps and lighting fixtures, and control devices.	• Companies	2012	2020
	3.12. Monitoring of consumptions and adoption of more efficient behaviour when using heating and cooling systems, lighting and other equipment.	• Companies	2012	2020
Public lighting	3.13. Energy efficiency programme in public services – substitution of existing lamps and lighting fixtures of low efficiency, installation of control and management systems.	• EEM • AREAM • Municipality • IPM	2012	2020

EXPECTED RESULTS IN 2020		
Energy savings [MWh/year]	**Renewable energy increase [MWh/year]**	**Reduction of CO_2 emissions [ton/year]**
2 413	1 269	2 169

4.5. Transports

In the transport sector, the actions to be implemented cover the services of passenger transport, public and private service fleets, and private transport, focusing mainly on the use of public transport, acquisition of more efficient vehicles and in the adoption of more efficient driving habits.

Table 26: Actions for the transport sector

Sectors and fields of action	Actions	Responsible for the implementation	Implementation schedule	
			Starting year	Ending year
Passenger road transport	4.1. Energy efficiency programme in public services – increase supply of public transport service in Summer, ensuring a shuttle service connecting main residential and hotel areas, the beach, entertainment areas, the port and city centre, with introduction of electric vehicles and adoption of more efficient driving habits.	• Regional Government • Municipality • Companies	2013	2020
Other fleets for private and public services	4.2. Energy efficiency programme in public services – introduction of electric vehicles in public service fleets and adoption of more efficient driving habits.	• Regional Government • Municipality	2013	2020
	4.3. Acquisition of electric vehicles for private passenger transport fleets and adoption of more efficient driving habits.	• Companies	2013	2020
Private transports	4.4. Acquisition of electric vehicles and adoption of more efficient driving habits.	• Citizens	2013	2020
	4.5. Use of public transport.	• Citizens	2012	2020
	4.6. Use of bicycles.	• Citizens	2012	2020

EXPECTED RESULTS IN 2020		
Energy savings [MWh/year]	**Renewable energy increase [MWh/year]**	**Reduction of CO_2 emissions [ton/year]**
4 156	-	942

4.6. Secondary energy production

The actions in the domain of secondary energy production refer essentially to the production of electricity, aiming at the use of renewable energy.

Table 27: Actions for secondary energy production

Sectors and fields of action	Actions	Responsible for the implementation	Implementation schedule	
			Starting year	Ending year
Wind	5.1. Installation of wind farms.	• Companies	2017	2020
Solar	5.2. Installation of solar photovoltaic kits in micro and mini production regimes.	• Companies • Citizens	2011	2020
Biomass	5.3. Installation of a biofuel production plant using micro-algae for conversion to electricity.	• EEM	2011	2012
Storage	5.4. Installation of a storage and power stabilization system to mitigate the disruptions in energy production from wind and solar photovoltaic in the stability of the electricity grid.	• EEM	2012	2015

EXPECTED RESULTS IN 2020		
Energy savings [MWh/year]	**Renewable energy increase [MWh/year**	**Reduction of CO_2 emissions [ton/year]**
-	12 173	9 816

4.7. Land use planning

The actions in the scope of land use planning integrate measures that lead to a reduction of energy needs, namely in the transport and building sectors, and an optimization of energy infrastructures and of the use of renewable energy resources.

Table 28: Actions for land use planning

Sectors and fields of action	Actions	Responsible for the implementation	Implementation schedule	
			Starting year	Ending year
Regional and local strategic planning	6.1. Integration of criteria and norms in land use planning and municipal regulations that encourage the minimization of energy needs in transports and buildings.	• Regional Government • Municipality	2012	2020
	6.2. Implementation of a municipal sustainable energy action plan in the scope of the Covenant of Mayors.	• Municipality	2012	2015
Transports and mobility planning	6.3 Preparation of a mobility plan that covers traffic conditioning and parking in urban centre and favours public transport, electric vehicles, bicycles and pedestrian circulation.	• Municipality	2012	2015
	6.4. Installation of charging infrastructures for electric vehicles.	• EEM • Municipality • Companies	2012	2020
	6.5. Expansion of the cycle lane to connect main residential and hotel areas, the beach, city centre, so that the bicycle may constitute an attractive and safe means of transport.	• Municipality	2012	2020
Energy infrastructures planning	6.6. Transfer of electricity consumption from peak to off-peak hours, through the accumulation of cold in hotels (ice banks), vehicle battery charging and changing hours of operation of consuming equipments, to maximize the share of intermittent renewable energy in the electricity grid.	• Companies • Citizens	2013	2020
Renewable energy land use planning	6.7. Assessment of the potential of renewable energy resources, development of forecasting models of intermittent renewable sources and study of dynamic behaviour of the electricity grid.	• Regional Government • AREAM • EEM	2012	2015
	6.8. Land use planning of wind farms, photovoltaic and other renewable energy installations, based on the assessment of the potential of the resources, the dynamic behaviour of the electricity grid and the constraints in a territorial scope.	• Regional Government • Municipality • AREAM • EEM	2014	2015

4.8. Public procurement of products and services

The definition of standards and criteria for energy efficiency and use of renewable energy in public procurement of works, acquisition of goods and services, besides providing better energy performance of services and public facilities, have multiplying effects, as it streamlines the market in these areas, contributing to create a critical mass, improve the quality of energy services and reduce costs, as well as raise awareness of decision makers of companies and society in general.

Table 29: Actions for public procurement of products and services

Sectors and fields of action	Actions	Responsible for the implementation	Implementation schedule	
			Starting year	Ending year
Energy efficiency requirements or standards	7.1. Definition of standards and criteria for energy efficiency in the specifications of tender documents for procurement of works, goods and services.	• Regional Government • Municipality • Companies	2012	2020
Renewable energy requirements or standards	7.2. Definition of standards and criteria for use of renewable energy in the specifications of tender documents for procurement of works, goods and services.	• Regional Government • Municipality • Companies	2012	2020

4.9. Citizen and stakeholders

In order for the strategy advocated in this action plan be implemented satisfactorily and the targets achieved, it is fundamental that all of society participates, which justifies a set of actions to bring about the involvement and commitment of citizens and stakeholders in the energy area.

Table 30: Actions for citizens and stakeholders

Sectors and fields of action	Actions	Responsible for the implementation	Implementation schedule	
			Starting year	Ending year
Advisory services	8.1. Creation of an information helpline and a forum with questions and answers, based on an e-learning platform, for domestic energy users, in order to clarify doubts and provide advice on energy efficiency, use of renewable energy and reduction of CO_2 emissions.	• Regional Government • AREAM	2012	2020
Financial support and grants	8.2. Financial support for public promoters and non-profit organizations to implement the actions of the Sustainable Energy Action Plan.	• IDR	2012	2020
	8.3. Financial incentive for business promoters to implement voluntary energy efficiency measures, use of renewable energy for own consumption and reduction of CO_2 emissions.	• IDE-RAM	2012	2020
	8.4. Financial incentive for residential promoters to implement voluntary energy efficiency measures, use of renewable energy for own consumption and reduction of CO_2 emissions.	• Regional Government	2013	2020
	8.5. Reduction of public parking fees for electric vehicles.	• Municipality	2012	2015
	8.6. Promotion and support in the preparation and negotiation of energy service contracts and specific financial systems for energy efficiency and renewable energy, with energy services companies and credit institutions.	• Regional Government • AREAM	2012	2015
Awareness-raising and networking	8.7. Awareness-raising campaigns for adoption of passive measures in buildings, purchase of efficient equipment, installation of control devices, use of renewable energy for own consumption, sustainable mobility, monitoring of consumptions and adoption of more efficient practices directed mainly at the residential and services sectors, involving associations and the media.	• Regional Government • AREAM	2012	2020
	8.8. Development of cooperation projects in the energy domain with other regions, in particular with outermost island regions presenting similar problems.	• Regional Government • AREAM	2012	2020

	8.9. Elaboration of awareness-raising guides and brochures on urban regeneration, mobility, energy efficiency and use of renewable energy aimed at energy consumers, promoters/developers and professionals.	• AREAM	2013	2015
	8.10. Promotion of cooperation activities in the energy field between public regional and local administration, research institutes, business associations, companies, credit institutions, NGOs and the media.	• Regional Government • AREAM	2012	2020
Training and education	8.11. Development of educational material, awareness-raising and information sessions, and other educational activities on sustainable energy, involving students and teachers.	• Regional Government • AREAM	2012	2020
	8.12. Introduction of eco-driving habits in training of driving school students and in complementary training of fleet drivers.	• Regional Government • Companies	2012	2020
	8.13. Training of technicians for installation and maintenance of heating, cooling and ventilation (HVAC) systems, hot water production and other energy systems.	• Companies • Associations	2012	2020
Monitoring	8.14. Installation of systems for monitoring and managing energy consumption in the residential sector and in services buildings.	• EEM • Companies • Citizens	2012	2020
Legislation	8.15. Increase of supervision/inspection on applicable energy efficiency regulation (SGCIE).	• Regional Government	2012	2020
	8.16. Increase of supervision/inspection on applicable energy efficiency regulation (SCE).	• Regional Government • Municipality • AREAM	2012	2020
	8.17. Preparation of a master plan for street lighting, to define efficiency and control requirements in new projects.	• EEM • Municipality • IPM • AREAM	2012	2012

5. ORGANIZATIONAL AND FINANCIAL MECHANISMS

In order to implement the action plan, it is necessary to establish a coordination and organizational structure, to ensure appropriate technical expertise, mobilise the involvement and commitment of stakeholders and provide financial means for the actions. To ensure that the objectives and targets are achieved, it is also necessary to establish follow-up and monitoring mechanisms.

5.1. Coordination and organizational structures

The Vice-Presidency of the Regional Government is the authority responsible for the formulation and implementation of the energy policy in the Autonomous Region of Madeira and, in particular, for the implementation of the Sustainable Energy Action Plan of Porto Santo Island.

The coordination for the implementation of the action plan is carried out by the Steering Committee, constituted by representatives from the following entities:

- Vice-Presidency of the Regional Government;
- Regional Directorate of Commerce, Industry and Energy;
- *Empresa de Electricidade da Madeira, S.A.*;
- AREAM – *Agência Regional da Energia e Ambiente da Região Autónoma da Madeira*.

The Advisory Committee, constituted by representatives of stakeholders, has the role to ensure society's involvement and participation and to support in the monitoring and follow-up of the plan's actions.

5.2. Staff capacity

The Autonomous Region of Madeira has vast experience in the preparation and implementation of energy plans, as well as cooperation with other regions in these domains, having created the structures and developed the technical expertise necessary to prepare and implement the present action plan. The first energy plan, which covered the Madeira and Porto Santo Islands, was approved by the Regional Government in 1989, followed by an update in 1992 and the Energy Policy Plan of the Autonomous Region of Madeira in 2002. In sequence to the first energy plan, a working group was constituted for its implementation which gave rise to the creation of AREAM – *Agência Regional da Energia e Ambiente da Região Autónoma da Madeira*, in 1993. AREAM has since then carried out activities in planning, cooperation, research and awareness-raising in the areas of energy, environment and transports, amongst others.

Concerning the electricity sector, the *Empresa de Electricidade da Madeira, S.A* has technical staff, covering various areas of engineering and management, with internal experience and relevant expertise to implement the actions related to this sector. It may also resort occasionally to a network of specialized consultants for projects in specific areas.

The Regional Civil Engineering Laboratory has technical expertise in monitoring endogenous energy resources, as well as providing construction solutions for buildings, relevant to their energy performance.

The University of Madeira has a centre of competences in the technical and scientific area, asserting itself in the energy domain, in particular concerning biofuels and instrumentation. It has

conferred doctor and master university degrees, and taught technological specialization courses in the energy area and other related areas.

As regards to technical expertise in buildings, the National Energy Certification and Indoor Air Quality in Buildings, created in 2006 in sequence to the Community Directive 2002/91/CE of the Parliament and of the Council, of 16 December 2002, promoted the training of specialized technicians on energy efficiency and renewable energy, existing currently many exercising their activity in Porto Santo Island. These technicians, from engineering and architectural areas, with technical skills for project design and energy audits in buildings, HVAC and hot water systems, are fundamental elements to implement the actions regarding energy performance of residential and services buildings.

There are also private and public training centres that provide professional courses on installation and maintenance of energy systems, including renewable energy systems in various technical areas related to energy, in order to meet the needs of the market.

In the private sector, there are various energy service companies that cover the project design, construction, installation, maintenance and audits of buildings, energy systems and renewable energy, which also constitute a fundamental support to implement a strategy for sustainable energy to boost the market and encourage the participation of private investors.

5.3. Involvement of stakeholders

To catalyse the involvement of stakeholders, periodic meetings with the Advisory Committee will be held. The Advisory Committee will be made up of representatives from various sectors of society with a say or interest in the energy area and will inform on the actions and the progress of the plan's implementation, identify existing or possible constraints and analyse measures to optimize the results and correct possible deviations.

To reach a wider public, the media will be used, to date with events, forums and publications, including electronic platforms, to disseminate information on the plan's actions and on the benefits and incentives available, raising awareness to the importance of these actions, in the scope of regional development and the improvement of quality of life and of the environment.

5.4. Budget

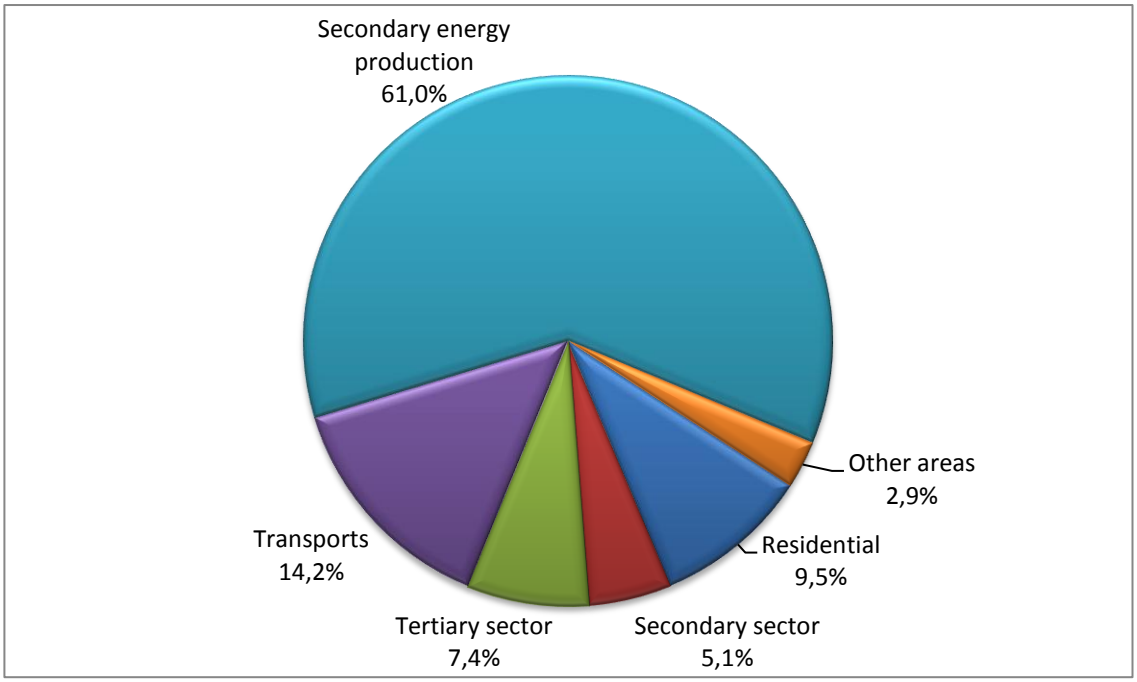
The overall investment foreseen to implement the Sustainable Energy Action Plan of Porto Santo Island is 41,67 million Euros, to be carried out until 2020. Around 55% to 60% of this investment will be for local human resources, income of companies located in the Region and tax revenue for Local and Regional Administration, while the remaining 40% to 45% will be for importation of goods and services, including renewable energy technologies, efficient equipment and specialized services.

In the following table and figures, a breakdown of the investment per sector and area of intervention and per promoter is presented.

Table 31: Investments to be carried out until 2020

Sectors and fields of action	Regional Government [Meuro]	Municipality [Meuro]	Public companies [Meuro]	Private companies and organizations [Meuro]	Citizen [Meuro]	TOTAL [Meuro]
Residential					3,98	3,98
Primary sector						
Secondary sector			2,00	0,11		2,11
Tertiary sector	0,56	0,08		2,43		3,08
Transports	0,23	0,23		0,45	5,00	5,90
Production of secondary energy			20,00	3,30	2,10	25,40
Other areas	0,13	0,61	0,03	0,40	0,04	1,21
TOTAL	**0,92**	**0,92**	**22,03**	**6,69**	**11,12**	**41,67**

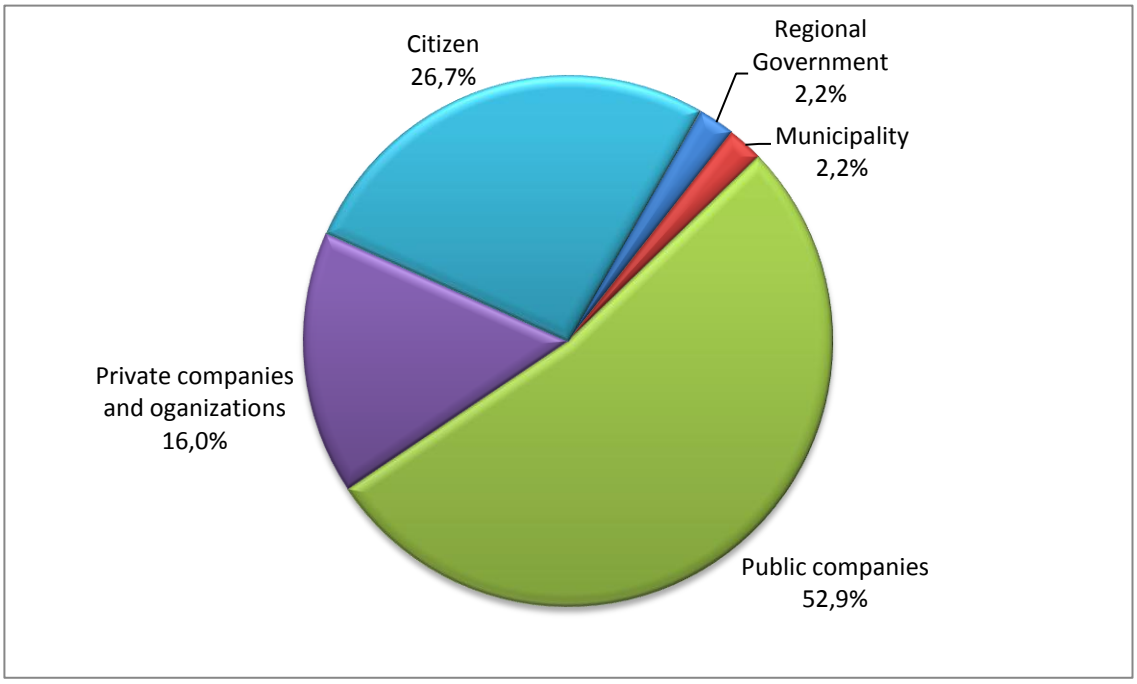
Figure 27: Breakdown of investments per sector and area of intervention



It is found that 61,0% of the investment for the implementation of the action plan is aimed at the secondary energy production sector, which includes fundamentally the use of renewable energy for electricity production and a storage and stabilization system to enable greater penetration of renewable energy in the electricity grid.

Analysing the investments per promoter, with 52,9%, are public companies, whose investments are aimed primarily at biofuel production for conversion into electricity, using wind energy and the installation of a storage and stabilization system of the electricity grid. This is followed by the citizens, with 26,7% of the investments, carried out on actions aimed mostly at the residential sector and at private transport, as well as micro-production of electricity. Private companies and organizations, with 16,0%, include mostly actions on energy efficiency and renewable energy in buildings, transport fleets and electricity production from renewable energy sources. The Regional Government and the municipality each represent 2,2% of the investment, with actions to improve their own energy performance in buildings and vehicle fleets as well as cross-cutting actions to promote society's participation in the implementation of the plan and in pursuing the objectives and targets set.

Figure 28: Breakdown of investments per promoter



5.5. Financing sources and instruments

The main financing sources and available support instruments to implement the plan's actions for each type of promoter are presented in the following table.

Table 32: Financing sources and support instruments

Promoter	Financing sources	Support instruments
Regional Government	• Regional Budget. • European Investment Bank. • Bank loan. • Energy Service Companies (ESCO). • Public-private partnerships.	• Operational programmes (*Intervir+* and *Rumos*). • European programmes. • Energy Efficiency Fund.
Municipality	• Municipal Budget. • European Investment Bank. • Bank loan. • Energy Service Companies (ESCO). • Public-private partnerships.	• Operational programmes (*Intervir+* and *Rumos*). • European programmes. • Energy Efficiency Fund.
Public companies	• Own funds. • European Investment Bank. • Bank loan. • Energy Service Companies (ESCO). • Public-private partnerships.	• Operational programmes (*Intervir+* and *Rumos*). • European programmes. • Energy Efficiency Fund.
Private companies and organizations	• Own funds. • Bank loan. • Energy Service Companies (ESCO). • Public-private partnerships.	• Incentive Systems (*Qualificar+*, *SI Turismo*, etc.). • Operational programmes (*Intervir+* and *Rumos*). • European programmes. • Energy Efficiency Fund. • Tax benefits. • Special tariffs.
Citizens	• Own funds. • Bank loan. • Energy Service Companies (ESCO).	• Energy Efficiency Fund. • Tax benefits. • Special tariffs.

5.6. Monitoring and follow-up

For monitoring, data will be collected periodically regarding final energy demand, secondary energy production, use of renewable energy and state of implementation of sustainable energy actions, as presented in the following table.

Table 33: Data collection for monitoring

Data to collect	Information sources	Frequency
Demand of fossil fuels	• Fuel suppliers. • Operators of public transport and other fleets. • Samples of users from key sectors, when necessary.	Annual
Electricity demand	• *Empresa de Electricidade da Madeira, S.A.*	Annual
Electricity production	• *Empresa de Electricidade da Madeira, S.A.*	Annual
Installation of renewable energy systems	• *Empresa de Electricidade da Madeira, S.A.* • Installation companies. • Samples of users from key sectors, when necessary.	Annual
Implementation of the plan's actions	• Entities responsible for implementation. • Advisory Committee.	Annual

Based on the information gathered, AREAM will prepare an energy balance and an emissions inventory, to verify the progress of the indicators in relation to the objectives and targets set, in order to evaluate the results of the actions implemented.

The Advisory Committee will analyse the indicators concerning the objectives and targets and the progress of the actions, and meet every two years, to discuss the results and the solutions to optimize the implementation of the action plan.

In the case of significant deviation in the implementation of the actions and results obtained, as well as relevant changes in the socio-economic and political context, which may pose a risk for the targets set for 2020, the Steering Committee or the Advisory Committee may propose a revision of the Sustainable Energy Action Plan of Porto Santo Island.

PACT OF ISLANDS

www.islepact.eu

Regional Authority:

Elaboration:

Financing: