SUSTAINABLE ENERGY ACTION PLAN

MADEIRA ISLAND

March, 2012

Sustainable Energy Action Plan of Madeira Island

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

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Advisory Committee:

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.

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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

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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 Madeira 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.	20%
		Increase to 50% the use of renewable energy resources in electricity production.	50%
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.	23%

In macroeconomic terms, the implementation of the action plan will provide a 51 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 884 million Euros, to be carried out until 2020. Around 60% to 65% 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 35% to 40% will be for importation of goods and services, including renewable energy technologies, energy efficient equipment and specialized services.

It is found that 58,7% of the investment for the implementation of the action plan is aimed at the secondary energy production sector, which includes fundamentally the introduction of natural gas, the development of renewable energy for electricity production and the improvement of electricity transport and distribution networks. The residential and transport sectors follow in terms of investment.

Analysing the investments per promoter, 31,1% is carried out by the citizens in actions aimed mostly at the residential sector and private transport, as well as micro-production of electricity. Public companies are attributed with 33,1% and private companies and organizations with 32,8%. The Regional Government and the municipalities represent, respectively, 2,3% and 0,7% of the overall investment.

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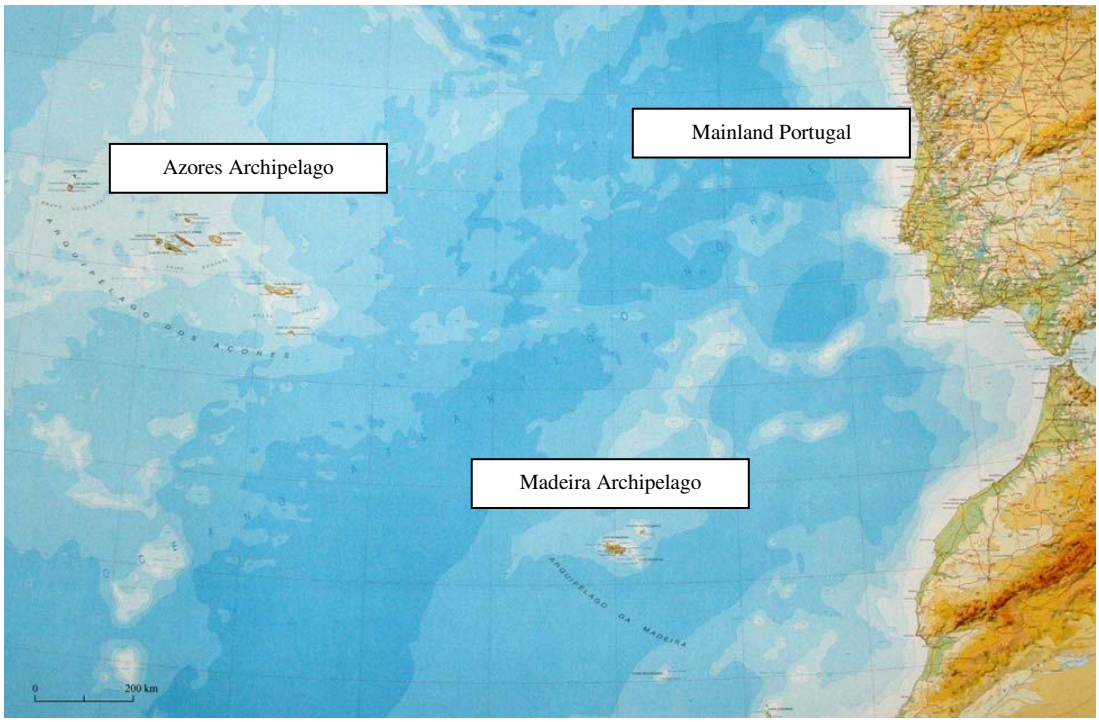
1. CONTEXT

1.1. Geography and territory

Madeira Island is the larger of the two inhabited islands of the Madeira archipelago, one of the seven outermost regions of the European Union, located in the North Atlantic ocean, between the parallels of 30º 01' N and 33º 08' N latitude and between the meridians of 15º 51' W and 17º 16' W longitude.

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

Figure 1: Madeira Archipelago and the nearest territories



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

The land area of Madeira Island is 736,75 km^2, with a maximum length of 58 km from West to East and with a maximum width of 23 km, from North to South. Madeira Island has a very rugged orography, being its highest point, *Pico Ruivo*, at 1 862 m. The main mountain ridges are located in the central mountain range of the island, with several peaks towering above 1 600 m and the *Paul da Serra* plateau between 1 400 and 1 600 m.

Approximately a quarter of the island's land area (189,50 km^2) is above 1 000 m. Most of the area has slopes greater than 25% (about 482 km^2 exceed 25%) and 170 km^2 have slopes between 25% and 16%.

The coast, with a total extension of 153 km, has steep cliffs, more evident in the North coast, but also in the South coast, being *Cabo Girão* the highest cliff at 580 m above sea-level. The series of cliffs is interrupted in Funchal "amphitheatre" and in Machico bay and also in the remaining coast by creeks mouths.

In terms of land occupation, about two thirds of the island is occupied by the Madeira Natural Park, integrating areas with different protection statuses. Approximately 75% of Madeira Island's population lives on only 35% of the land, especially along the south coast where 94% of the population resides and where the majority of hotels are situated.

1.2. Demography

According to preliminary data from the 2011 Census, the resident population of the Autonomous Region of Madeira is comprised of 267 785 inhabitants, of which, 262 302 reside in Madeira Island, representing 98% of the archipelago's population.

About 43% of Madeira Island's population is concentrated in the Funchal municipality, comprising 111 892 inhabitants. The population density of Madeira Island is 356 inhabitants/km^2, being 1 472 inhabitants/km^2 for Funchal, which shows the high population concentration in the island's capital.

In 2011, 94% of the total resident population of Madeira Island is concentrated along its southern coast.

Table 1: Resident Population by Municipality

	1981	1991	2001	2007	2009	2011
Calheta (South coast)	12 954	13 005	11 946	11 939	11 864	11 521
Câmara de Lobos (South coast)	31 035	31 476	34 614	35 969	36 279	35 666
Funchal (South coast)	112 746	115 403	103 961	99 214	97 793	111 892
Machico (South coast)	22 126	22 016	21 747	21 115	20 923	21 828
Ponta do Sol (South coast)	9 149	8 756	8 125	8 352	8 397	8 862
Porto Moniz (North coast)	3 963	3 432	2 927	2 679	2 616	2 711
Ribeira Brava (South coast)	13 480	13 170	12 494	12 599	12 583	13 375
Santa Cruz (South coast)	23 261	23 465	29 721	35 985	38 269	43 005
Santana (North coast)	11 253	10 302	8 804	8 326	8 198	7 719
São Vicente (North coast)	8 501	7 695	6 198	6 121	6 099	5 723
TOTAL	**248 468**	**248720**	**240 537**	**240 299**	**243 021**	**262 302**

Source: *INE* (Statistics of Portugal) – 1991 Census, 2001 Census, 2011 Census (provisional results), DREM – Demographic Statistics of the Autonomous Region of Madeira – 2007 and 2009.

The resident population of Madeira Island has not always had a constant growth. In 2001, this indicator falls in relation to previous decades, but in 2011, returns practically to 1960 values, due to the return of immigrants and to 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 Madeira 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 Madeira 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, hydro 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. It should also be referred an urban waste incineration plant with energy recovery and a private thermal power plant in Madeira Island, having a significant contribution to the electricity production.

- 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 Madeira Island are to:

1. Improve energy supply guarantee.
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 Madeira 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 50% 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 Madeira 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, six strategic guidelines are established, that aim to guide the implementation of sustainable energy actions in Madeira 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.
6. Promote low carbon energy carriers.

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. • Promote low carbon energy carriers.

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.

In the improvement of energy efficiency and valorisation of renewable energy resources, the public services, including buildings, public lighting and transport fleets are the aimed targets to be privileged, namely through a specific initiative to reduce energy consumption and respective costs, with a multiplying effect throughout society.

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 845 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 Madeira 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	259 265	11 108	79 972	492 557	22	842 924
	Heat			11 192			11 192
	Subtotal	259 265	11 108	91 164	492 557	22	854 116
Fossil fuels	Fueloil			23 121	12 097		35 218
	Diesel		17 488	10 335	9 832	1 151 345	1 189 000
	Gasoline				2 820	503 455	506 275
	LPG	202 603	3 438	8 232	125 918		340 191
	Subtotal	202 603	20 926	41 688	150 667	1 654 800	2 070 684
Renewable energy sources	Solar	24 683			2 303		26 986
	Biomass	55 191		5 058	1 686		61 935
	Subtotal	79 874		5 058	3 989		88 921
TOTAL		**541 742**	**32 034**	**137 910**	**647 213**	**1 654 822**	**3 013 722**

Figure 2: Final energy demand per sector in 2009

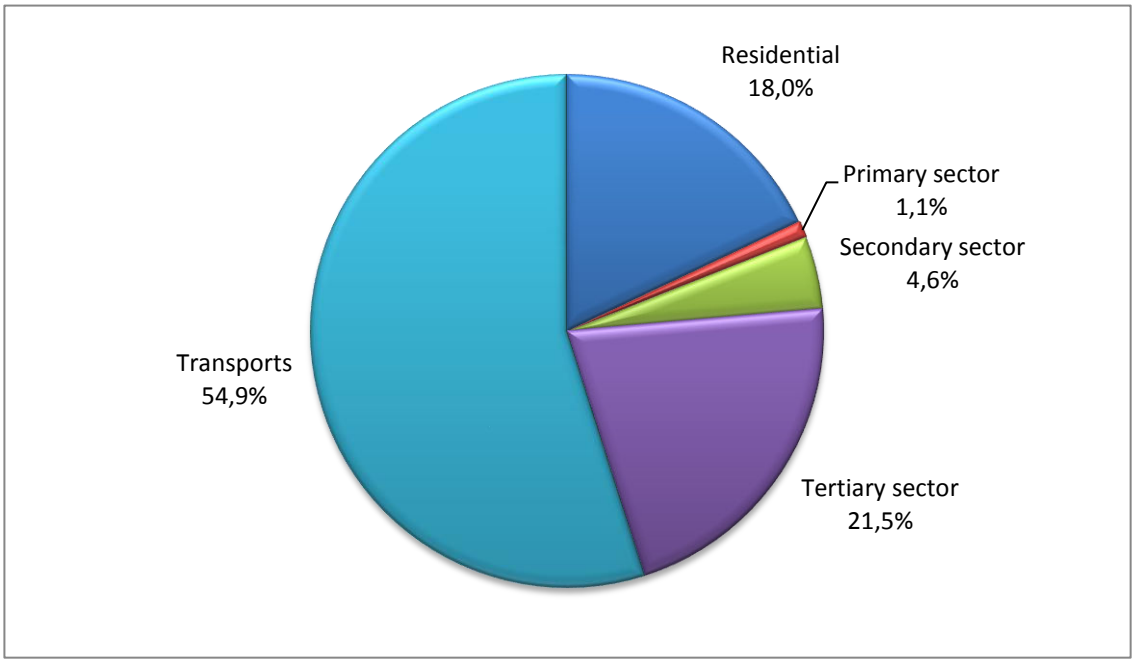
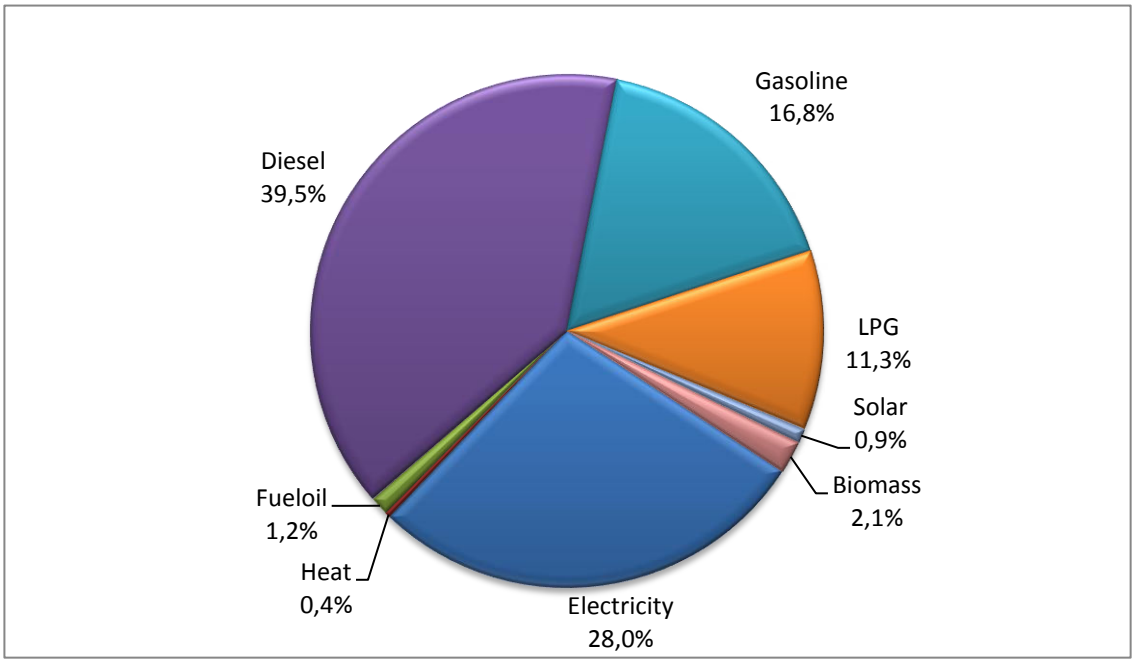


Figure 3: Final energy demand per energy carrier in 2009



From the analysis of the final energy demand, it's worthy to note the significant weight of the land transport sector, with a 54,9% contribution, followed by the tertiary sector, which includes hotels, commerce, services (public and private) and street lighting, contributing with 21,5% and the residential sector with 18,0%.

Regarding the energy carriers used by the final consumer, diesel represents the highest share in percentage terms, mainly, due to the transport sector. However, electricity, for having a significant component in thermal electricity production, provides a higher contribution to primary energy demand.

The share of renewable energy resources accounted for 3,0% of the final energy demand in 2009. Considering the contribution of renewable energy in electricity production, the total renewable component corresponds to 10,0% of the final energy demand.

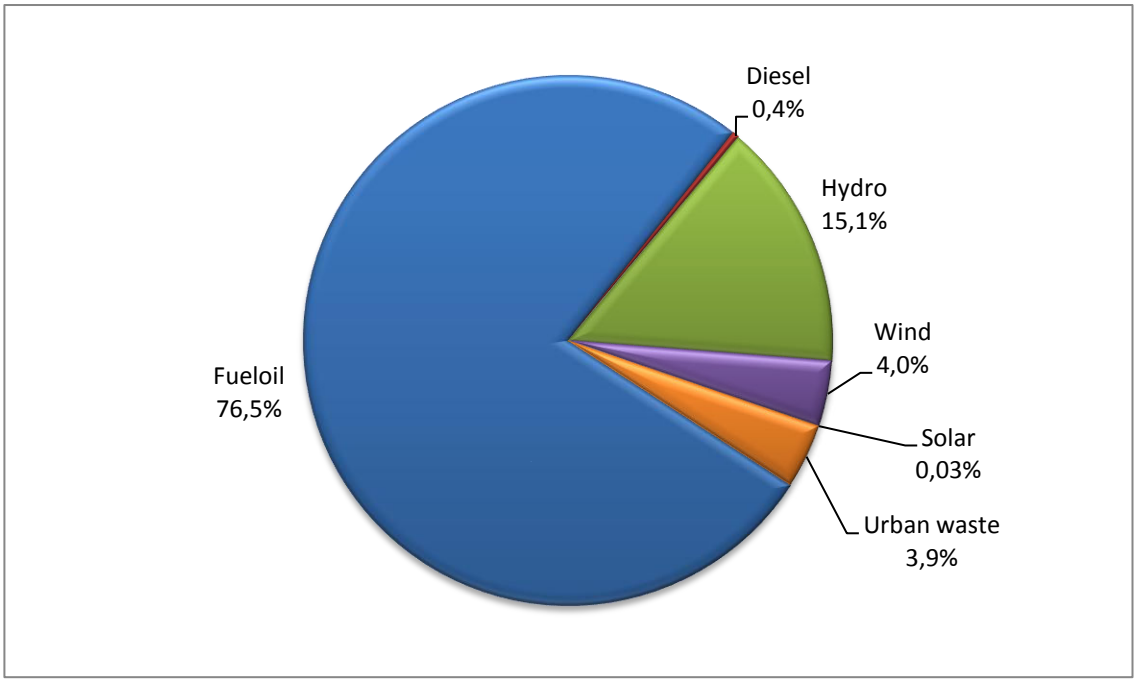
3.1.2. Energy conversion

In Madeira Island, energy conversion refers essentially to electricity production for the Public Service Electricity System of the Autonomous Region of Madeira. Thermal energy output of a cogeneration power plant for district heating represents only 1,2% of secondary energy production.

Table 7: Energy conversion in 2009

Energy carriers		Electricity production [MWh]	Heat production [MWh]	TOTAL [MWh]
Fossil fuels	Fueloil	708 238		708 238
	Diesel	4 009		4 009
	Subtotal	712 247		712 247
Renewable energy sources	Hydro	139 639		139 639
	Wind	36 905		36 905
	Solar	289		289
	Urban waste	36 512		36 512
	Energy recovery		11 192	
	Subtotal	213 345	11 192	224 537
Storage	Input to storage	-1 051		-1 051
	Output from storage	736		736
TOTAL		**925 276**	**11 192**	**936 468**
Distribution losses and self-consumption		82 352		82 352

Figure 4: Electricity production per energy source in 2009



The thermal share of fossil fuels (fueloil and diesel) represented 76,9% of electricity production in 2009. However, in 2010 and in 2011, new renewable energy plants arose which contributed to increase the share of renewable energies in electricity production.

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 heat and electricity.

Table 8: Primary energy demand in 2005 and 2009

Energy carriers		2005 [MWh]	2009 [MWh]
Fossil fuels	Fueloil	1 509 747	1 753 347
	Diesel	1 279 798	1 198 727
	Gasoline	561 338	506 275
	LPG	370 105	340 191
	Subtotal	3 720 988	3 798 540
Renewable energy sources	Hydro	86 550	139 639
	Wind	15 360	36 905
	Solar	20 360	27 275
	Biomass	96 592	61 935
	Urban waste	34 300	36 512
	Subtotal	253 162	302 266
TOTAL		**3 974 150**	**4 100 806**

Figure 5: Primary energy demand in 2005 and 2009

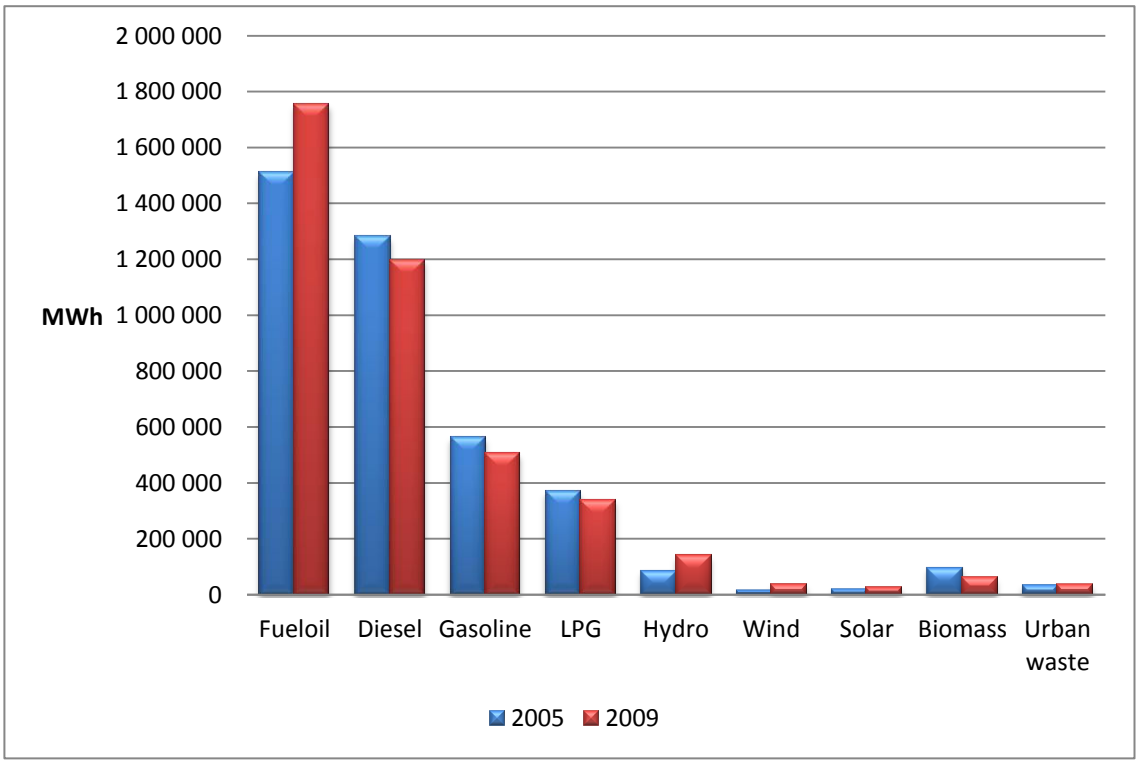
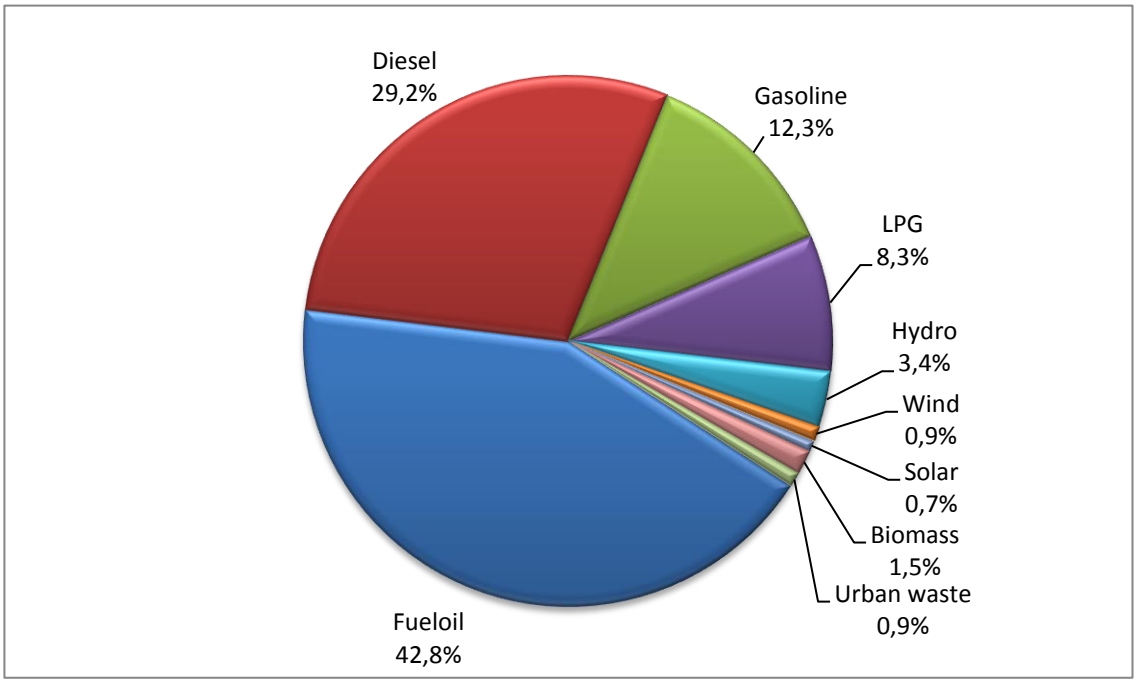


Figure 6: Primary energy demand in 2009



The share of renewable energy resources represented 6,4% of the total primary energy demand in 2005 and 7,4% 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.

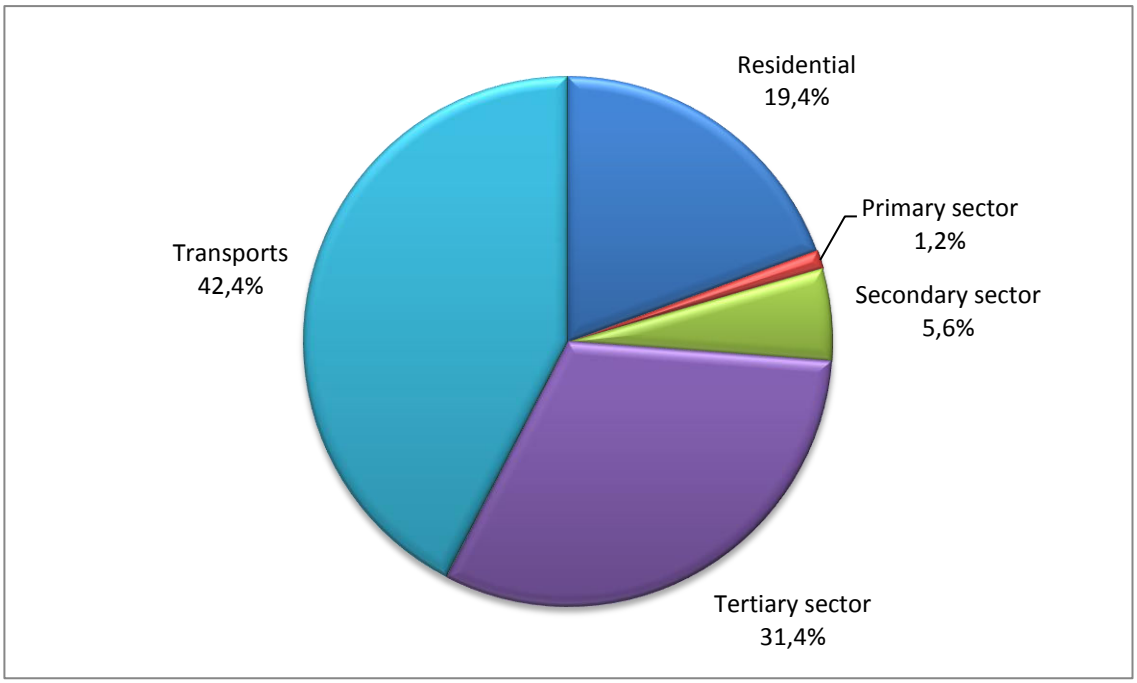
Table 9: CO_2 emissions per sector in 2009

Energy carriers		Residential [t]	Primary sector [t]	Secondary sector [t]	Tertiary sector [t]	Transports [t]	TOTAL [t]
Centralized energy services	Electricity	149 421	6 402	46 090	283 873	13	485 799
	Heat						
	Subtotal	149 421	6 402	46 090	283 873	13	485 799
Fossil fuels	Fueloil			6 451	3 375		9 826
	Diesel		4 669	2 759	2 625	307 409	317 463
	Gasoline				702	125 360	126 062
	LPG	48 625	825	1 976	30 220		81 646
	Subtotal	48 625	5 494	11 186	36 923	432 769	534 997
Renewable energy sources	Solar						
	Biomass						
	Subtotal						
TOTAL		**198 046**	**11 896**	**57 276**	**320 796**	**432 782**	**1 020 796**

For renewable energy sources, the contribution from hydro, wind and solar energy, as well as from waste heat recovery, to carbon dioxide emissions was null. For biomass, assuming a sustainable exploitation of the resources, a neutral balance of emissions was considered, whilst for urban

waste, the emission factor is not zero, as it has non-renewable components, hence, its contribution is not neutral.

Figure 7: CO_2 emissions per sector in 2009

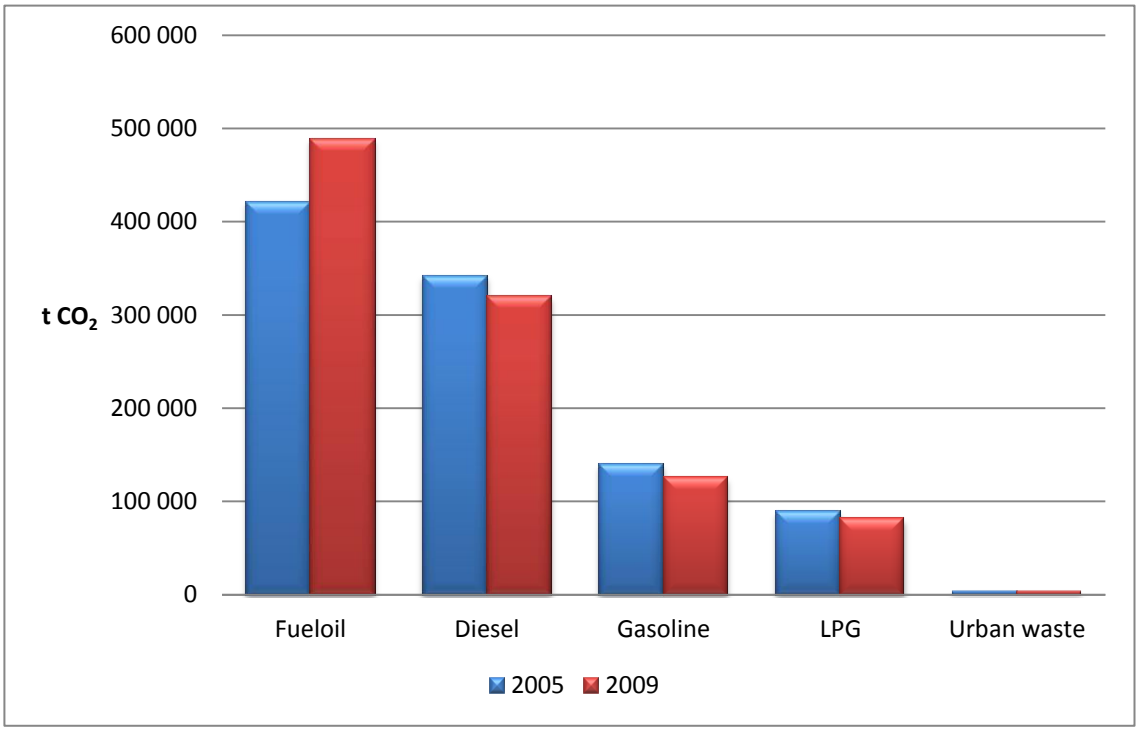


The transport sector, with its high weight on energy demand from fossil fuels, has the greatest share of carbon dioxide emissions (42,4%). The tertiary sector, where electricity contributes to aggravate the emissions, comes second (31,4%), followed by the residential sector (19,4%).

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

Energy carriers		2005 [t]	2009 [t]
Fossil fuels	Fueloil	421 219	489 184
	Diesel	341 706	320 060
	Gasoline	139 773	126 062
	LPG	88 825	81 646
	Subtotal	991 524	1 016 952
Renewable energy sources	Hydro		
	Wind		
	Solar		
	Biomass		
	Urban waste	3 611	3 844
	Subtotal	3 611	3 844
TOTAL		**995 135**	**1 020 796**

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 reduction in emissions from diesel, gasoline and LPG, there was a significant increase regarding fueloil.

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 production values of the base year were maintained, as the projects implemented after the start of the preparation of the present action plan are already included in the sustainable energy strategy which gave rise to the plan and are therefore not considered in the BAU scenario.

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

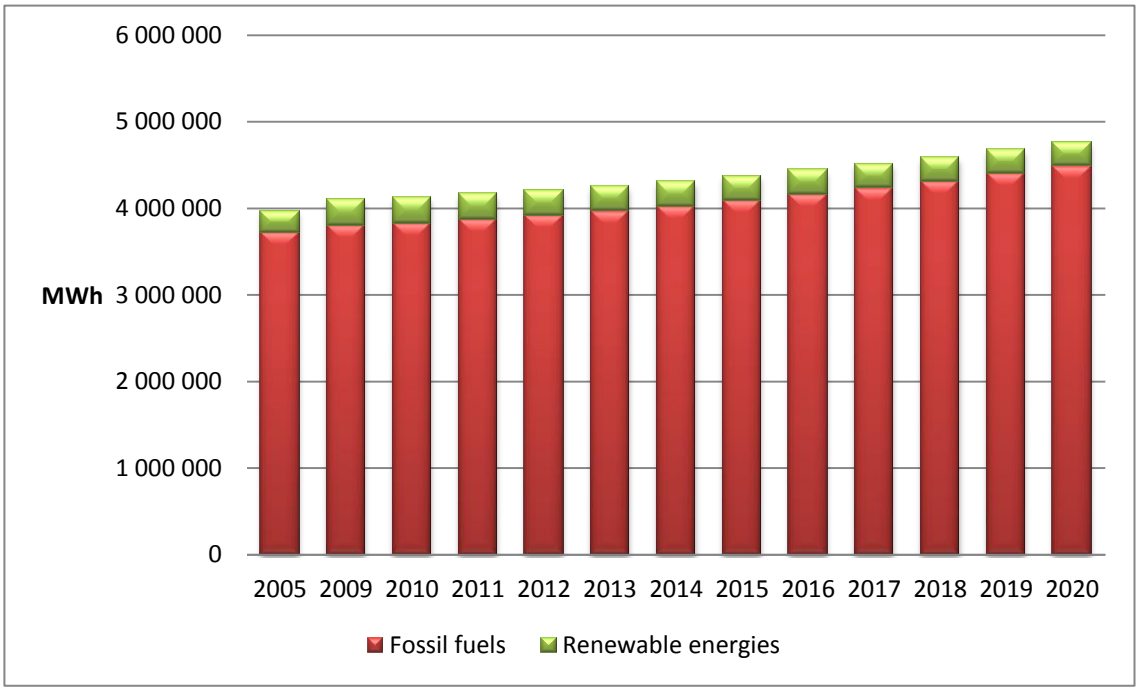
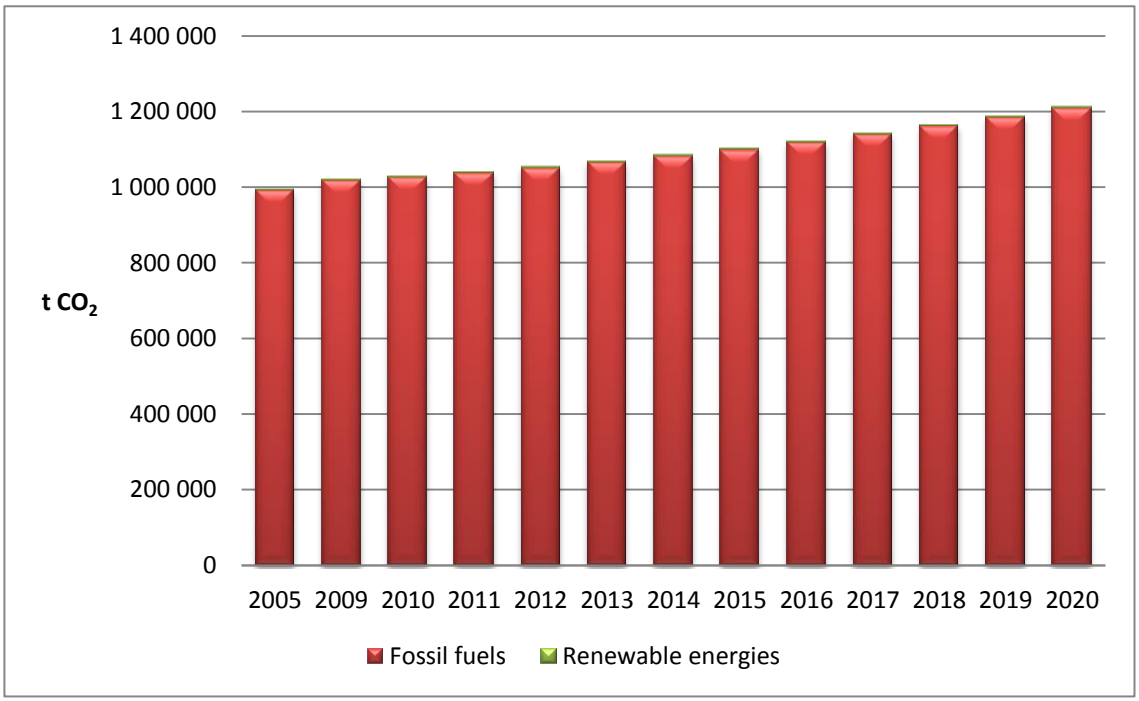


Figure 10: CO_2 emissions until 2020 – BAU scenario



In this scenario, the carbon dioxide emissions increase by 22%, 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 Madeira 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	315 667	13 172	77 115	709 686	18	1 115 658
	Heat			9 715			9 715
	Subtotal	315 667	13 172	86 831	709 686	18	1 125 373
Fossil fuels	Fueloil			20 635	13 974		34 609
	Diesel		20 738	10 248	14 391	1 060 097	1 105 474
	Gasoline				4 341	468 529	472 870
	LPG	243 036	4 077	7 253	168 566		422 932
	Subtotal	243 036	24 815	38 137	201 272	1 528 627	2 035 886
Renewable energy sources	Solar	29 609			2 997		32 606
	Biomass	22 056		4 391	2 316		28 763
	Subtotal	51 665		4 391	5 313		61 369
TOTAL		**610 368**	**37 987**	**129 358**	**916 271**	**1 528 645**	**3 222 629**

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

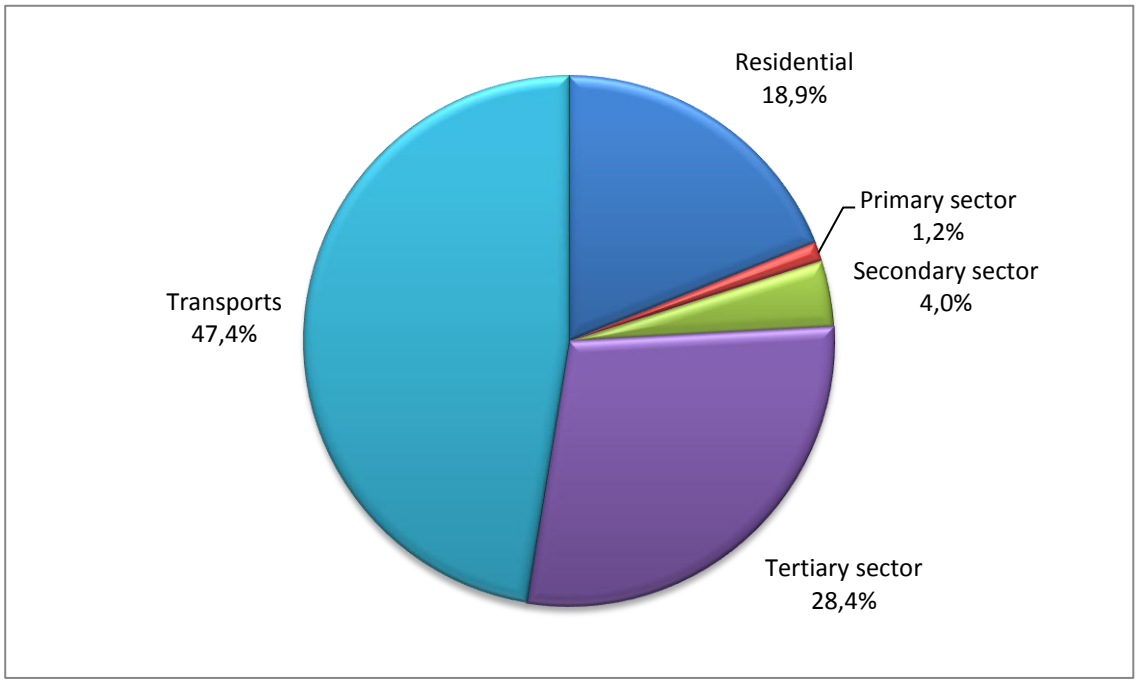
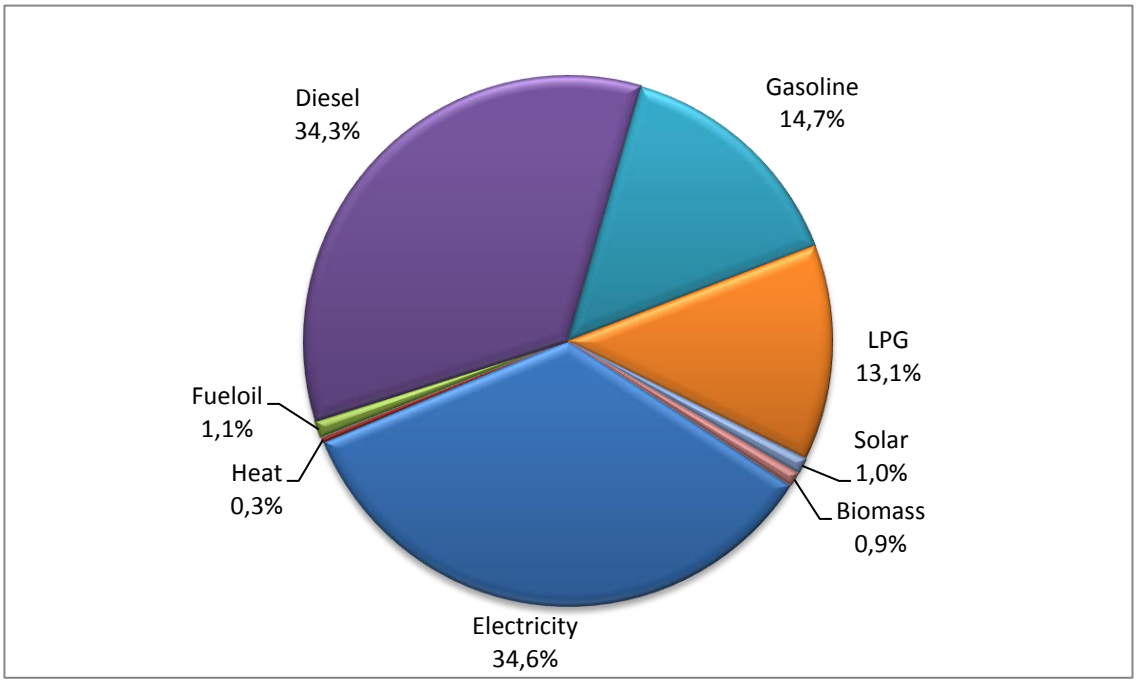


Figure 12: Final energy demand per energy carrier in 2020 – BAU scenario



From the analysis of the final energy demand, it can be highlighted the permanence of a significant weight in the land transport sector, although with a lower percentage than the base year (54,9% in 2009 and 47,4% in 2020), whilst the contribution of the tertiary sector increased (21,5% in 2009 and 28,4% in 2020) and also of the residential sector (18,0% in 2009 and 18,9% in 2020).

Per energy carrier, one can point out the growth of the electricity demand percentage (28,0% in 2009 and 34,6% in 2020).

The share of renewable energy sources represents, in this scenario, 1,9% of the final energy demand in 2020. Considering the contribution of renewable energy in electricity production, the total renewable share corresponds to 8,5% of the final energy demand, which represents a decrease compared to 2009.

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.

As the most recent projects of electricity production from renewable energy sources, which came into operation in 2011, are already included in the strategy of the Sustainable Energy Action Plan of Madeira Island, they are not considered in the BAU scenario.

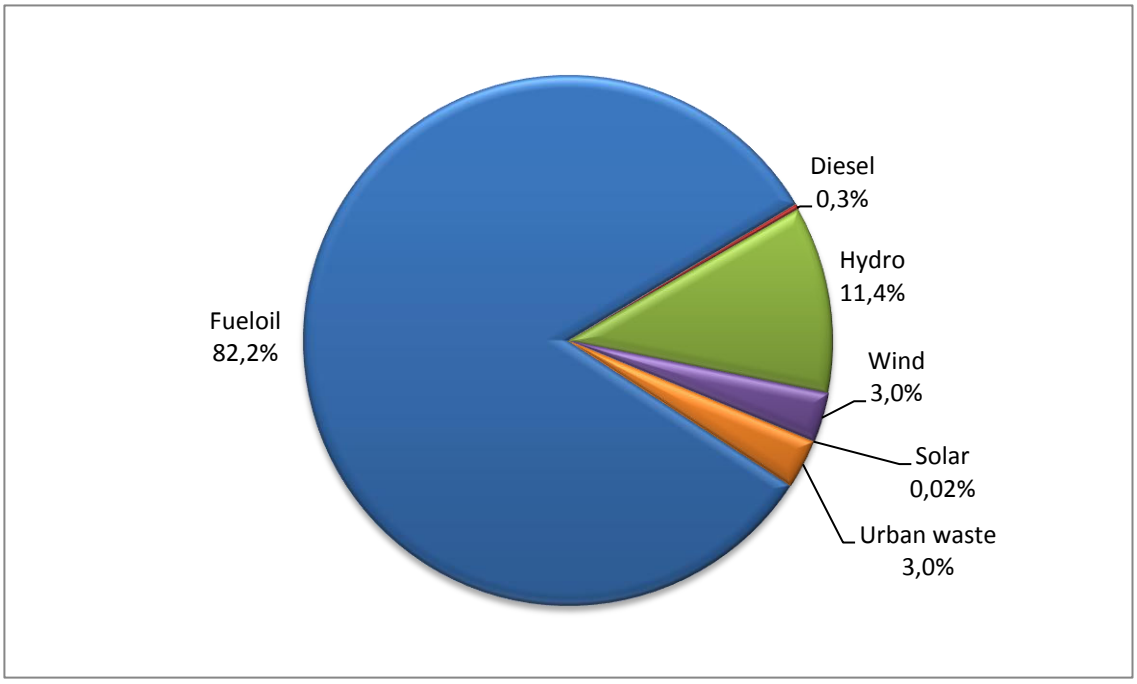
Regarding heat production, as there is a tendency for the energy demand from the industrial sector to decrease, meaning less use of the existing district heating, a reduction in heat recovery until 2020 can be observed, in comparison to 2009.

In this scenario, as verified in 2009, the energy conversion refers essentially to electricity production. The thermal energy production for distribution in a heat network represents only 0,8% of secondary energy production.

Table 12: Energy conversion in 2020 – BAU scenario

Energy carriers		Electricity production [MWh]	Heat production [MWh]	TOTAL [MWh]
Fossil fuels	Fueloil	1 006 515		1 006 515
	Diesel	4 009		4 009
	Subtotal	1 010 524		1 010 524
Renewable energy sources	Hydro	139 639		139 639
	Wind	36 905		36 905
	Solar	289		289
	Urban waste	36 512		36 512
	Energy recovery		9 715	9 715
	Subtotal	213 345	9 715	223 060
Storage	Input to storage	-1 051		-1 051
	Output from storage	736		736
TOTAL		**1 223 554**	**9 715**	**1 233 269**
Distribution losses and self-consumption		107 895		107 895

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 82,5%, which is a higher percentage than in 2009, because it was assumed in this scenario that the growth of the final energy demand would only be offset by an increase of energy production from fossil fuels.

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 and heat.

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

Energy carriers		2005 [MWh]	2009 [MWh]	2020 [MWh]
Fossil fuels	Fueloil	1 509 747	1 753 347	2 476 336
	Diesel	1 279 798	1 198 727	1 115 201
	Gasoline	561 338	506 275	472 870
	LPG	370 105	340 191	422 932
	Subtotal	3 720 988	3 798 540	4 487 340
Renewable energy sources	Hydro	86 550	139 639	139 639
	Wind	15 360	36 905	36 905
	Solar	20 360	27 275	32 895
	Biomass	96 592	61 935	28 763
	Urban waste	34 300	36 512	36 512
	Subtotal	253 162	302 266	274 714
TOTAL		**3 974 150**	**4 100 806**	**4 762 054**

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

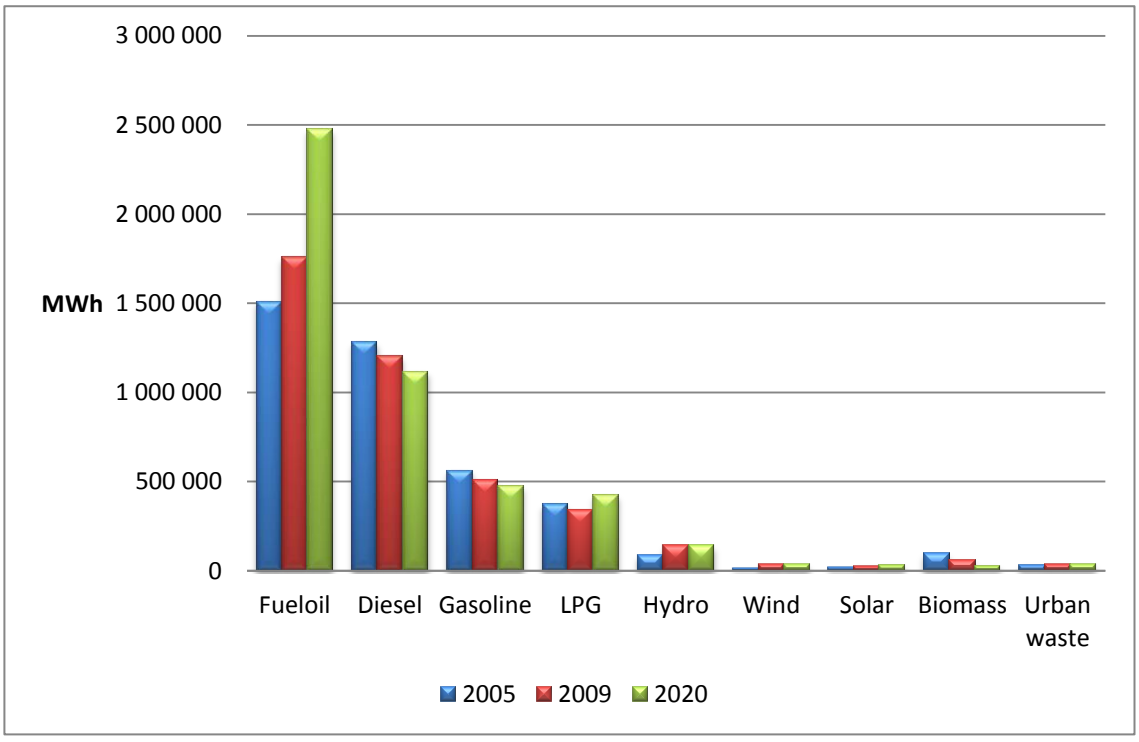
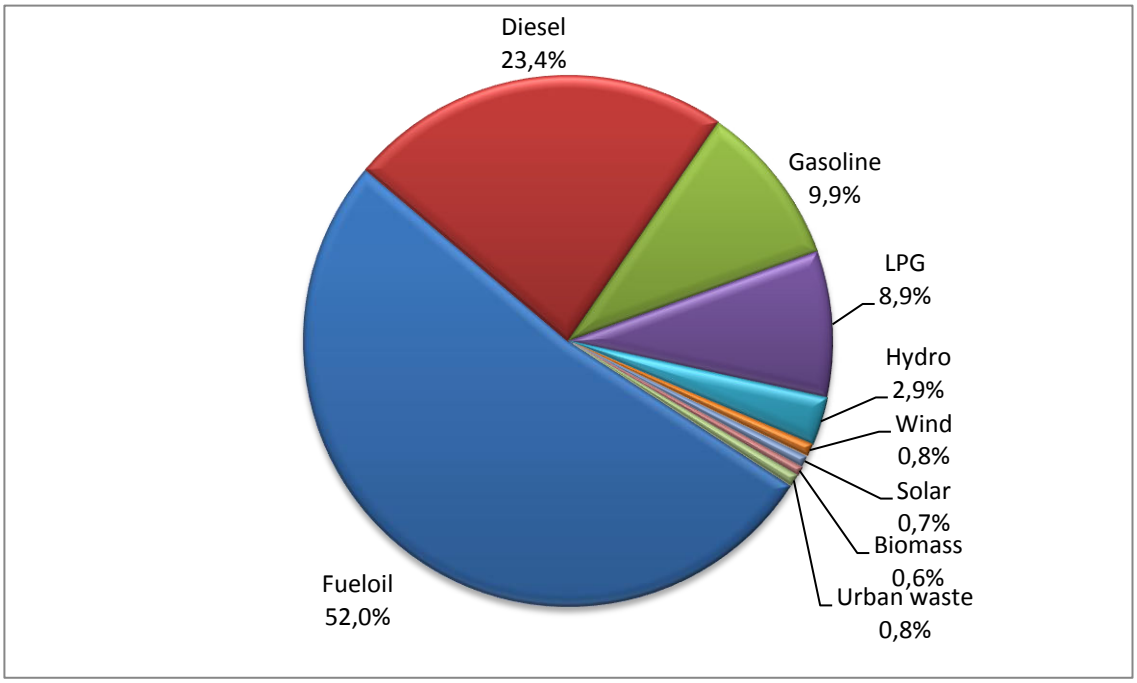


Figure 15: Primary energy demand in 2020 – BAU scenario



The BAU scenario leads to a 20% increase of primary energy demand until 2020 compared to 2005 and a 16% increase compared to 2009. The share of renewable energy resources is 5,8% in 2020, which was 6,4% in 2005 and 7,4% in 2009.

In macroeconomic terms, the supply of fossil fuels in 2020, for this scenario, is equivalent to 207 million Euros per year, at 2009 import prices.

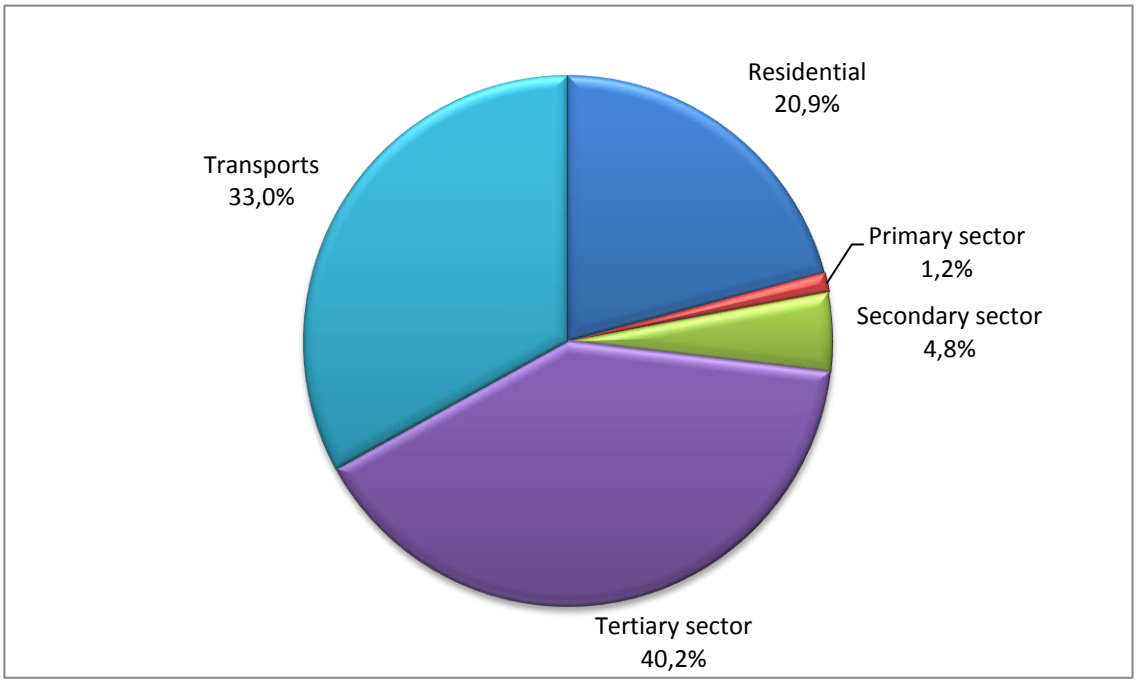
3.2.4. Carbon dioxide emissions

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	194 574	8 119	47 533	437 444	11	687 682
	Heat						
	Subtotal	194 574	8 119	47 533	437 444	11	687 682
Fossil fuels	Fueloil			5 757	3 899		9 656
	Diesel		5 537	2 736	3 842	283 046	295 162
	Gasoline				1 081	116 664	117 745
	LPG	58 329	978	1 741	40 456		101 504
	Subtotal	58 329	6 515	10 234	49 278	399 710	524 066
Renewable energy sources	Solar						
	Biomass						
	Subtotal						
TOTAL		**252 903**	**14 635**	**57 768**	**486 722**	**399 721**	**1 211 748**

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



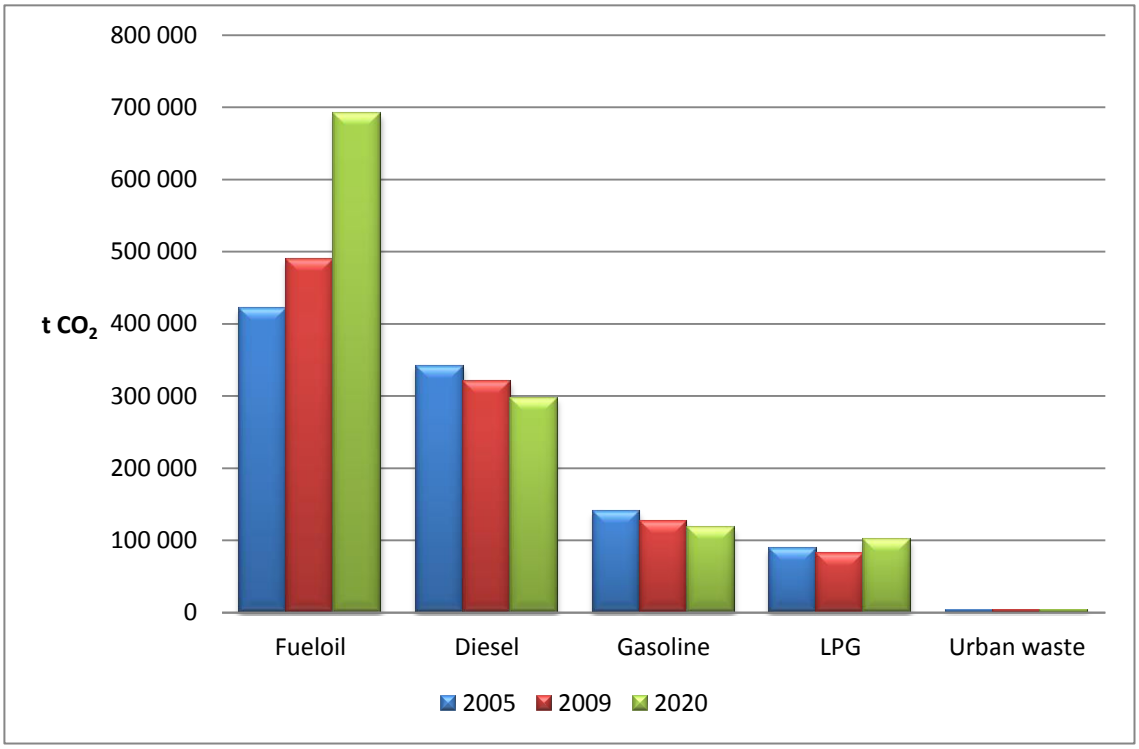
In this scenario, in comparison to 2009, there is a considerable increase of emissions in the tertiary sector, overtaking the transport sector, which reduces its relative weight. This factor is mainly due to the increase in electricity consumption and to the fact that it comes essentially from fossil fuels.

Analysing the emissions per energy carrier, there is a significant increase of carbon dioxide emissions.

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	421 219	489 184	690 898
	Diesel	341 706	320 060	297 759
	Gasoline	139 773	126 062	117 745
	LPG	88 825	81 646	101 504
	Subtotal	991 524	1 016 952	1 207 905
Renewable energy sources	Hydro			
	Wind			
	Solar			
	Biomass			
	Urban waste	3 611	3 844	3 844
	Subtotal	3 611	3 844	3 844
TOTAL		**995 135**	**1 020 796**	**1 211 748**

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



In comparison to the emissions in 2005, an increase of 22% can be noted. Despite a slight reduction of emissions from diesel and gasoline, there is an increase of 64% in relation to fueloil, justified by the increase of electricity demand.

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 considered, 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

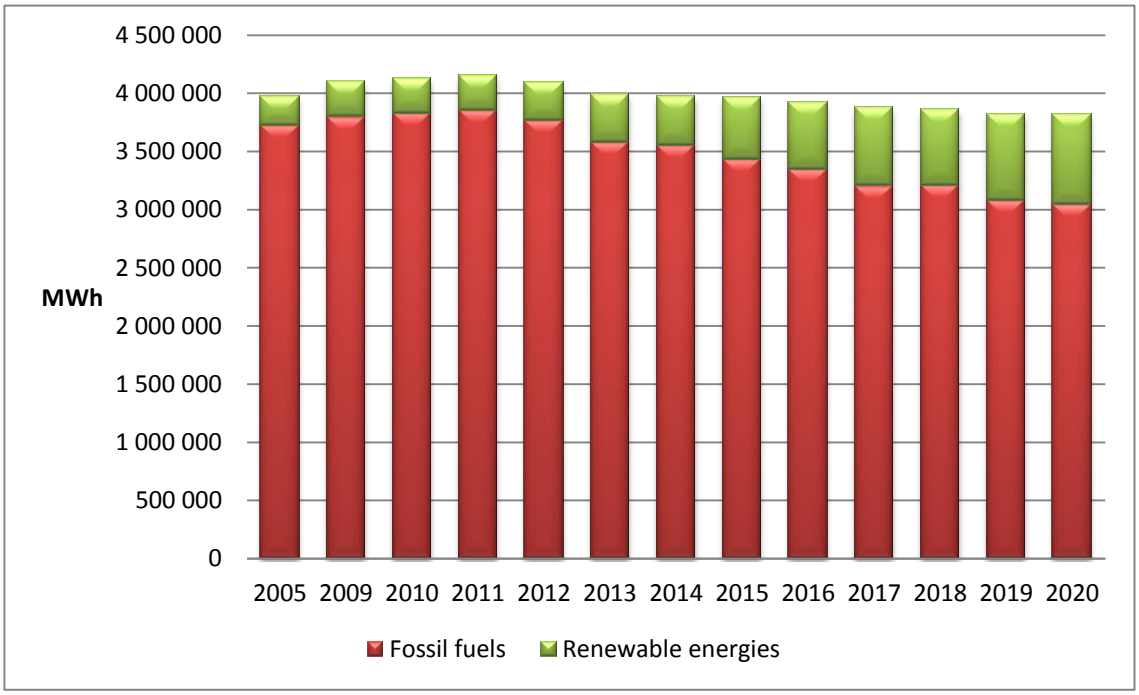
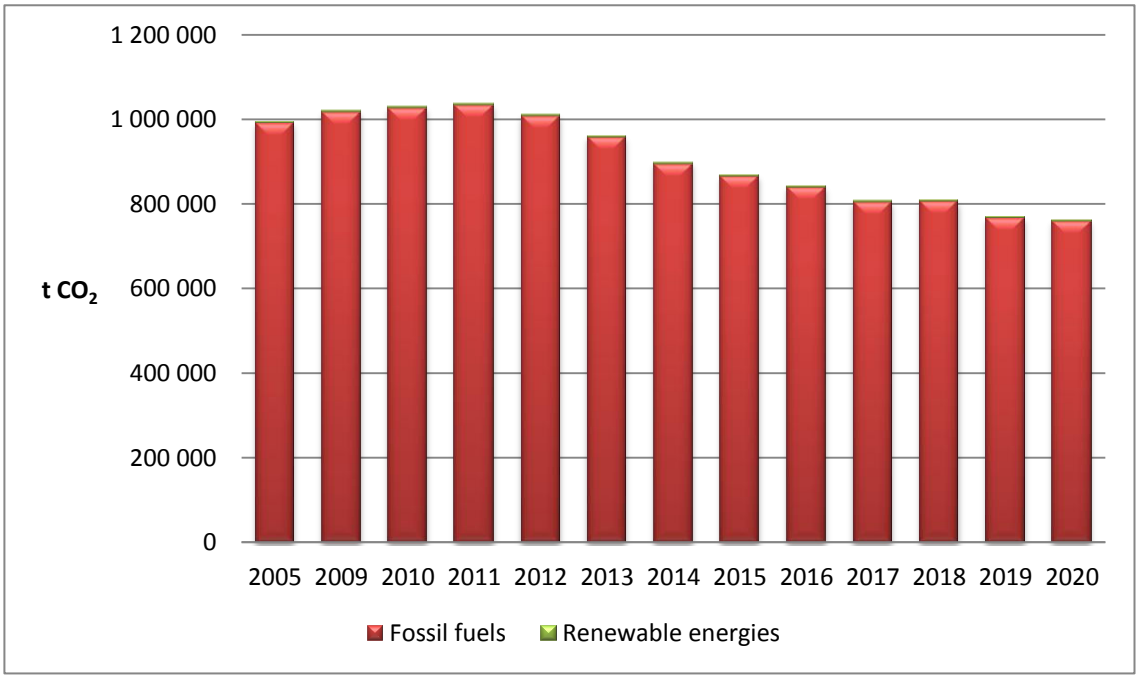


Figure 19: CO_2 emissions until 2020 – Action Plan scenario



In this scenario, the carbon dioxide emissions have a 23% 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 Madeira 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	277 640	13 172	75 568	631 557	2 074	1 000 012
	Heat			15 141			15 141
	Subtotal	277 640	13 172	90 709	631 557	2 074	1 015 152
Fossil fuels	Fueloil			12 901	10 308		23 209
	Diesel		20 738	10 204	13 333	959 752	1 004 028
	Gasoline				4 341	417 265	421 606
	LPG	164 301	4 077	5 979	129 634		303 990
	Subtotal	164 301	24 815	29 084	157 616	1 377 017	1 752 833
Renewable energy sources	Solar	71 280		2 261	23 517		97 058
	Biomass	26 739		4 391	2 316	5 106	38 552
	Subtotal	98 019		6 652	25 834	5 106	135 611
TOTAL		**539 960**	**37 987**	**126 445**	**815 006**	**1 384 197**	**2 903 596**

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

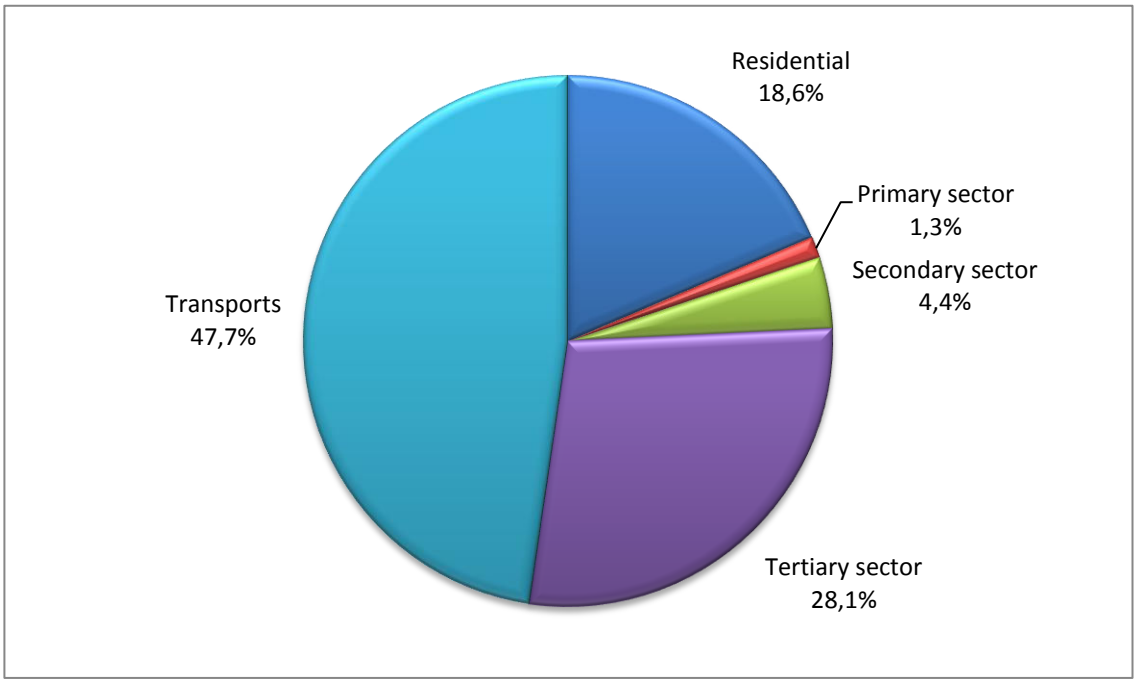
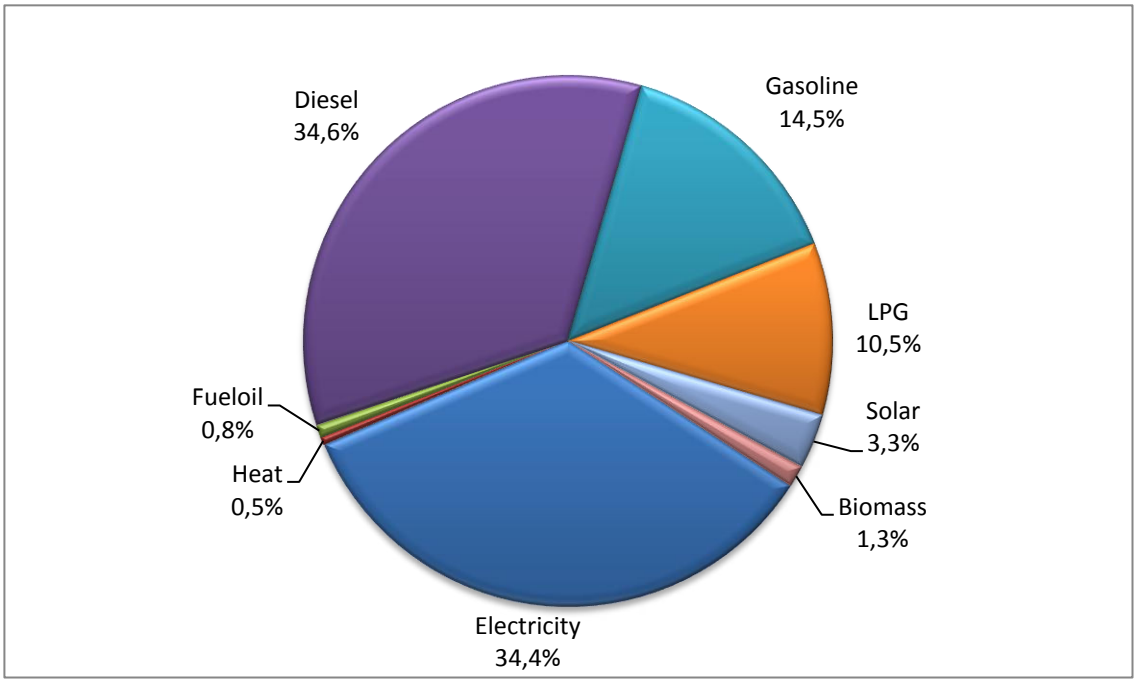


Figure 21: Final energy demand per energy carrier in 2020 – Action Plan scenario



From the analysis of the final energy demand, it can be highlighted the permanence of a significant weight in the land transport sector, although with a lower percentage than in the base year (54,9% in 2009 and 47,7% in 2020), having an increase in the tertiary sector (21,5% in 2009 and 28,1% in 2020) and in the residential sector (18,0% in 2009 and 18,6% 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 (319 033 MWh).

Per energy carrier, one can note a growth in electricity demand percentage (28,0% in 2009 and 34,4% in 2020).

The share of renewable energy resources, represents, in this scenario, 4,7% of the final energy demand in 2020. Considering the contribution of renewable energy in electricity production, the total renewable component corresponds to 26,6% of the final energy demand, while in the BAU scenario, this stood around 8,5%.

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, including energy storage with reversible hydro-electric plants, and the introduction of natural gas, to substitute fueloil used in the production of thermal origin.

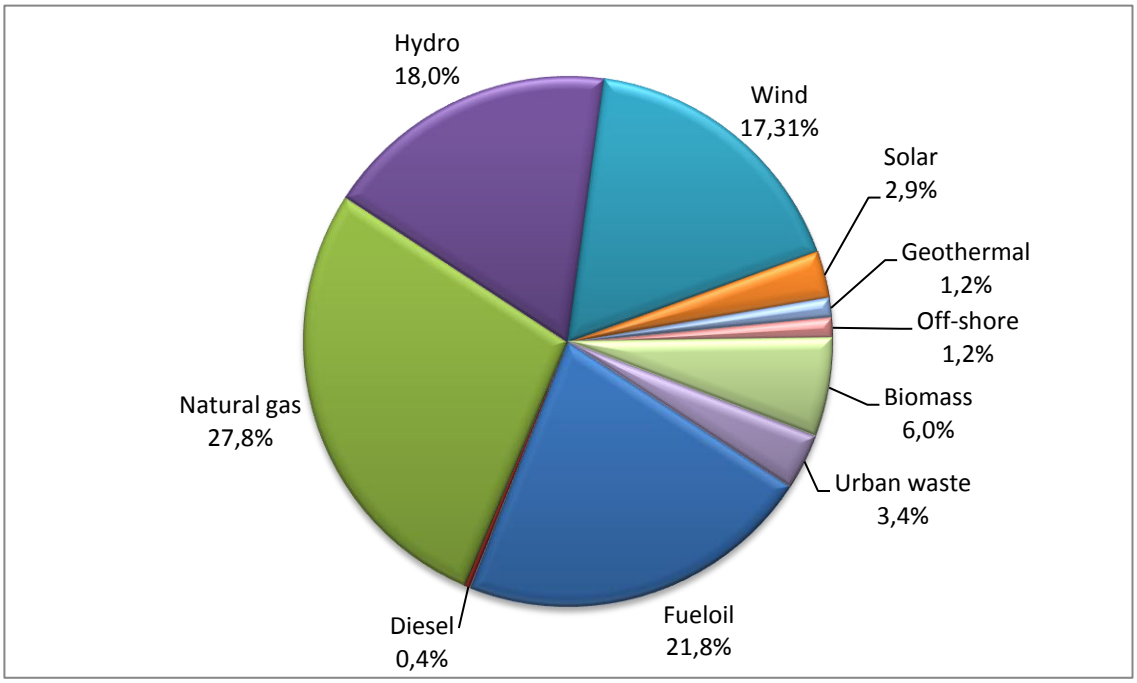
Regarding heat production, despite a tendency of the energy demand from the industrial sector to decrease, meaning less use of the existing district heating, an increase in heat recovery until 2020 can be achieved, in relation to 2009, which results from a greater effort of using waste heat from electricity production.

In this scenario, as verified in 2009 and in the BAU scenario, energy conversion refers essentially to electricity production. Thermal energy production for distribution in a heat network represents only 1,4% of secondary energy production.

Table 17: Energy conversion in 2020 – Action Plan scenario

Energy carriers		Electricity production [MWh]	Heat production [MWh]	TOTAL [MWh]
Fossil fuels	Fueloil	235 313		235 313
	Diesel	4 009		4 009
	Natural gas	300 000		300 000
	Subtotal	539 323		539 323
Renewable energy sources	Hydro	194 389		194 389
	Wind	186 701		186 701
	Solar	30 949		30 949
	Geothermal	12 600		12 600
	Off-shore	13 140		13 140
	Biomass	64 800		64 800
	Urban waste	36 512		36 512
	Energy recovery		15 141	15 141
	Subtotal	539 091	15 141	554 231
Storage	Input for storage	-44 107		-44 107
	Output from storage	30 875		30 875
TOTAL		**1 065 182**	**15 141**	**1 080 322**
Distribution losses and self-consumption		65 170		65 170

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



In the electricity production for 2020, a thermal component of fossil origin (fueloil, diesel and natural gas) represents 50%, subtracting the total of the losses resulting from energy storage, being the remaining 50% 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 and heat.

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

Energy carriers		2005 [MWh]	2009 [MWh]	2020 [MWh]
Fossil fuels	Fueloil	1 509 747	1 753 347	594 061
	Diesel	1 279 798	1 198 727	1 013 754
	Gasoline	561 338	506 275	421 606
	LPG	370 105	340 191	303 990
	Natural gas			714 286
	Subtotal	3 720 988	3 798 540	3 047 698
Renewable energy sources	Hydro	86 550	139 639	194 389
	Wind	15 360	36 905	186 701
	Solar	20 360	27 275	128 008
	Geothermal			12 600
	Off-shore			13 140
	Biomass	96 592	61 935	200 552
	Urban waste	34 300	36 512	36 512
	Subtotal	253 162	302 266	771 902
TOTAL		**3 974 150**	**4 100 806**	**3 819 599**

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

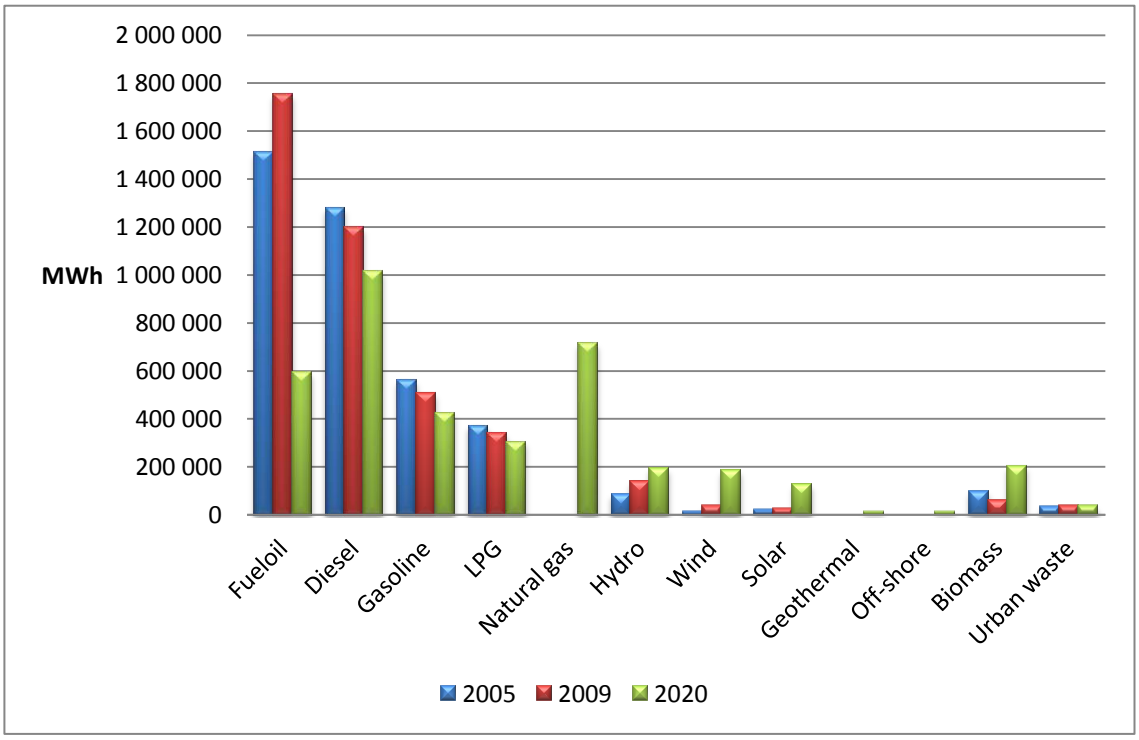
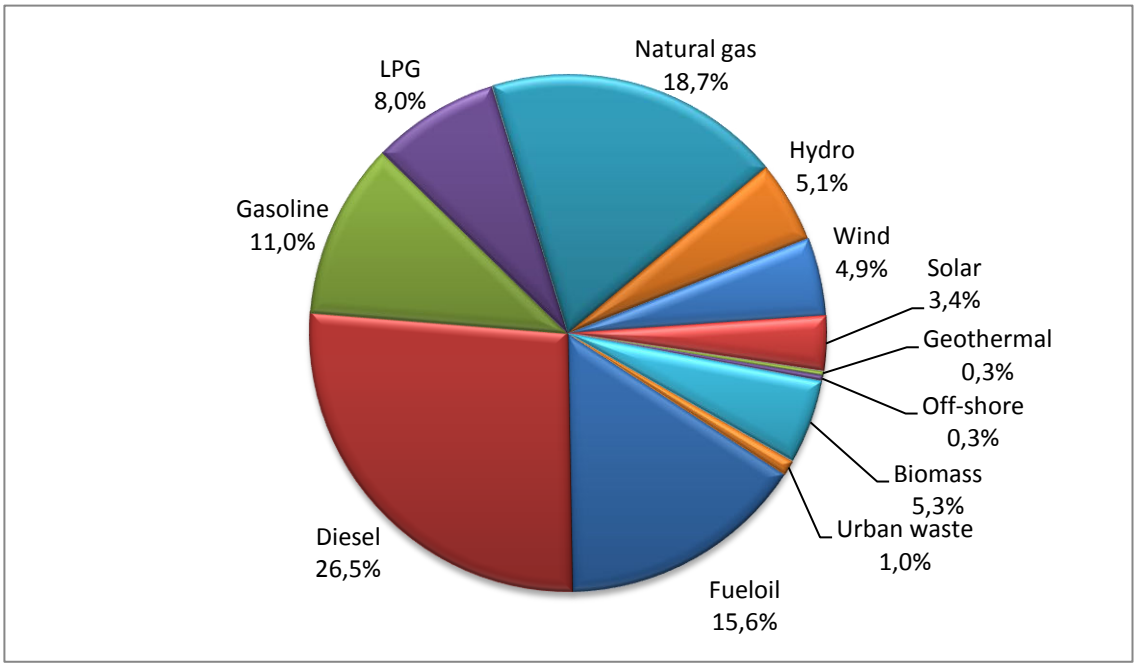


Figure 24: Primary energy demand in 2020 – Action Plan scenario



This scenario leads to a 4% reduction in primary energy demand by 2020 compared to 2005 and a 7% reduction compared to 2009. The share of renewable energy resources is 20% in the total primary energy demand in 2020, which was 6,4% in 2005 and 7,4% in 2009. In the BAU scenario, this percentage lies at 5,8%.

In macro-economic terms, the use of fossil fuels in 2020, for this scenario, is equivalent to 156 million Euros per year, at import prices of 2009, which corresponds to a 51 million Euros per year saving, in relation to the BAU scenario. With oil prices rising in international markets, at a rate higher than inflation, it is probable that this saving be more significant in the future.

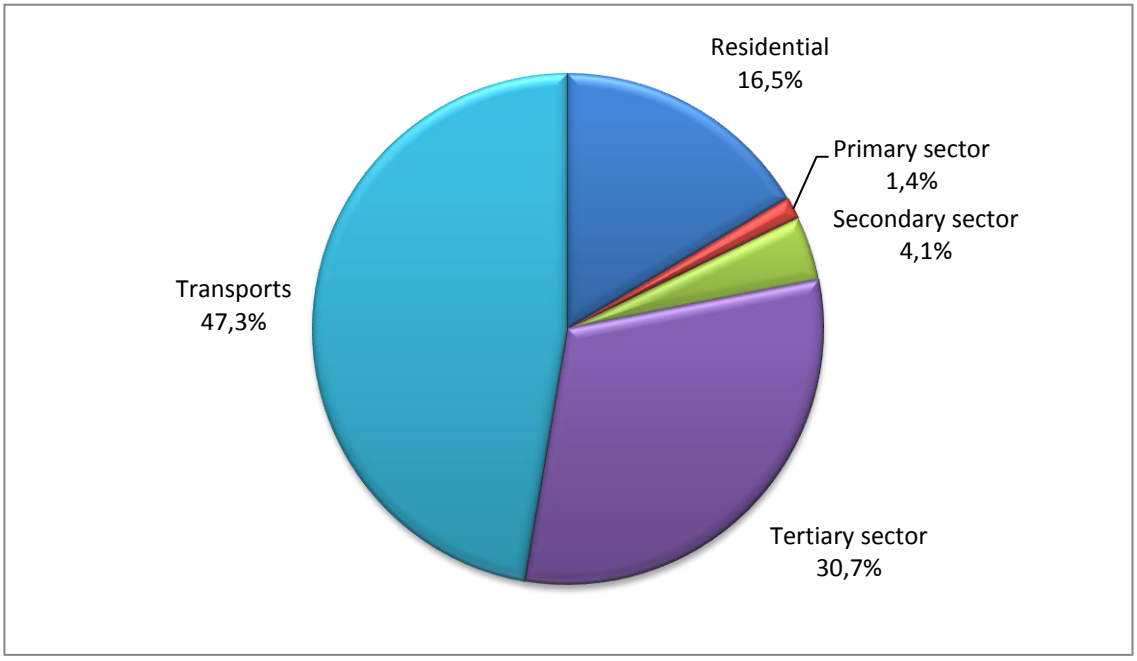
3.3.4. Carbon dioxide emissions

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]	Transport [t]	TOTAL [t]
Centralized energy services	Electricity	86 066	4 083	23 425	195 777	643	309 994
	Heat						
	Subtotal	86 066	4 083	23 425	195 777	643	309 994
Fossil fuels	Fueloil			3 599	2 876		6 475
	Diesel		5 537	2 725	3 560	256 254	268 075
	Gasoline				1 081	103 899	104 980
	LPG	39 432	978	1 435	31 112		72 958
	Subtotal	39 432	6 515	7 759	38 629	360 153	452 488
Renewable energy sources	Solar						
	Biomass						
	Subtotal						
TOTAL		**125 498**	**10 599**	**31 184**	**234 405**	**360 796**	**762 482**

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



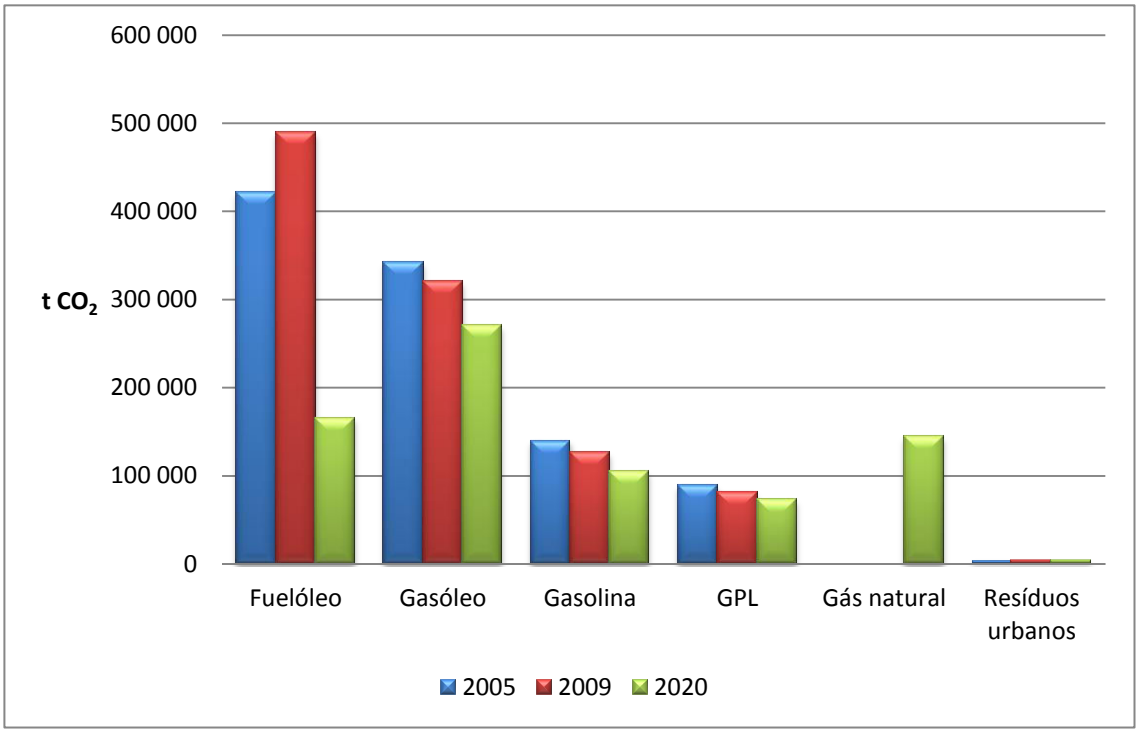
In this scenario, in comparison to 2009, there is a considerable reduction of emissions, namely in the services, transport and residential sectors.

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, energy efficiency improvement and introduction of natural gas.

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	421 219	489 184	165 743
	Diesel	341 706	320 060	270 672
	Gasoline	139 773	126 062	104 980
	LPG	88 825	81 646	72 958
	Natural gas			144 286
	Subtotal	991 524	1 016 952	758 639
Renewable energy sources	Hydro			
	Wind			
	Solar			
	Geothermal			
	Off-shore			
	Biomass			
	Urban waste	3 611	3 844	3 844
	Subtotal	3 611	3 844	3 844
TOTAL		**995 135**	**1 020 796**	**762 482**

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 23% can be verified in the action plan scenario, while, in the BAU scenario, the emissions increased by 22%.

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 increase [MWh/year]	Reduction of CO_2 emissions [ton/year]
Residential	67 460	46 354	44 589
Primary sector	-	-	-
Secondary sector	2 913	2 261	1 674
Tertiary sector	99 079	20 521	65 433
Transport	157 959	5 106	41 061
Secondary energy production	31 542	422 946	296 509
Other areas	-	-	-
TOTAL	**358 953**	**497 188**	**449 266**

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.	20%
		Increase to 50% the share of renewable energy resources in electricity production.	50%
3.	Reduce energy intensity in Gross Domestic Product	Reduce by 20% the energy intensity in Gross Domestic Product (primary energy/Gross Domestic Product).	>20%
4.	Reduce carbon dioxide emissions	Reduce by 20% CO_2 emissions in comparison to 2005.	23%

The increase in autonomous storage results mainly from the 18% reduction of primary energy demand from fossil fuels, the construction of storage facilities for natural gas and 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 18% 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
	1.4. Use of biomass products (wood bricks, pellets, etc.) for heating.	• Citizens	2016	2020
Lighting	1.5. Installation of energy efficient lamps, lighting fixtures and control devices, and adoption of more efficient behaviour.	• Citizens	2012	2020
	1.6. Campaigns to provide energy efficient lamps and control devices (light and movement sensors).	• EEM • AREAM • Citizens	2012	2015
Kitchen	1.7. Acquisition of high performance kitchen equipment and adoption of more efficient behaviour.	• Citizens	2012	2020
Refrigerators and freezers	1.8. Acquisition of high performance refrigerators and freezers, and adoption of more efficient behaviour.	• Citizens	2012	2020
Laundry machines and dryers	1.9. Acquisition of high performance laundry machines and dryers, use of solar heated water and adoption of more efficient behaviour.	• Citizens	2012	2020
Dish washing machines	1.10. Acquisition of high performance dish washing machines, use of solar heated water and adoption of more efficient behaviour.	• Citizens	2012	2020
TV sets	1.11. Acquisition of televisions with less energy consumption and less use of stand-by mode.	• Citizens	2012	2020
Other electric appliances	1.12. 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]**
67 460	46 354	44 589

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, 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 • Municipalities	2012	2020

EXPECTED RESULTS IN 2020		
Energy savings [MWh/year]	Renewable energy increase [MWh/year]	Reduction of CO_2 emissions [ton/year]
2 913	2 261	1 674

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, 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, 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, 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, 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. Programme for energy efficiency in public services – substitution of existing lamps and lighting fixtures of low efficiency, installation of control and management systems.	• EEM • AREAM • Municipalities • IPM	2012	2020

EXPECTED RESULTS IN 2020		
Energy savings [MWh/year]	**Renewable energy increase [MWh/year]**	**Reduction of CO_2 emissions [ton/year]**
99 079	20 521	65 433

4.5. Transports

In the transport sector, which is the sector with the highest relative weight in the final energy demand, 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, the introduction of biofuels 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 – renewal of public transport fleets, with the introduction of more efficient technologies, vehicles of smaller capacity and electric vehicles, use of biofuels and adoption of more efficient driving habits.	• Companies	2012	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 • Municipalities	2012	2020
	4.3. Acquisition of electric vehicles and adoption of more efficient driving habits.	• Companies	2012	2020
Private transports	4.4. Acquisition of electric vehicles and adoption of more efficient driving habits.	• Citizens	2012	2020
	4.5. Use of public transport.	• Citizens	2012	2020

EXPECTED RESULTS IN 2020		
Energy savings [MWh/year]	Renewable energy increase [MWh/year]	Reduction of CO_2 emissions [ton/year]
157 959	5 106	41 061

4.6. Secondary energy production

The actions in the domain of secondary energy production refer essentially to electricity production, because heat production is of little significance. In the electricity production, in general, the actions aim for the introduction of natural gas, to substitute fueloil in thermal power production, the use of renewable energy and improvement of electrical grid efficiency.

Table 27: Actions for secondary energy production

Sectors and fields of action	Actions	Responsible for the implementation	Implementation schedule	
			Starting year	Ending year
Electricity (non-renewable)	5.1. Introduction of natural gas in thermal power generation (construction of natural gas terminal).	• EEM	2012	2016
Hydro	5.2. Increase water retention and water storage capacity and the power installed of hydroelectric plants and reversible hydroelectric plants.	• EEM	2012	2020
Wind	5.3. Installation of wind farms and micro-wind turbines in micro and mini production regimes.	• Companies • Citizens	2011	2020
Solar	5.4. Installation of solar photovoltaic parks and solar photovoltaic kits in micro and mini production regimes.	• Companies • Citizens	2011	2020

Geothermal	5.5. Installation of an induced geothermal pilot power plant.	• Companies	2018	2020
Ocean	5.6. Installation of wave energy power plants.	• Companies	2018	2020
Biomass	5.7. Installation of power plants for biomass from forest, agriculture and livestock farms.	• Companies	2013	2015
	5.8. Production of solid, liquefied and gaseous biofuels from plants, agricultural biomass, from livestock farms and selected waste.	• Companies	2015	2020
Distribution losses and self-consumption	5.9. Renewal of infrastructures and equipment of electricity transmission and distribution networks.	• EEM	2012	2020

EXPECTED RESULTS IN 2020		
Energy savings [MWh/year]	**Renewable energy increase [MWh/year**	**Reduction of CO_2 emissions [ton/year]**
31 542	422 946	296 509

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 • Municipalities	2012	2020
	6.2. Implementation of a sustainable energy action plan for all municipalities, in the scope of the Covenant of Mayors.	• Municipalities	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.	• Municipalities	2012	2015
	6.4 Installation of charging infrastructures for electric vehicles.	• EEM • Municipalities • Companies	2012	2020
Energy infrastructures planning	6.5. Installation of power stabilization systems to mitigate the disruptions in energy production from wind and solar photovoltaic in the electricity grid.	• EEM	2012	2015
	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
	6.7. Feasibility study on heat recovery from thermal power station in Victoria for hotels and industries, through a hot water network or through heat accumulation containers.	• EEM • AREAM	2012	2015

Renewable energy land use planning	6.8. 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
	6.9. 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 • Municipalities • 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, acquisition of goods and services.	• Regional Government • Municipalities • 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, acquisition of goods and services.	• Regional Government • Municipalities • 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 incentives	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, sustainable mobility and reduction of CO_2 emissions.	• IDE-RAM	2012	2020

	8.4. Financial incentive for residential promoters to implement voluntary of 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.	• Municipalities	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 • Municipalities • AREAM	2012	2020
	8.17. Preparation of a master plan for street lighting, to define efficiency and control requirements in new projects.	• EEM • Municipalities • 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, 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 Madeira 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 more than a hundred exercising their activity in Madeira 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 sustainable energy strategy 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

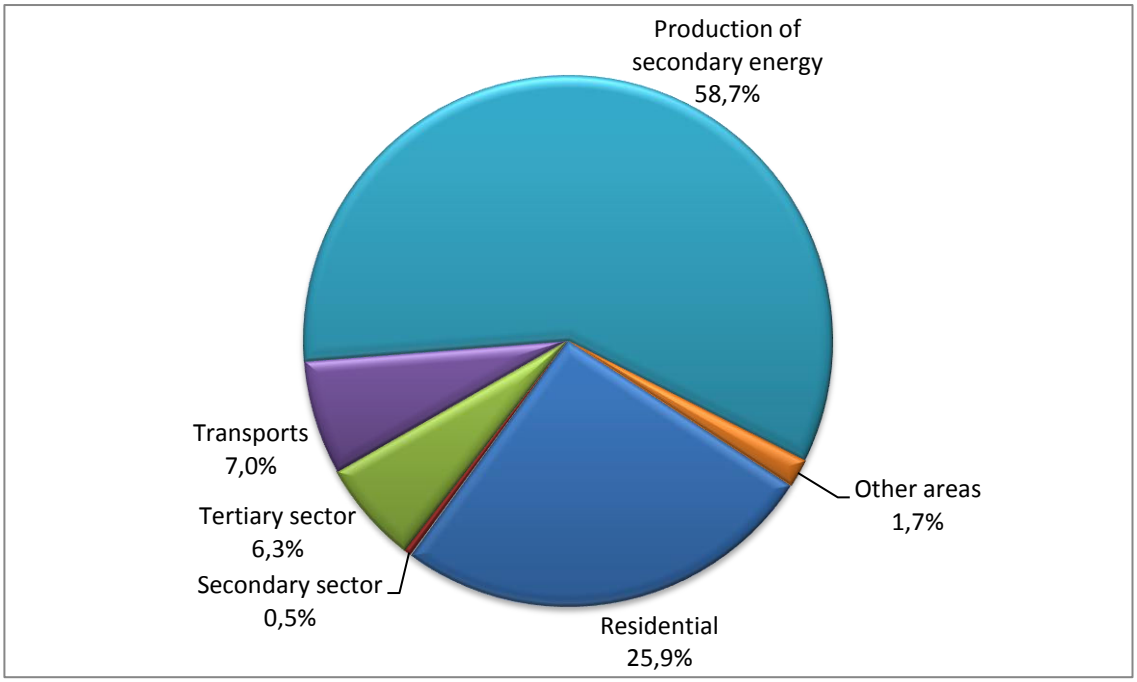
The overall investment foreseen to implement the Sustainable Energy Action Plan of Madeira Island is 884 million Euros, to be carried out until 2020. Around 60% to 65% of this investment will be for local human resources, income of companies located in the Region and tax revenue for Local and Regional Administration, while the remaining 35% to 40% 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]	Municipalities [Meuro]	Public companies [Meuro]	Private companies and organizations [Meuro]	Citizen [Meuro]	TOTAL [Meuro]
Residential					228,8	228,8
Primary sector						
Secondary sector		0,0	0,4	3,7		4,1
Tertiary sector	18,0	4,3		33,4		55,7
Transports	1,0	1,0	14,0	5,5	40,0	61,5
Production of secondary energy			270,0	242,9	5,6	518,5
Other areas	1,0	1,2	8,6	4,1	0,5	15,4
TOTAL	**20,0**	**6,6**	**293,0**	**289,5**	**274,9**	**884,0**

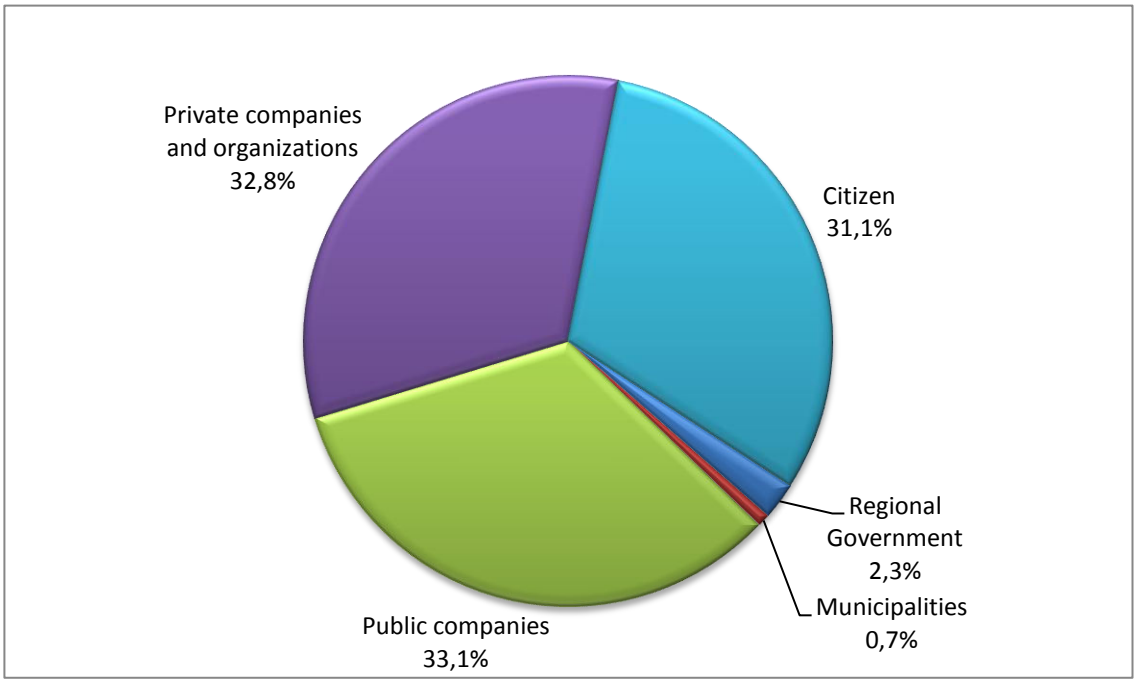
Figure 27: Breakdown of investments per sector and area of intervention



It is found that 58,7% of the investment for the implementation of the action plan is aimed at the secondary energy production sector, which includes fundamentally the introduction of natural gas, the use of renewable energy for electricity production and the improvement of electricity transport and distribution networks. In terms of investment volume, the residential and transport sectors follow suit.

Analysing the investments per promoter, 31,1% is carried out by the citizens in actions aimed mostly at the residential sector and at private transport, as well as micro-production of electricity. With 33,1%, are public companies, whose investments are aimed primarily to the provision of natural gas, electricity production, electricity network and public transport. Private companies and organizations, with 32,8%, 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 municipalities represent, respectively, 2,3% and 0,7% 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 meeting the objectives and targets set.

Figure 28: Breakdown of investments per promoter



15.1. 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.
Municipalities	• 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.

15.2. 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 Madeira Island.

PACT OF ISLANDS

www.islepact.eu

Regional Authority:

VICE-PRESIDÊNCIA
GOVERNO REGIONAL DA MADEIRA

Elaboration:

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Agência Regional da Energia e Ambiente da Região Autónoma da Madeira

D.R.C.I.E.
Direcção Regional do Comércio, Indústria e Energia

Electricidade da Madeira

Financing:

EUROPEAN COMMISSION
Directorate-General for Energy

Electricidade da Madeira

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