

ISLAND SUSTAINABLE ENERGY ACTION PLAN

ISLAND OF LESVOS

Date

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Executive summary

The Municipality of Lesvos by signing the Pact of Islands takes action towards sustainable development and the fight against climate change at local level. Together with other Greek and European islands commits to meet the targets set by the European Union for the reduction of greenhouse gas emissions.

The long-term vision of the local authorities is to succeed into restricting the rapidly increasing CO₂ emissions of the island by introducing the maximum amount of renewable energy sources in the energy production and demand side and by promoting the adoption of energy saving and efficiency in all activity sectors.

Objectives and Targets

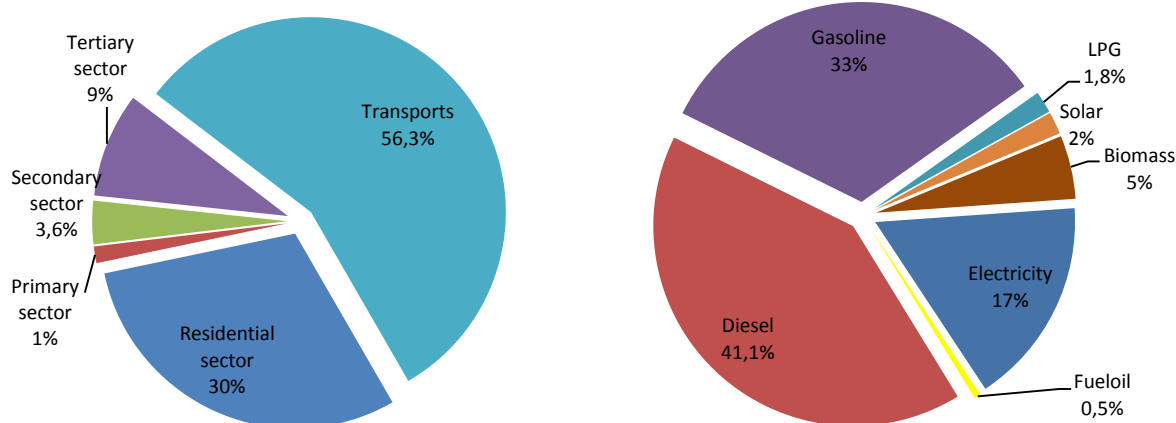
The Municipality of Lesvos has developed different sustainable energy action plans, for each one of the islands under its administration, highlighting the special needs and potentials of each island. Individual priorities and targets are set for each island. The present action plan concerns the island of Lesvos and sets clear and ambitious objectives and targets concerning the island's local energy policy.

The objectives set for the target year 2020 focus on increasing the island's energy supply security, reducing its dependence on fuel imports and finally reducing the island's energy and CO₂ emissions footprint.

Specifically, the targets set for 2020 focus on reducing by 39% the primary energy demand and by 56% the CO₂ emissions in comparison to the projections of the business as usual scenario, meeting the 19% of the primary energy demand and the 45% of the electricity demand by the use of local renewable energy sources.

Energy balance and CO₂ emissions in the base year

The year 2005 was selected as base year for the energy planning process of Lesvos' ISEAP, following the EU targets set for fighting climate change. In the following figures Lesvos' energy profile for the year 2005 is shown. The strong dependence on fossil fuels is apparent.



Main fields of action

A wide range of actions is included in the action plan dealing with all the major activity sectors of the island. The selection of actions was carried out after considering several alternative scenarios with the scope to maximize the emissions reduction target with the minimum cost in the given time framework considering also the lately formulated national and local economic conditions.

Coordination structure

A two level coordination and organizational structure is decided in order to ensure the efficient implementation of the ISEAP. The steering committee on the one hand will take over the coordination during the ISEAP's different phases while on the other hand the work group will mainly focus on the realization of the actions, the monitoring of the ISEAP and the possible updating of the ISEAP contents.

Budget and Financing

The budget will be finalized upon the final approval of the ISEAP.

Securing the necessary financing sources and instruments for the successful implementation of the ISEAP will be one of the major challenges for the Municipality. The allocation of Municipal and Regional budget combined with loans, revolving funds, citizens cooperatives, third party financing, private investments and public and private sector partnerships are some of the financing schemes to be used for the realization of the ISEAP.

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1. CONTEXT

1.1. Geography and territory

Lesvos is the third biggest Greek island, located to the northeast of the Aegean Sea, very close to the Minor Asia (Anatolia) coastline. It covers an area of 1.636 km². The coastline of Lesvos is 370 km long. It is 190nm away from the port of Pireaus and together with the island of Lemnos and Agios Eftraios consist the Lesvos county with capital town Mytilini, capital also of Lesvos. Mytilini is also hosting the Region of North Aegean and the General Secretariat of Aegean and Islands Policy. Mytilini is also hosting the chair of the University of Aegean with departments distributed among other Aegean islands.

The shape of the island is triangular characterized by the two deep gulfs on the south coastline, gulf of Kalloni (southwest) and Gera (southwest), important ecosystems with great cultural and economic history for the whole of the island.

The island is mainly mountainous and semi-mountainous with three main mountain ranges, on the southeast mountain Olympos (967m), on the north mountain Lepetymnos (968m) and on the west mountain Ordymnos (589m). The two thirds of the island is volcanic, with apparent volcanic formations (petrified tree trunks) still apparent in the western part of the island, where the petrified forest of Sigri is situated, a world natural and cultural heritage. Cultivated areas are formulated close to the coastlines with the Kalloni, Gera and Polichnitos areas being the most significant ones, all of them surrounding the two main gulfs of the island.

Except of the western part of the island, where the grounds are rather dry with low and sparse vegetation the rest of the island is characterized by dense and rich forests. A beautiful forest of chestnut and maple trees covers the area around the mountain Olympos in the south, while dense pine tree forestry covers the center part of the island. However, the olive tree is considered the most representative vegetation of the island covering several parts of the island, creating a long history of olive oil and byproducts production for the inhabitants.

Several fresh water and hot springs can be found around the island, providing sufficient water both for irrigation and drinking purposes. The hot springs are very popular among locals and visitors for their therapeutic properties. These springs are also a visible indication of the very rich geothermal fields of the island that can be found in different locations and in the future are also expected to contribute the island's energy balance.

There are about 85.333 people (estimation of 2011 census) living in Lesvos today. About a third of the population lives in Mytilini; while the rest inhabit 75 villages varying in size and spread around the island, which remain inhabited the whole year.

Their main source of income is commerce, especially food production activities, different kinds of services but also agriculture, animal farming and fishing. Also in the last 20 years

the island had a significant touristic development; however, it is considered a mild destination with a short touristic period.

In terms of infrastructure, road network is quite extensive because of the large area of the island, though not always in very good condition. There are problems with the local land transportation and the connection with the port of Piraeus, because of limited services.

The following table presents the land use as percentage of the total area of the island.

Area under cultivation and fallow land	Pastures	Forests	Area under water	Areas occupied by the locality (buildings, roads, etc)	Other areas
41,4%	20,8%	35,1%	0,4%	1,1%	1,2%

Table 1.1. Land use



Figure 1.1. The Island of Lesbos

1.2. Demography

Regarding the variation in the population of Lesvos, the last decades is observed a variation in the population, while the estimation of the 2011 census predicts a new decrease in the population of about 9,4% reaching 85.330 inhabitants.

Year	Population	Growth rate
1981	108.840	-
1991	90.790	-16,6%
2001	94.283	+3,8%

Table 1.2. Population evolution (source: EL.STAT)

1.3. Economy

The tertiary sector is the most important for the local economy. Activities related to commerce, tourism, public and private services are the most representative examples.

The secondary sector follows mainly related to food and beverage industry and constructions. Lesvos is well-known for the existence of several local cooperatives in most of the islands dealing with the production of local food products but also cultural objects and decorates from women cooperatives (ceramic pots, baskets, wood-sculptures, etc.)

Finally, the primary sector has a small contribution to the local economy providing the primary sources to the food industry for the productio of local products, like olive oil and by-products, preserved fish, cheese, local pasta, sweets and other.

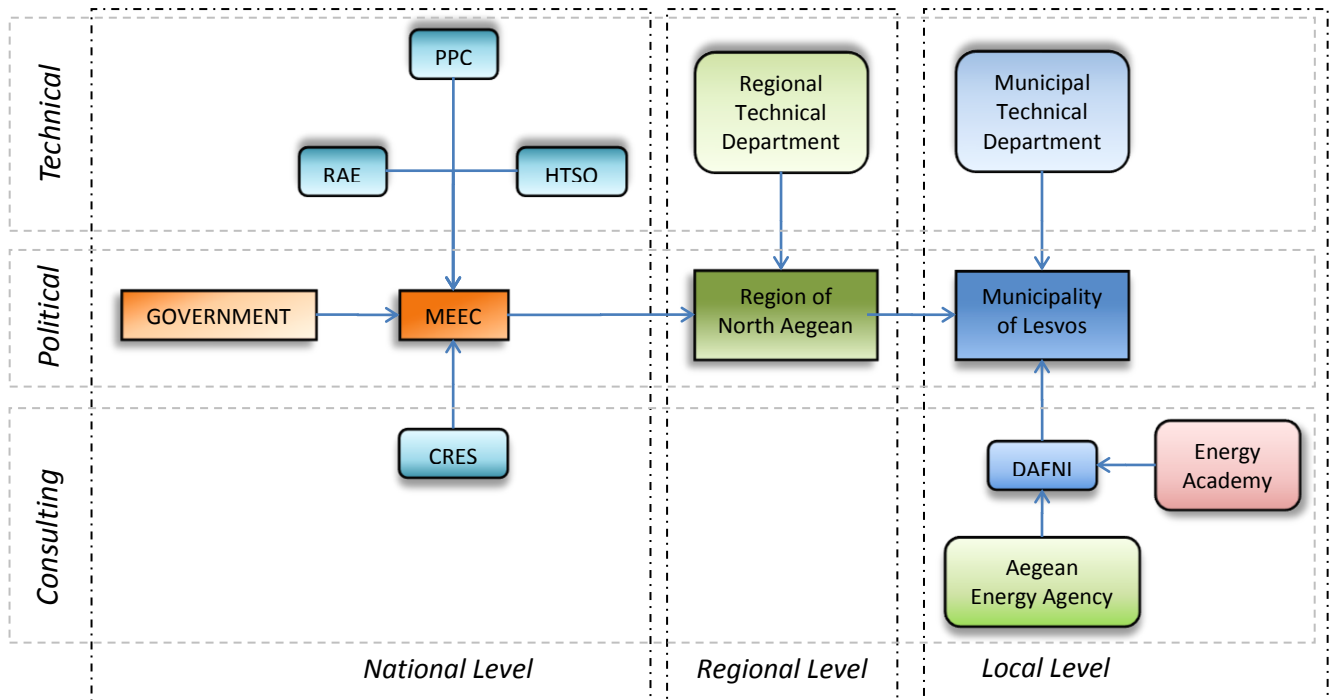
Activity Sectors	Percentage (%)
Primary	4,6
Secondary	12,0
Tertiary	83,4

Table 1.3. Occupational Data per activity sector

1.4. Political and administrative structures

Lesvos belongs to the Region of North Aegean and with the late administrative reformation the thirteen (13) former municipalities consolidated into the Municipaity of Lesvos.

The political and administrative organisational structure of Lesvos island in relation to the energy field and sustainable development is presented in the following diagram.



PPC: Public Power Corporation

RAE: Regularity Authority for Energy

HTSO: Hellenic Transmission System Operator S.A.

MEECC: Ministry of Environment Energy & Climate Change

CRES: Centre for Renewable Energy Sources

DAFNI: Network of Aegean Islands for Sustainability

2. OVERALL STRATEGY

2.1. Current framework and vision for the future

Lesvos island is the commercial and administrative centre for the north Aegean area. However, Lesvos is also a popular touristic destination and as a result the population of the island is increasing during summertime when tourists and people with origins from the island arrive.

The permanent population of the island although decreased the last decade is expected to rise again by 10% in 2020, resulting also to increasing energy demand. According to the business as usual scenario the CO₂ emissions for the island of Lesvos are expected to increase by 57% until 2020 in comparison to 2005 levels.

Lesvos is electrically autonomous with a thermal power station installed on the island, using diesel and fuel oil as primary energy source. Also, large amounts of fossil fuels are imported to the island through boat transfers to cover mainly the demand of the transport and heating sectors. In present small wind farms and PV stations are installed also on the island. However, the island still relies greatly to energy imports.

Furthermore, the last years the need for extension of the existing thermal station and moving to a new area, away from the town of Mytilini, has caused several disputes among locals in the process of finding an adequate new location. The alternative to maximize the penetration of renewables to the electrical system in order to avoid a new large thermal station gains significant support among the local citizens and stakeholders.

In this sense, the Municipality of Lesvos aims to reduce the dependence of the island from energy imports by promoting the local energy production through small and medium scale RES installations with the expectation to cover 17% of the island's primary energy demand in 2020. In addition to that in order to increase the energy security of the island and reduce the per capita cost of energy and energy footprint demand side management actions will be promote and implemented by the municipality setting an example of effective energy saving and increased energy efficiency.

2.2. Objectives and targets

In December 2008 the EU adopted an integrated energy and climate change policy, including ambitious targets¹ for 2020. It hopes to set Europe on the right track - towards a sustainable future with a low-carbon, energy-efficient economy by:

- cutting greenhouse gases by 20% (30% if international agreement is reached)
- reducing energy consumption by 20% through increased energy efficiency

¹ The targets refer to accumulated result among the whole of EU. However, the targets differ among the Member States.

- meeting 20% of our energy needs from renewable sources.

Greece as an EU Member State must comply with the EU policy. The targets on national level are translated into 4% reduction of greenhouse gases according to 2005 levels and 18% penetration of renewable energy sources into the gross energy consumption

The Municipality of Lesvos by signing the Pact of Islands and developing a concrete ISEAP commits to take actions on local level towards sustainability.

The objectives set for 2020 focus on:

- a. Increasing energy supply security
- b. Reducing dependence on energy imports
- c. Reducing the island's energy and CO₂ emissions footprint

The targets set for 2020 focus on:

- a. Reducing by 39% the primary energy demand in comparison to the BAU scenario
- b. Reducing by 56% the CO₂ emissions in comparison to the BAU scenario
- c. Reducing by 14% the CO₂ emissions in comparison to 2005 levels, going beyond the national targets and reaching the average target for the whole EU
- d. Meeting the 19% of the primary energy demand by renewable energy sources
- e. Meeting the 45% of the electricity demand by the use of local renewable energy sources

2.3. Strategic guidelines

The ISEAP strategic guidelines to achieve the objectives and targets set by the Municipality of Lesvos can be summarized in the following five (5) points:

1. Take advantage of the local renewable energy sources for electricity and heat production
2. Substitute fossil fuels with electricity to be produced locally from RES installations
3. Implement actions towards sustainability by the Municipality to set an example for the rest of the island
4. Increase energy efficiency and responsible energy saving behaviours from the end users to reduce the energy imports
5. Involve the visitors of the island to the realization of the ISEAP

3. ENERGY BALANCE AND EMISSION INVENTORY

3.1. Baseline situation

The year 2005 is chosen as the baseline year. In order to carry on with the energy modelling of the Business As Usual (BAU) and ISEAP scenarios a detailed, accurate and concrete description of the baseline situation is needed.

A bottom-up calculation approach was adopted making use of the in-house modelling tools to calculate the energy profile of the island. Several input data were employed either as a direct information of energy amounts (i.e. final energy demand of the sectors solely related to the municipality, fuel mix for the electricity production, etc.) or indirect statistical and general information supplied to the modelling tools (i.e. energy demand profile of different consumers, typical efficiency of technologies in use, etc.). For this purpose several questionnaires and energy audits were circulated to the different demand and production sectors with the active participation of the local authorities and dedicated working groups. Especially, it should be pointed out that information related to the energy behaviour and demand profile of the residential sector was gathered through an extensive collaboration with the local schools. The students circulated energy audits to their parents' and neighbouring houses collecting valuable information for the ISEAP and becoming active participants to the ISEAP development. Climate change, renewable energy sources, energy efficiency and energy saving were some of the subjects that the students got affiliated through this process.

Energy data related solely to the municipality (municipal buildings, public lighting, municipal equipment and facilities, etc.) were gathered in a consistent way creating an energy data base for the past years, starting from 2005, supplied from the energy bills stored in the municipal records. The foundations for the monitoring of the municipal energy profile were set providing to the municipality a substantial long-term insight to their energy demands and costs.

The information gathered in present time were projected back to 2005 taking into consideration the recorded demand growth rates of the last years. However, in many cases energy data depicting the values of 2005 were directly available.

3.1.1. Final energy demand

Residential sector

In the following table the results of the energy modelling of the base year are presented for the residential sector. The energy carriers most in use in the domestic sector are electricity and diesel with the latter one mainly covering the space heating needs of the houses. LPG is mainly used for heating and cooking purposes, similarly with biomass which translated to simple firewood burnt in most cases in open fireplaces. Finally solar

energy is solely attributed to water heating demand through the solar water heater appliances.

	Electricity	Diesel	LPG	Solar	Biomass	Total
Residential	145.544	231.265	27.504	24.036	62.361	490.709
Hot water	28.487	23.235	0	24.036	7.211	82.968
Heating and cooling	31.872	208.030	17.580	0	46.880	304.362
Lighting	23.667	0	0	0	0	23.667
Cooking	16.540	0	9.924	0	8.270	34.733
Refrigerator and freezers	23.213	0	0	0	0	23.213
Laundry machines and dryers	1.413	0	0	0	0	1.413
Dish washing	1.978	0	0	0	0	1.978
Tv sets	1.838	0	0	0	0	1.838
Other electric appliances	16.537	0	0	0	0	16.537

Table 3.1. Final energy demand of the residential sector in base year 2005 [MWh]

In the following figures the distribution of final energy demand of the residential sector among the different sub-sectors (see Figure 3.1) and energy carriers (see Figure 3.2) is presented. The heating and cooling sub-sector is by far the most energy demanding area followed by the hot water demand. Also the energy demand distribution to the different energy carriers of the main sub-sectors is depicted in Figure 3.3 and Figure 3.4 and Figure 3.5.

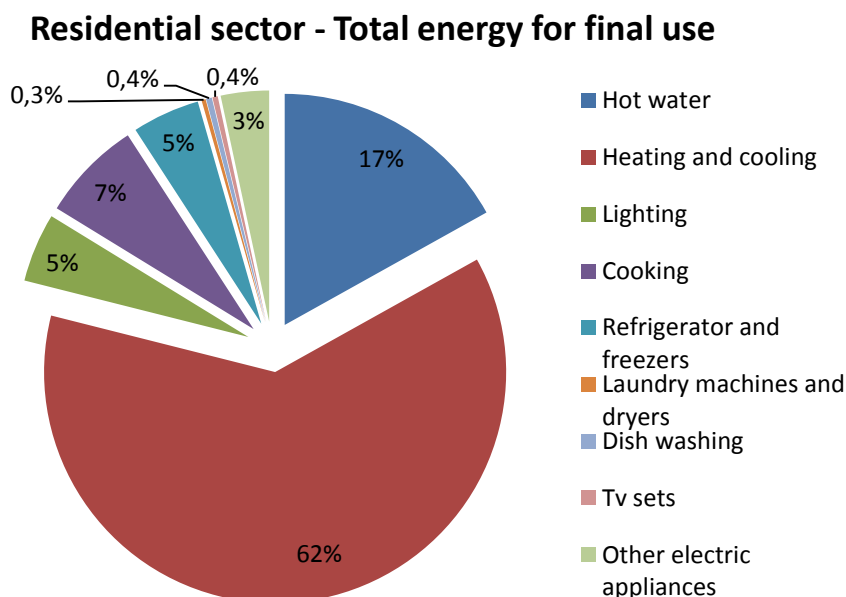


Figure 3.1. Distribution of residential final energy demand among the different sub-sectors

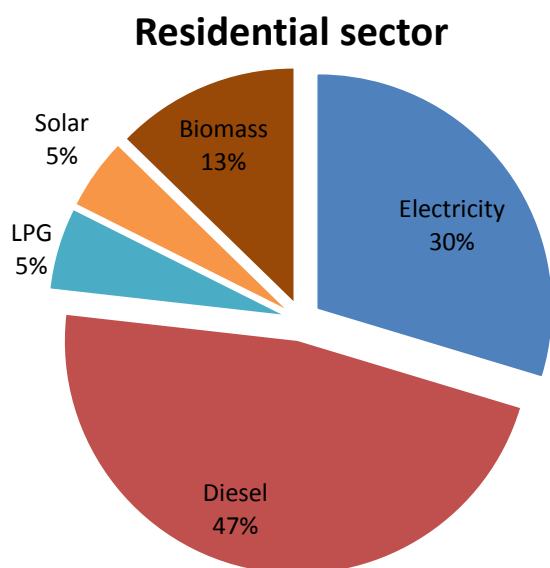


Figure 3.2. Distribution of the residential sector FED to the different energy carriers

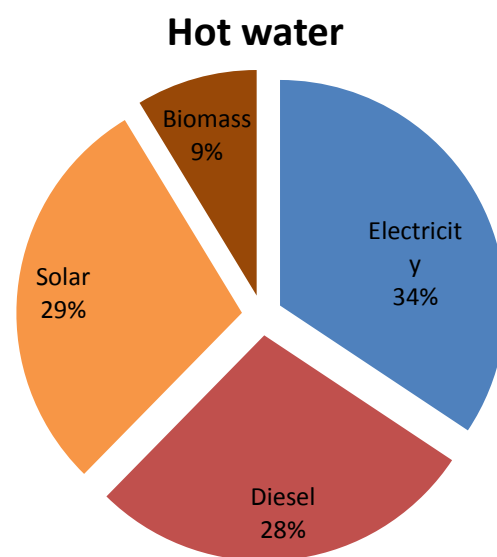


Figure 3.3. Distribution of hot water energy demand to the different energy carriers

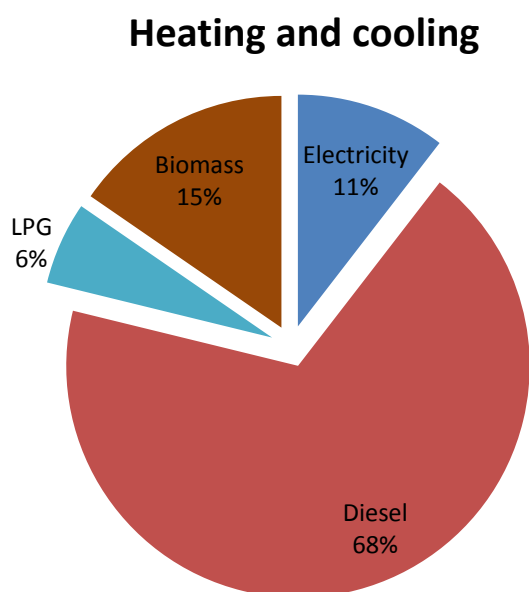


Figure 3.4. Distribution of heating and cooling energy demand to the different energy carriers

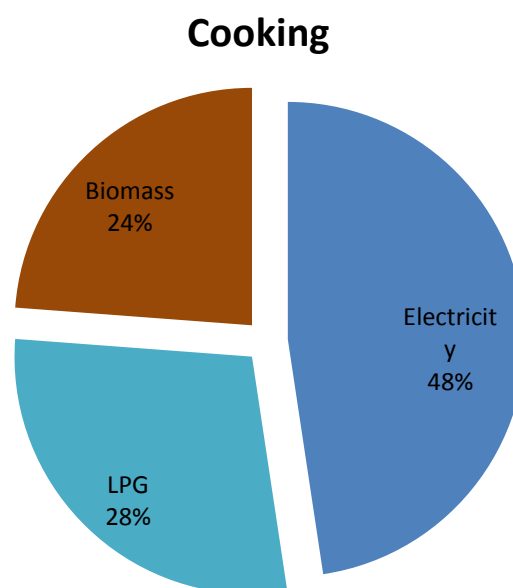


Figure 3.5. Distribution of cooking energy demand to the different energy carriers

Primary sector

In the following table the results of the energy modelling of the base year are presented for the primary sector corresponding mainly to the energy demand of the agricultural and partially fishing activities. The energy carriers most in use are electricity, diesel and biomass covering the energy needs for irrigation, heating and cooling, lighting and operation of general instruments and equipment.

In the figure, following the table, a graphical analysis of the primary sector energy demand distribution to respective energy carriers is shown.

	Electricity	Diesel	Biomass	Total
Primary sector	16.242	2.940	3.357	22.540
Agriculture, forestry and fishing	16.242	2.940	3.357	22.540

Table 3.2. Final energy demand of the primary sector in base year 2005 [MWh]

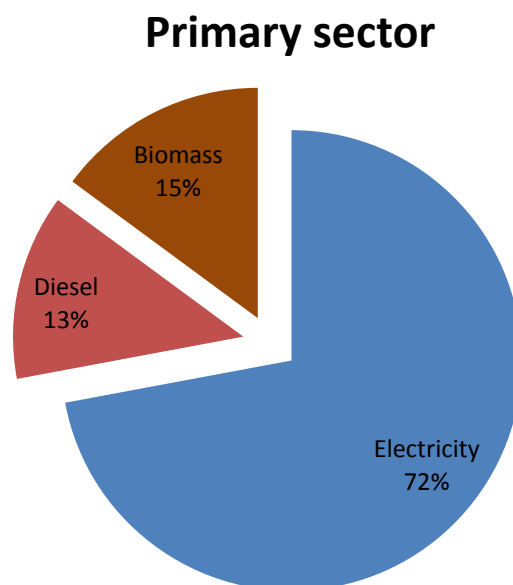


Figure 3.6. Distribution of the primary sector FED to the different energy carriers

Secondary sector

In the following table the results of the energy modelling of the base year are presented for the secondary sector. The energy carriers most in use are electricity, diesel and fueloil.

The manufacturing and construction sub-sectors are the most energy demanding areas of the secondary sector, in Figure 3.9 and Figure 3.10, the energy demand distribution to the respective energy carriers is shown.

	Electricity	Fueloil	Diesel	LPG	Solar	Biomass	Total
Secondary sector	21.668	8.621	9.011	910	512	17.880	58.601
Manufacturing	11.573	6.466	6.758	910	512	17.880	44.098
Water supply, sewerage, waste management and remediation activities	6.238	0	0	0	0	0	6.238
Construction	3.858	2.155	2.253	0	0	0	8.266

Table 3.3. Final energy demand of the secondary sector in base year 2005 [MWh]

Secondary sector

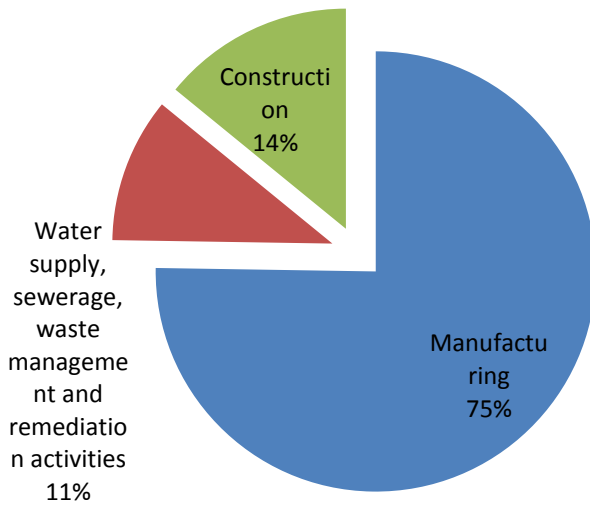


Figure 3.7. Distribution of the secondary sector FED to the different sub-sectors

Secondary sector

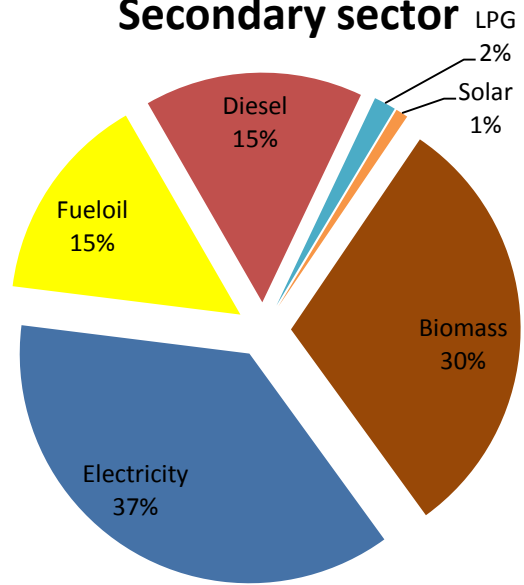


Figure 3.8. Distribution of the secondary sector FED to the different energy carriers

Manufacturing

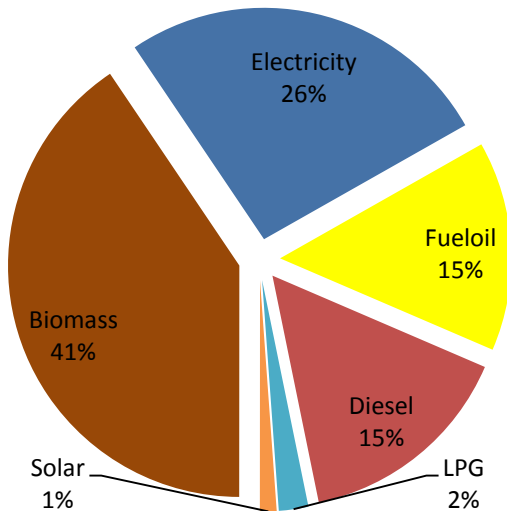


Figure 3.9. Distribution of manufacturing sector energy demand to the different energy carriers

Construction

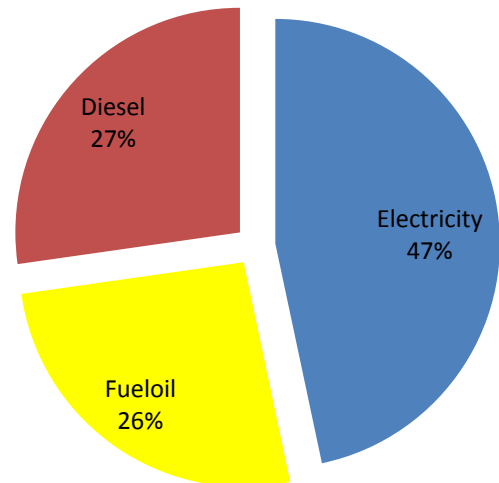


Figure 3.10. Distribution of construction sector energy demand to the different energy carriers

Tertiary sector

In the following table the results of the energy modelling of the base year are presented for the tertiary sector. The energy carriers most in use in the tertiary sector are by far electricity followed by diesel. LPG and biomass (in the form of charcoal) are mainly used in restaurants for cooking purposes, whereas solar energy is solely attributed to water heating demand mainly in hotels.

In the following figures the distribution of final energy demand of the tertiary sector among the different sub-sectors (see Figure 3.11) and the energy demand distribution to the different energy carriers of the main sub-sectors (see Figure 3.13 – Figure 3.17) are depicted.

	Electricity	Diesel	LPG	Solar	Biomass	Total
Tertiary sector	91.115	45.243	385	4.892	286	141.921
Wholesale and retail trade; repair of motor vehicles and motorcycles	29.460	17.664	0	1.496	0	48.620
Accommodation and food service activities	17.497	8.319	385	2.649	286	29.135
General public administration and social security	13.400	3.069	0	0	0	16.470
Education	7.703	6.116	0	0	0	13.820
Human health and social work activities	1.453	1.242	0	0	0	2.696
Other services	14.730	8.832	0	748	0	24.310
Public lighting	6.871	0	0	0	0	6.871

Table 3.4. Final energy demand of the tertiary sector in base year 2005 [MWh]

Tertiary sector

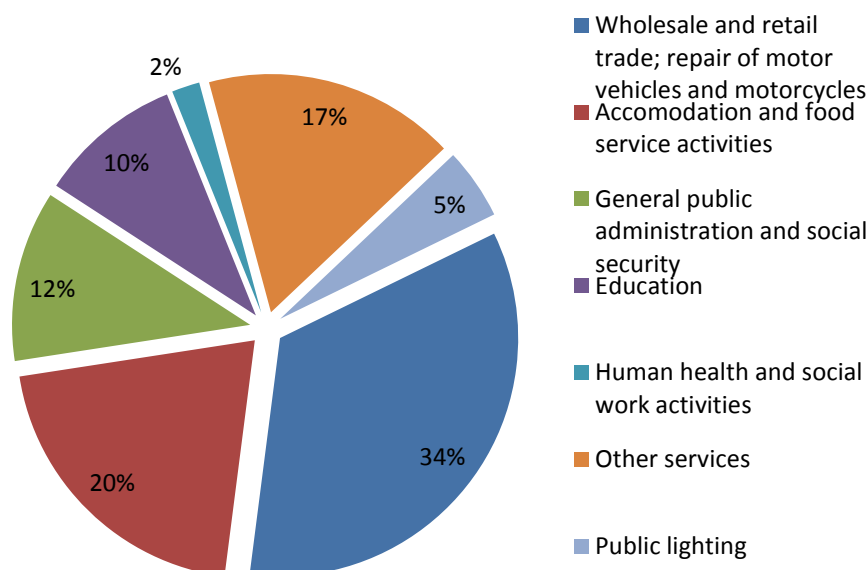


Figure 3.11. Distribution of the tertiary sector FED to the different sub-sectors

Tertiary sector

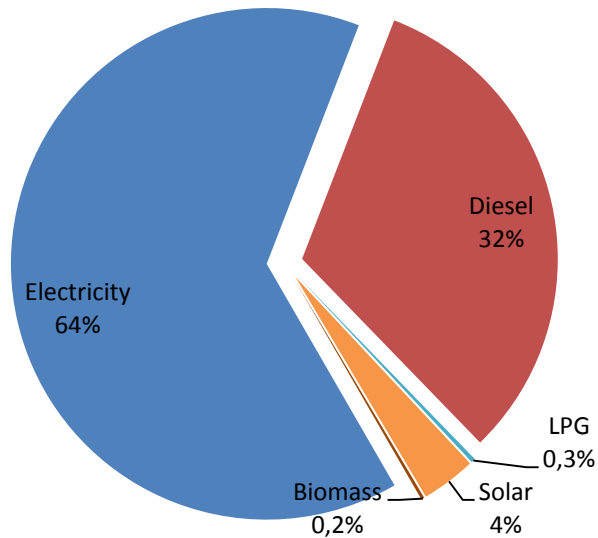


Figure 3.12. Distribution of the tertiary sector FED to the different energy carriers

Wholesale and retail trade

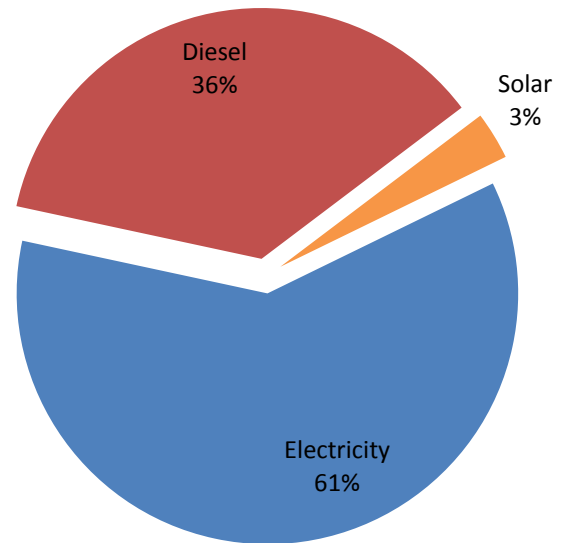


Figure 3.13. Distribution of wholesale and retail trade sector energy demand to the different energy carriers

Accommodation and food service activities

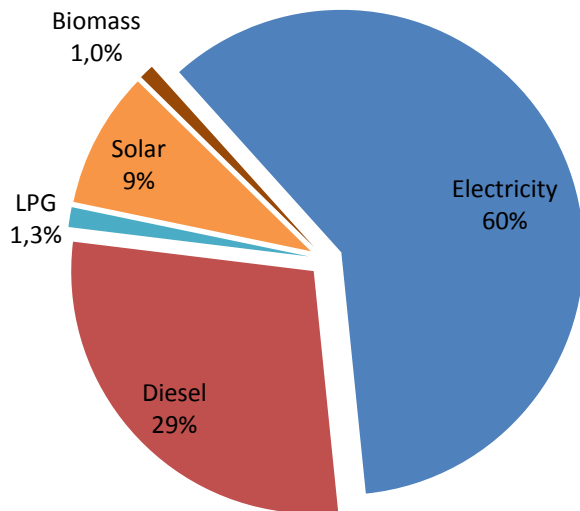


Figure 3.14. Distribution of accommodation and food service activities sector energy demand to the different energy carriers

General public administration and social security

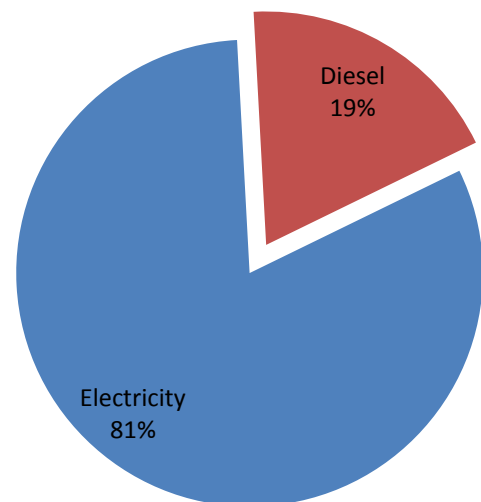


Figure 3.15. Distribution of general public administration and social security sector energy demand to the different energy carriers

Human health and social work activities

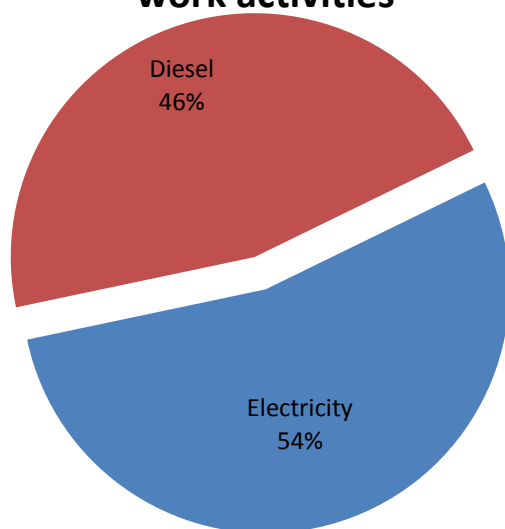


Figure 3.16. Distribution of human health and social work activities sector energy demand to the different energy carriers

Education

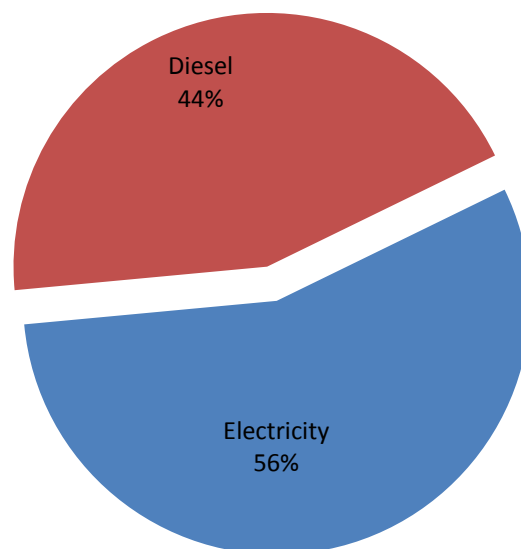


Figure 3.17. Distribution of education sector energy demand to the different energy carriers

Transports sector

In the following table the results of the energy modelling of the base year are presented for the transports sector.

In the following figures the distribution of final energy demand of the transports sector among the different sub-sectors (see Figure 3.18) and the energy demand distribution to the different energy carriers of (see Figure 3.19) are depicted.

	Diesel	Gasoline	Total
Transports (vehicles)	382.505	536.627	919.132
Passenger transport by road (public transport, taxi, tourism, transfers, etc.)	2.426	559	2.985
Freight transport by road and removal services	295.297	68.090	363.388
Other fleet for public and private services	1.249	11.980	13.230
Private transports	83.532	455.997	539.530

Table 3.5. Final energy demand of the transports sector in base year 2005 [MWh]

Transports (vehicles)

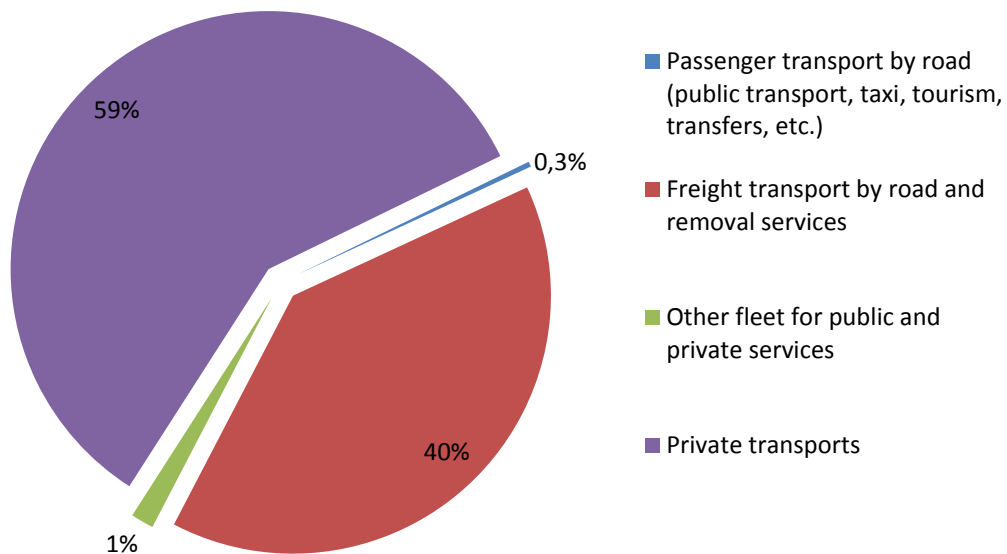


Figure 3.18. Distribution of the transports sector FED to the different sub-sectors

Transports (vehicles)

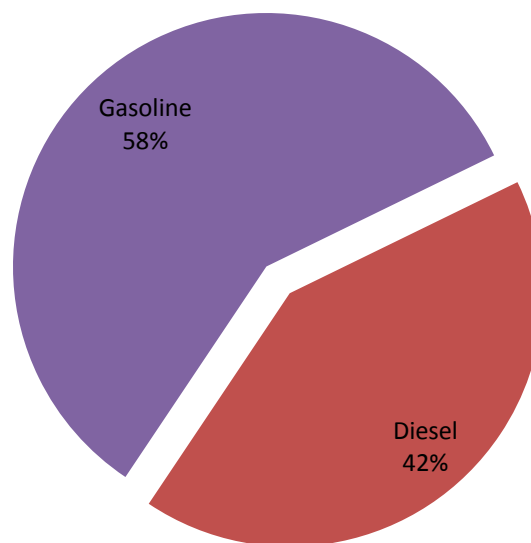


Figure 3.19. Distribution of the tertiary sector FED to the different energy carriers

Overall results

In the following table the overall results of the energy modelling of the base year are presented for the total final energy demand.

In the following figures the distribution of total final energy demand among the different sectors (see Figure 3.20) and the energy demand distribution to the different energy carriers of (see Figure 3.21) are depicted.

Energy carrier		Residential [MWh]	Primary sector [MWh]	Secondary sector [MWh]	Tertiary sector [MWh]	Transports [MWh]	TOTAL [MWh]
Centralized Energy services	Electricity	145.544	16.242	21.668	91.115		274.569
Fossil fuels	Fueloil			8.621			8.621
	Diesel	231.265	2.940	9.011	45.243	382.505	670.964
	Gasoline					536.627	536.627
	LPG	27.504		910	385		28.798
Renewable Energy sources	Solar	24.036		512	4.892		29.440
	Biomass	62.361	3.357	17.880	286		83.883
TOTAL		490.709	22.540	58.601	141.921	919.132	1.632.903

Table 3.6. Final energy demand per sector and energy carrier

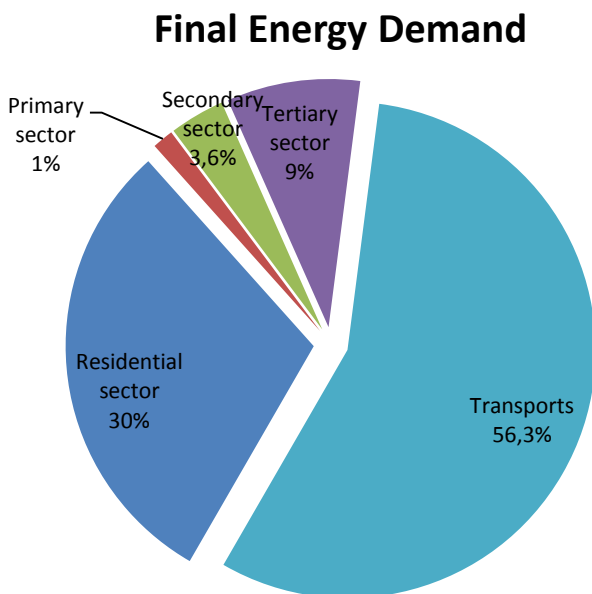


Figure 3.20. Distribution of Final Energy Demand to the different sectors

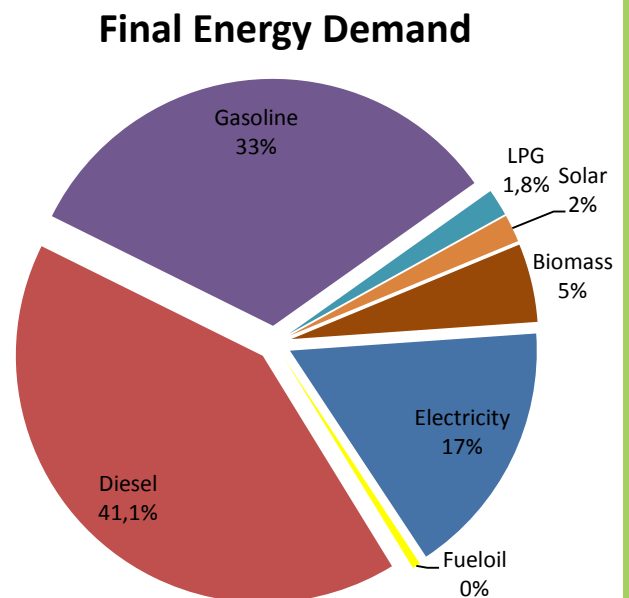


Figure 3.21. Distribution of Final Energy Demand to the different energy carriers

3.1.2. Energy conversion

Lesvos as an electrically autonomous island produces most of the electricity from the local thermal station using solely diesel and fuel oil as primary energy source. A 12% of the electricity is supplied from the installed wind farms.

There are no district heating or cooling installations.

In the following figure the electricity demand distribution to the different energy carriers is presented.

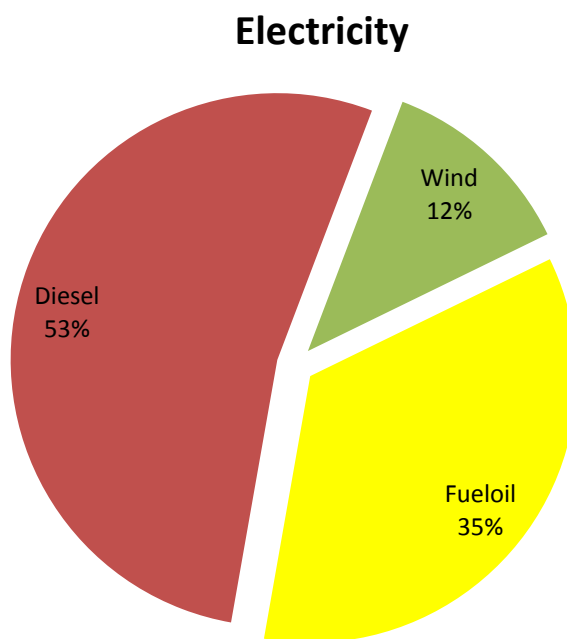


Figure 3.22. Distribution of Final Energy Demand to the different energy carriers

3.1.3. Primary energy demand

Only a fraction of 7% of the primary energy demand is covered by renewable energy sources and the remaining amounts are met through fossil fuel local consumption, with diesel being the dominant fossil fuel mainly because of the electricity and heating energy demand.

PRIMARY ENERGY DEMAND					
Fossil fuels [MWh]					TOTAL
Fueloil	Diesel	Gasoline	LPG	Sub-total	2,117,791
296,919	1,107,529	536,627	28,798	1,969,873	
Renewable energy sources [MWh]					2,117,791
Hydro	Wind	Solar	Biomass	Sub-total	
0	34,596	29,440	83,883	147,919	

Table 3.7. Primary energy demand per energy carrier [MWh]

PRIMARY ENERGY DEMAND

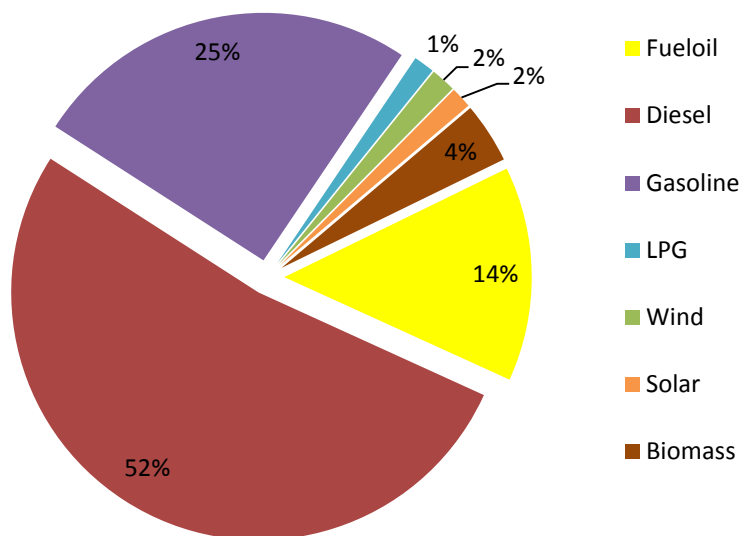


Figure 3.23. Primary energy demand distribution to the different energy carriers

3.1.4. Emissions of carbon dioxide

In the following tables and figures the emitted CO₂ from the locally consumed fossil fuels and the electricity imported are presented. For the latter amounts, the national CO₂ factor for electricity production is employed whereas generally for CO₂ emissions generated by fossil fuels consumption the proposed CO₂ factors from IPCC are used.

ENERGY FOR FINAL USE

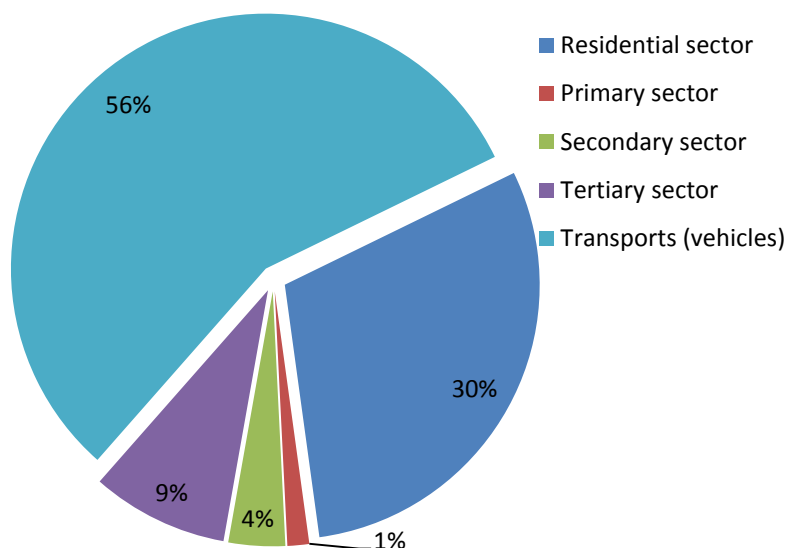


Figure 3.24. Distribution of overall CO₂ emissions from final use to the different sectors

Residential sector

	Electricity	Diesel	LPG	Total
Residential sector	104.425	61.748	6.601	172.774
Hot water	20.439	6.204	0	26.642
Heating and cooling	22.867	55.544	4.219	82.631
Lighting	16.981	0	0	16.981
Cooking	11.867	0	2.382	14.248
Refrigerator and freezers	16.655	0	0	16.655
Laundry machines and dryers	1.014	0	0	1.014
Dish washing	1.419	0	0	1.419
Tv sets	1.319	0	0	1.319
Other electric appliances	11.865	0	0	11.865

Table 3.8. CO2 emissions of the residential sector per sub-sector and energy carrier [tons]

CO2 emissions - Residential sector

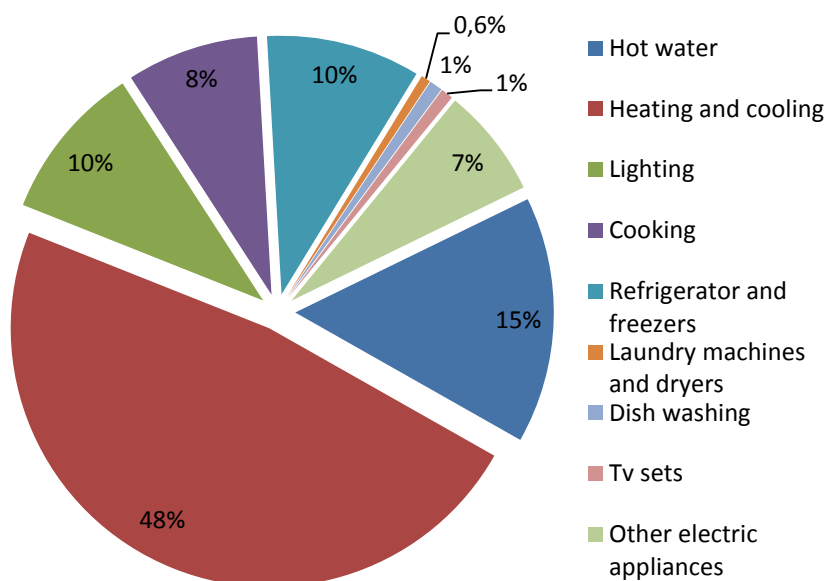


Figure 3.25. CO2 emissions from final use in the residential sector

Primary sector

	Electricity	Diesel	Total
Primary sector	11.653	785	12.439
Agriculture, forestry and fishing	11.653	785	12.439

Table 3.9. CO2 emissions of the primary sector per sub-sector and energy carrier [tons]

Secondary sector

	Electricity	Fueloil	Diesel	LPG	Total
Secondary sector	15.546	2.405	2.406	218	20.576
Manufacturing	8.303	1.804	1.804	218	12.130
Water supply, sewerage, waste management and remediation activities	4.475	0	0	0	4.475
Construction	2.768	601	601	0	3.971

Table 3.10. CO2 emissions of the secondary sector per sub-sector and energy carrier [tons]

CO2 emissions - Secondary sector

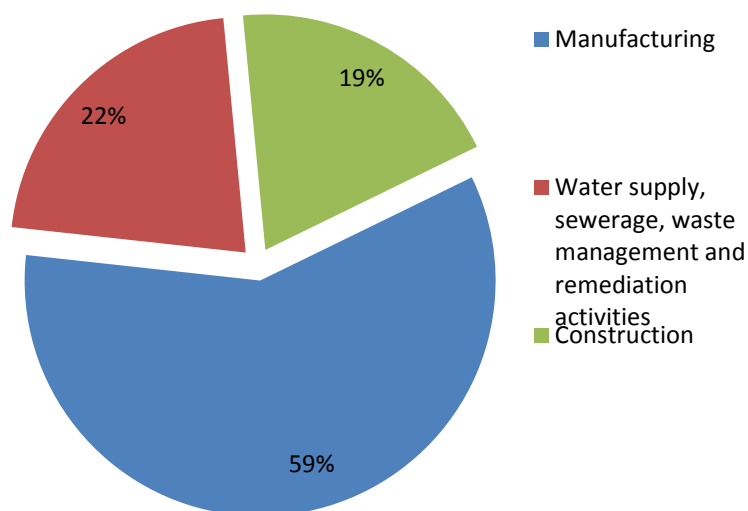


Figure 3.26. CO2 emissions from final use in the secondary sector

Tertiary sector

	Electricity	Diesel	LPG	Total
Tertiary sector	65.373	12.080	92	77.545
Wholesale and retail trade; repair of motor vehicles and motorcycles	21.137	4.716	0	25.853
Accommodation and food service activities	12.553	2.221	92	14.867
General public administration and social security	9.614	820	0	10.434
Education	0	0	0	0
Human health and social work activities	5.527	1.633	0	7.160
Other services	1.043	332	0	1.374
Public lighting	10.569	2.358	0	12.927

Table 3.11. CO2 emissions of the tertiary sector per sub-sector and energy carrier [tons]

CO2 emissions - Tertiary sector

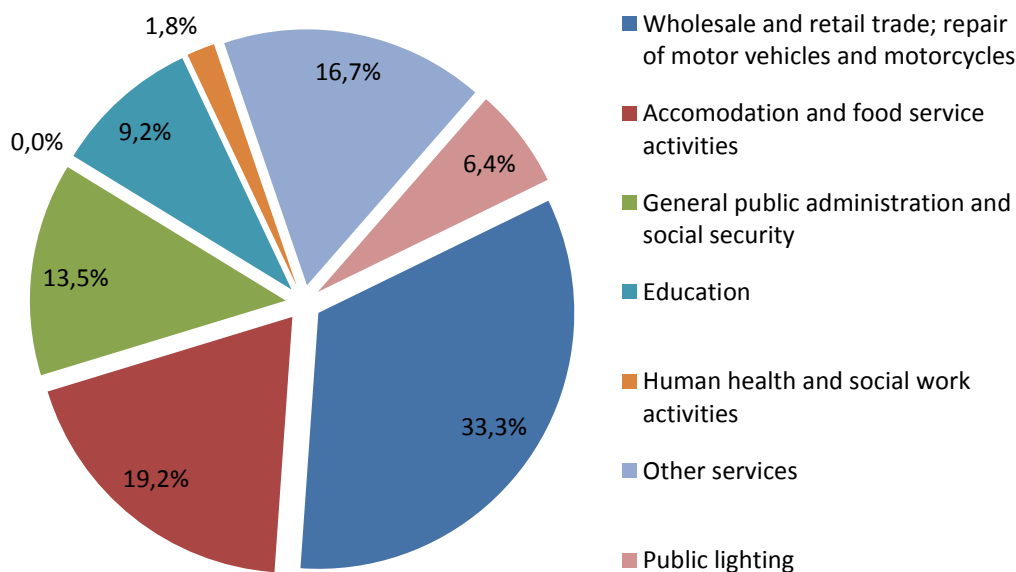


Figure 3.27. CO2 emissions from final use in the tertiary sector

Transports sector

	Diesel	Gasoline	Total
Transports (vehicles)	102.129	133.620	235.749
Passenger transport by road (public transport, taxi, tourism, transfers, etc.)	648	139	787
Freight transport by road and removal services	78.844	16.955	95.799
Other fleet for public and private services	334	2.983	3.317
Private transports	22.303	113.543	135.846

Table 3.12. CO2 emissions of the transports sector per sub-sector and energy carrier [tons]

CO2 emissions - Transports (vehicles)

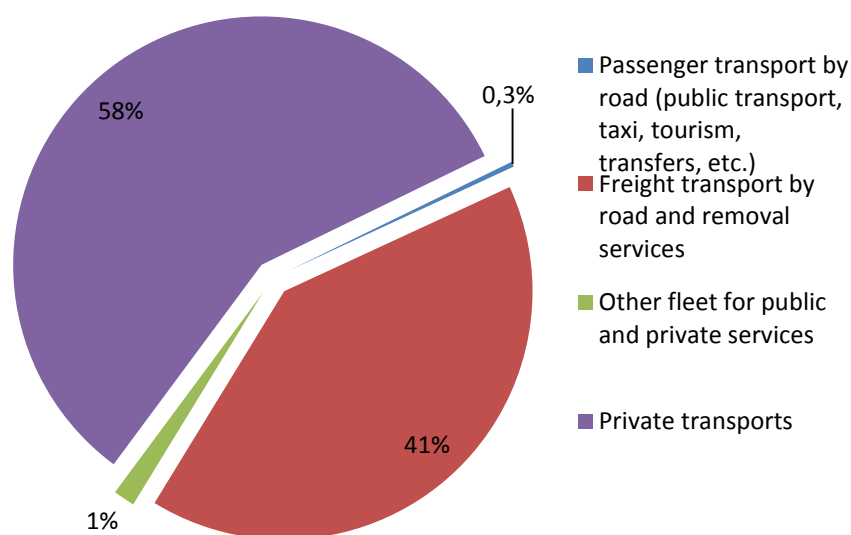


Figure 3.28. CO2 emissions from final use in the transports sector

3.2. Projections to 2020 – Business as usual scenario

The Business As Usual (BAU) scenario results from a combination of existing data for the period 2005 – 2011 and simulated growth rates for the period 2012 – 2020.

The estimation of growth rates is based on national statistics and on local special characteristics in relation to estimated economic growth of each activity sector.

However, it should be noted that because of the uncertain status of the national economy the estimations are susceptible to change during the ISEAP implementation period; in this case the projections will be re-evaluated and updated accordingly.

In the following figures the development of the primary energy demand and the CO₂ emissions from final use from the base year 2005 till the target year 2020 are presented, showing an expected increase of 36% and 37% respectively.

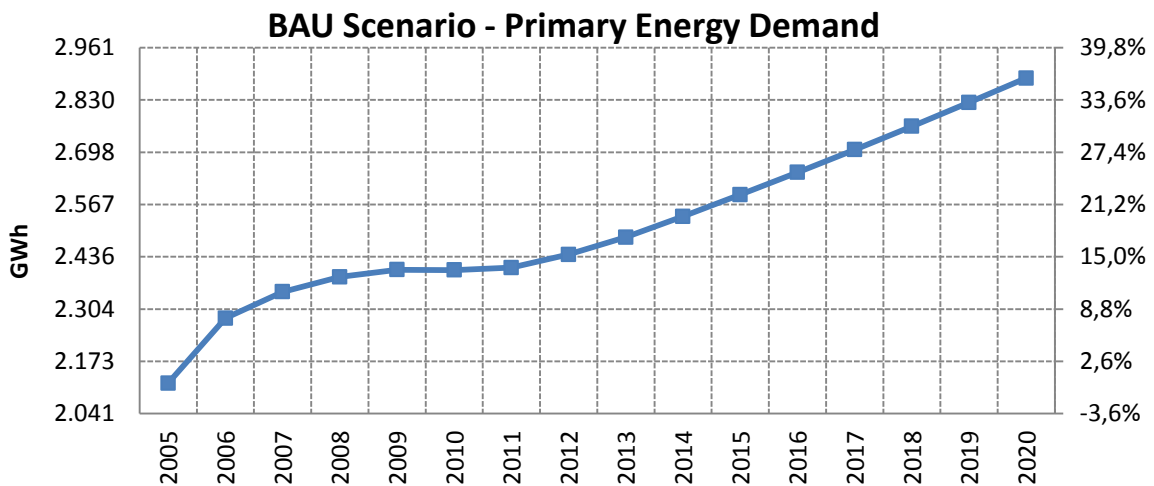


Figure 3.29. BAU Scenario – Growing trend of Primary Energy Demand

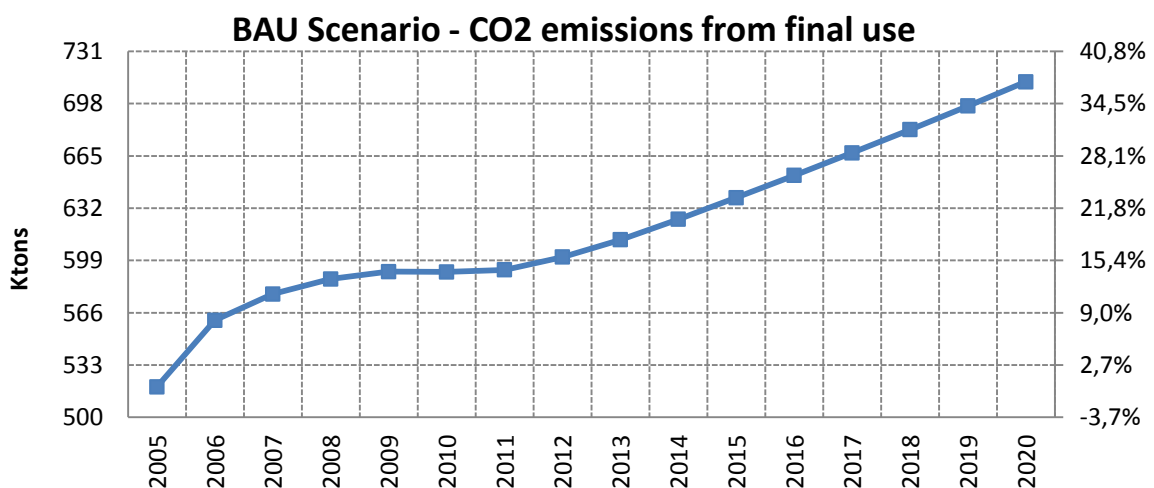


Figure 3.30. BAU Scenario – Growing trend of CO₂ emissions from final use

3.2.1. Final energy demand

The evolution of the final energy demand according to the BAU scenario is presented in the following figures. The projections are shown per energy source (electricity, fossil fuels and renewable energy sources) and activity sector.

An almost linear increase (see Figure 3.31) in the use of the available energy sources is expected, while a growth trend decrease is depicted for the period 2008 – 2011 mainly resulting from the national economic crisis.

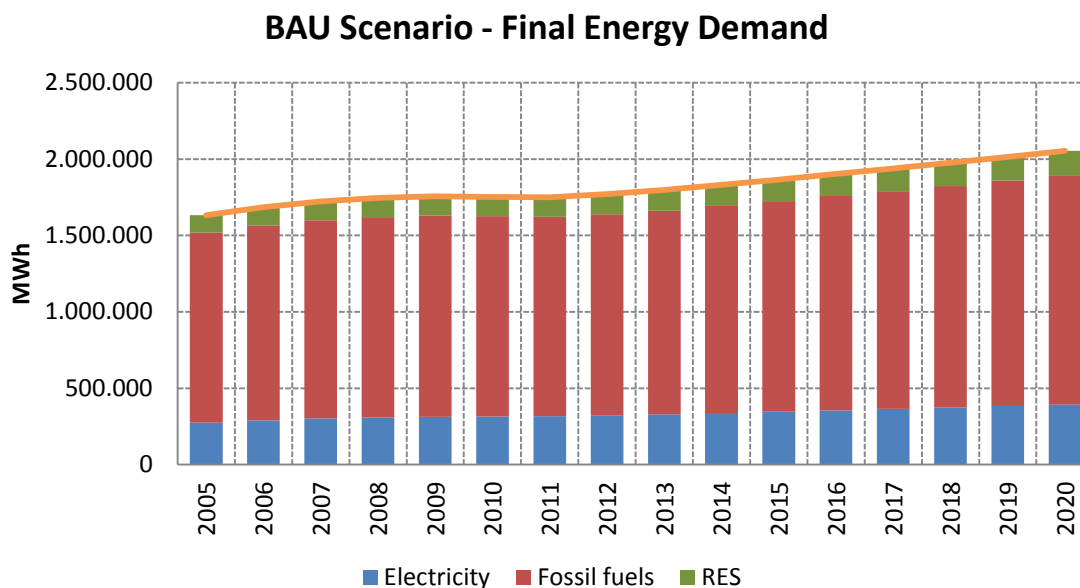


Figure 3.31. BAU Scenario – Final Energy Demand per energy source

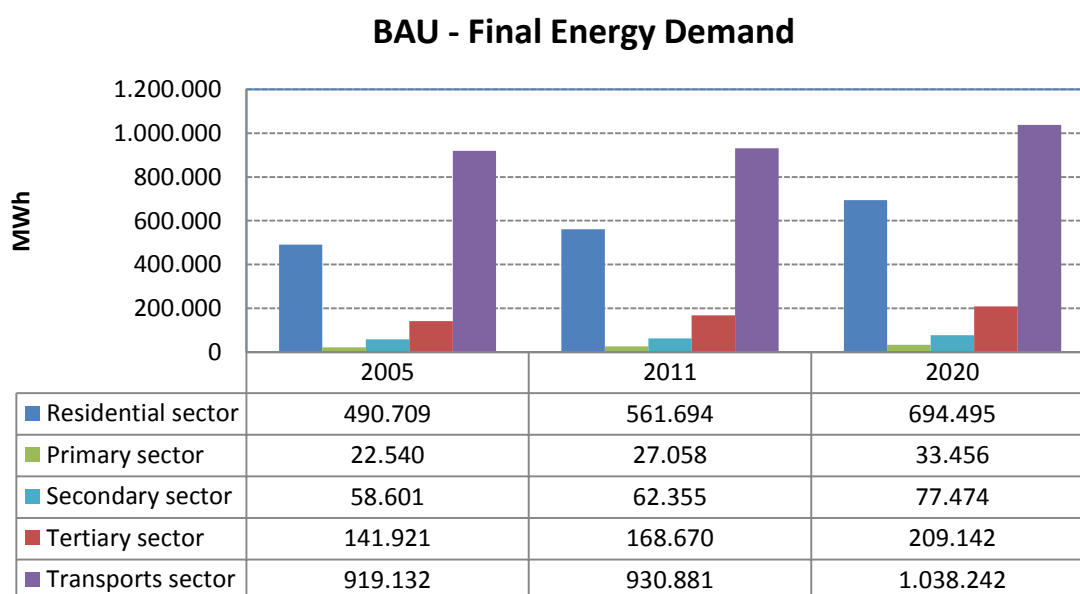


Figure 3.32. BAU Scenario – Final Energy Demand per activity sector

The final energy demand distribution per energy carrier and activity sector as expected for the year 2020 is presented in the following figures. Electricity (19%), diesel (41%) and gasoline (29%) will account for almost 90% of the total demand with the residential (34%) and transports (50%) sectors being the largest consumers.

In Table 3.13 a summary of the final energy demand distribution per energy carrier and activity sector for the target year 2020 is presented.

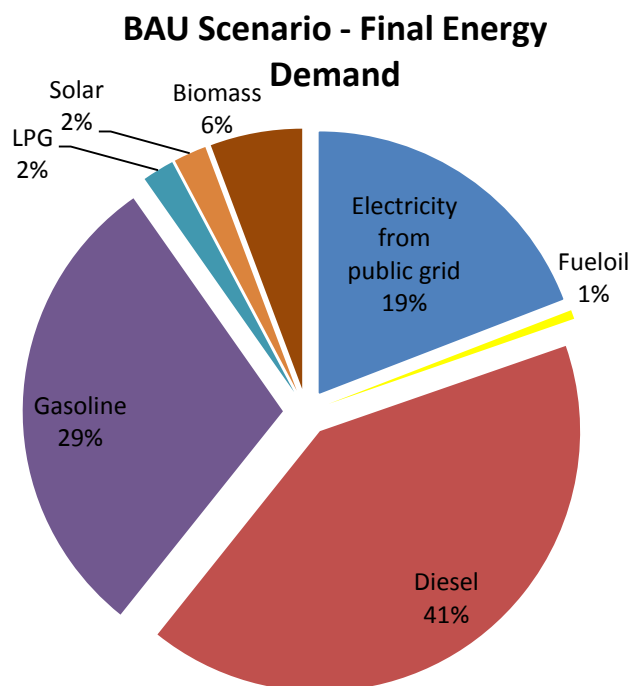


Figure 3.33. BAU Scenario – Final Energy Demand per energy carrier in 2020

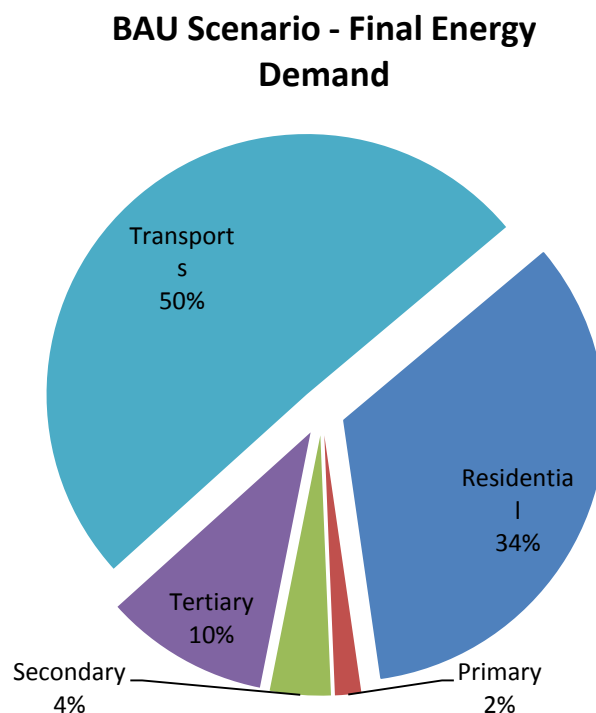


Figure 3.34. BAU Scenario – Final Energy Demand per sector in 2020

Energy carrier		Residential [MWh]	Primary sector [MWh]	Secondary sector [MWh]	Tertiary sector [MWh]	Transports [MWh]	TOTAL [MWh]
Centralized Energy services	Electricity	205.987	24.108	28.646	134.058		392.800
	Fueloil			11.398			11.398
Fossil fuels	Diesel	327.307	4.365	11.913	66.799	432.073	842.456
	Gasoline					606.169	606.169
	LPG	38.926		1.202	573		40.701
Renewable Energy sources	Solar	34.018		677	7.285		41.980
	Biomass	88.258	4.983	23.638	426		117.305
TOTAL		694.495	33.456	77.474	209.142	1.038.242	2.052.808

Table 3.13. BAU Scenario final energy demand per sector and energy carrier in 2020

3.2.2. Energy conversion

Lesvos as an electrically autonomous island to is considered to produce electricity through the local power station. No further RES installations are foreseen in the BAU scenario. There are no district heating or cooling installations. The estimated projection of electricity production is shown in the following figure.

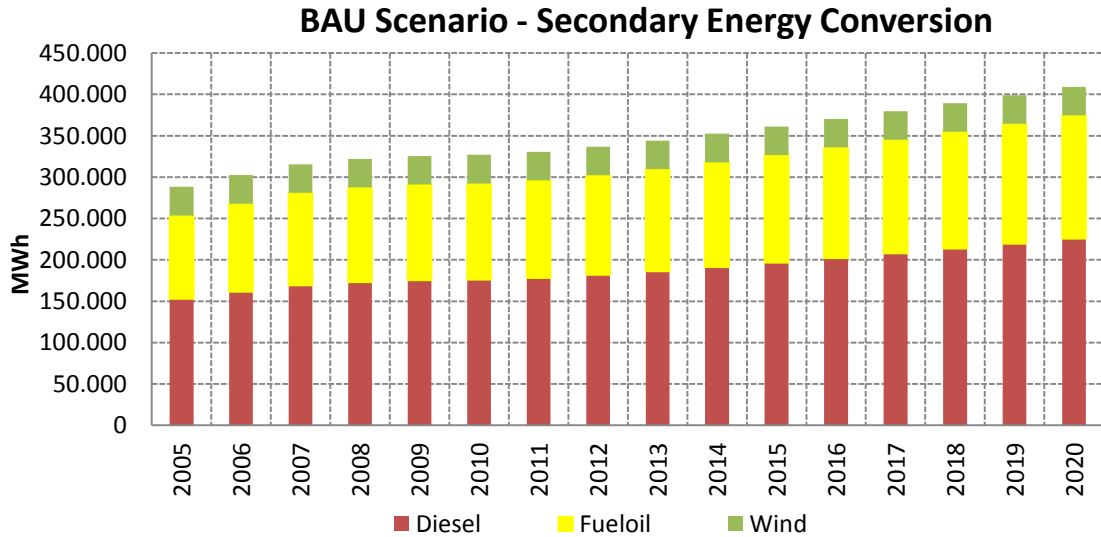


Figure 3.35. BAU Scenario – Secondary Energy Conversion

3.2.3. Primary energy demand

In the following figures the BAU scenario projection of the primary energy demand and the respective shares per energy carrier in the year 2020 are presented.

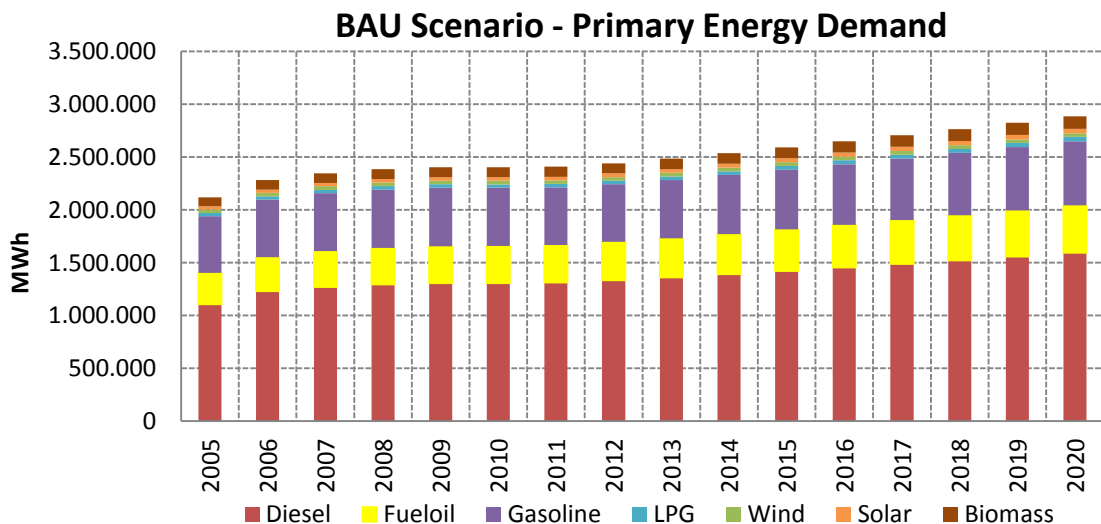


Figure 3.36. BAU Scenario – Primary Energy Demand projections per energy carrier

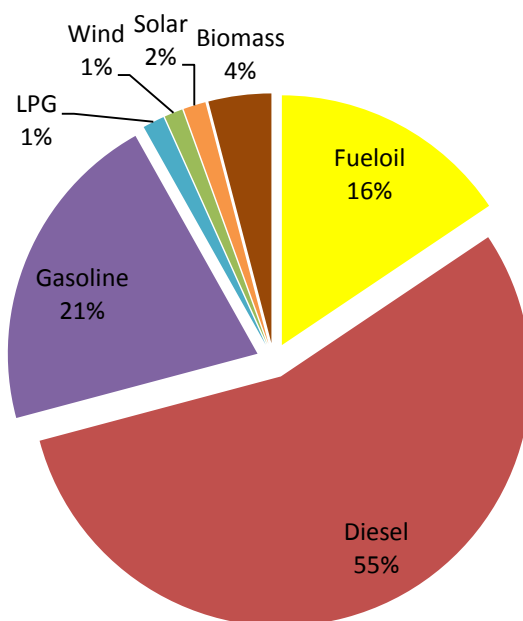


Figure 3.37. BAU Scenario – Primary Energy Demand per energy carrier in 2020

3.2.4. Emissions of carbon dioxide

In the following figures and tables the BAU scenario CO₂ emissions from final use per energy carrier and activity sector are presented.

BAU Scenario - CO₂ emissions from final use

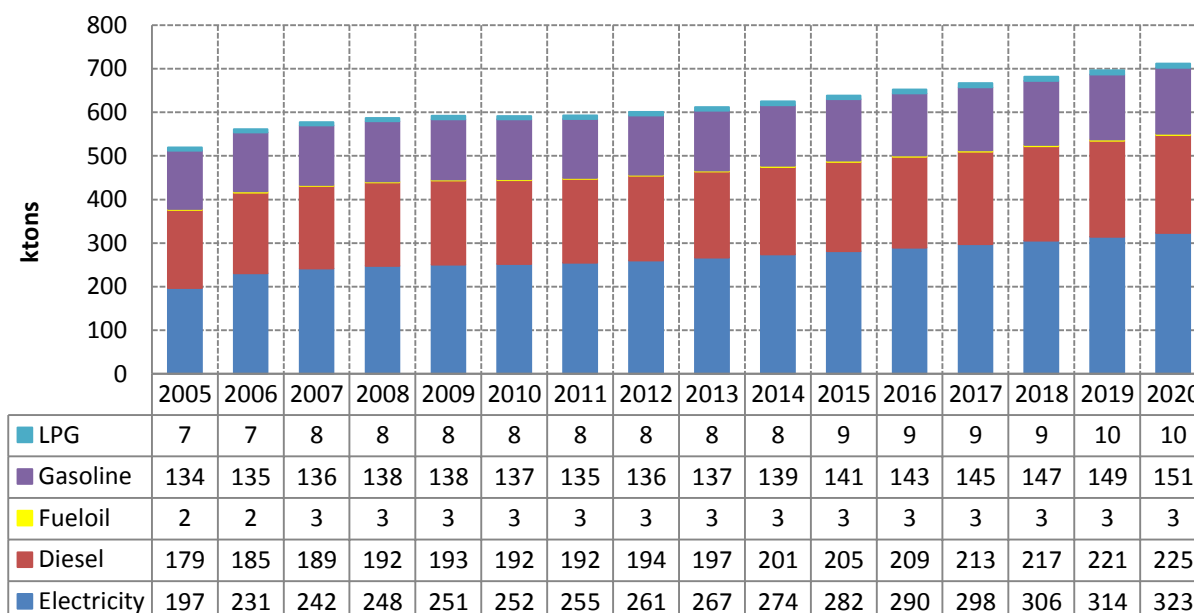


Figure 3.38. BAU Scenario – CO₂ emissions from final use projections per energy carrier

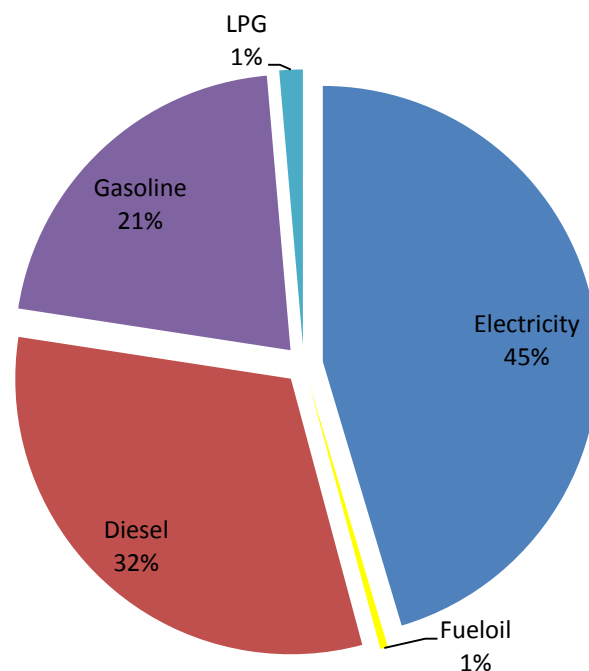


Figure 3.39. BAU Scenario – CO₂ emissions from final use per energy carrier in 2020

BAU Scenario - CO₂ emissions from final use

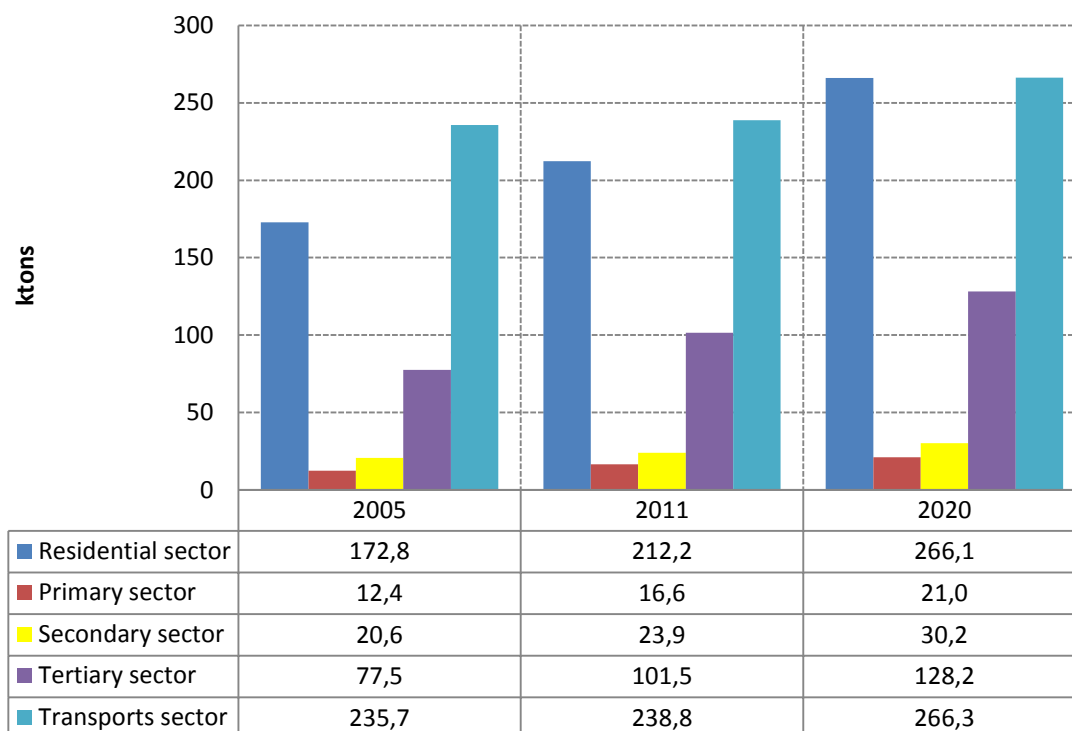


Figure 3.40. BAU Scenario – CO₂ emissions from final use projections per sector

3.3. Projections to 2020 – Action plan scenario

The ISEAP (Island Sustainable Energy Action Plan) scenario reflects the energy profile of the island to be achieved through the implementation of the planned actions in the period up to 2020. Several actions focusing on different activity sectors of the island contribute to the attainment of the ambitious goals of the local authority.

Specifically the local authority through the promotion and implementation of the ISEAP expects to reduce the primary energy demand by 39% and the CO₂ emissions by at least 56% in 2020 in comparison to the BAU scenario. In comparison to the baseline year (2005) values, the respective magnitudes will be decreased by 2,6% and 14% respectively, as presented in the following figures going beyond the EU goals, which for Greece is set to 4% reduction of GHG emissions by 2020 in comparison to 2005.

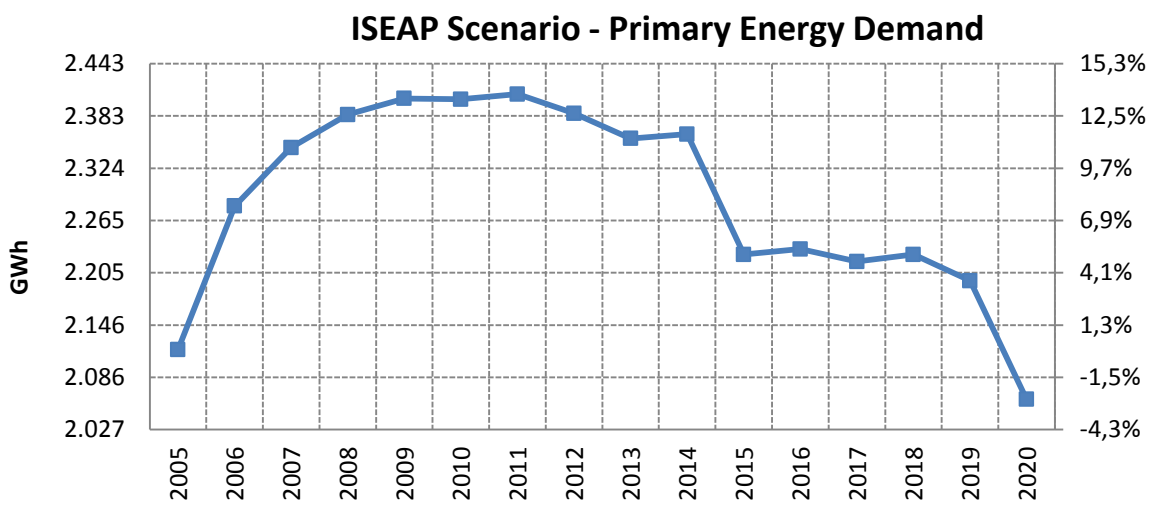


Figure 3.41. ISEAP Scenario – Growing trend of Primary Energy Demand

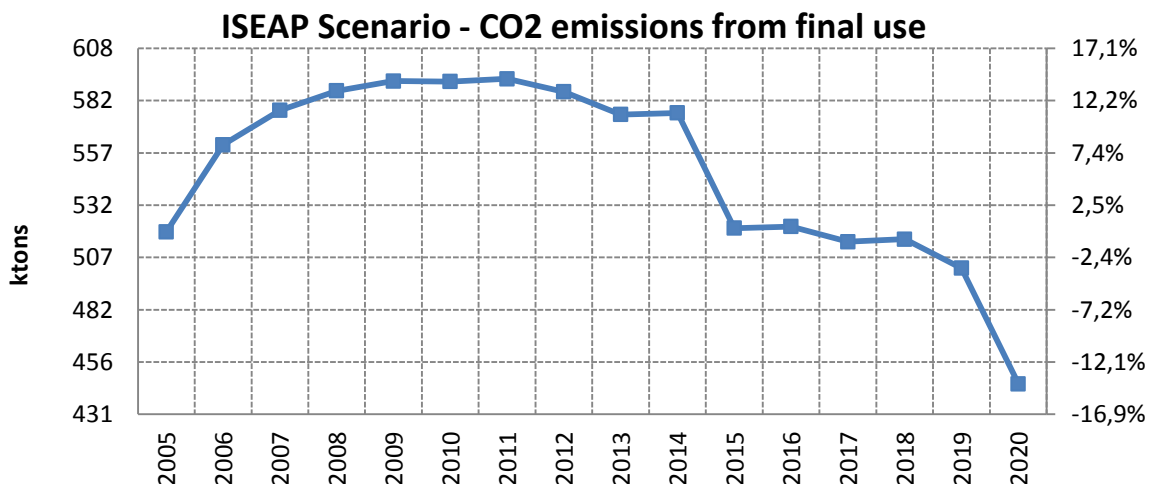


Figure 3.42. ISEAP Scenario – Growing trend of CO₂ emissions from final use

3.3.1. Final energy demand

The evolution of the final energy demand according to the ISEAP scenario is presented in the following figures. The projections are shown per energy source (electricity, fossil fuels and renewable energy sources) and activity sector.

The ISEAP scenario aims to shift the linearly increasing of the BAU scenario to linearly decreasing trend of the final energy demand from 2012 and on when the ISEAP implementation has initiated (see Figure 3.43). The highest reduction between 2011 and 2020 is expected in the residential (7,5%), the tertiary (6%) and transports (23,8%) sectors (see Figure 3.44).

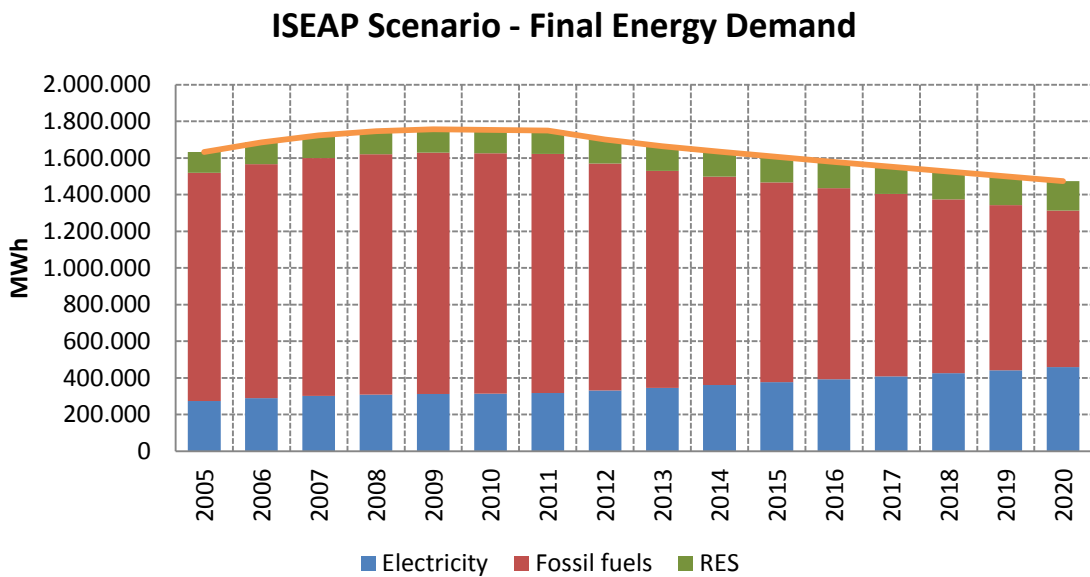


Figure 3.43. ISEAP Scenario – Final Energy Demand per energy source

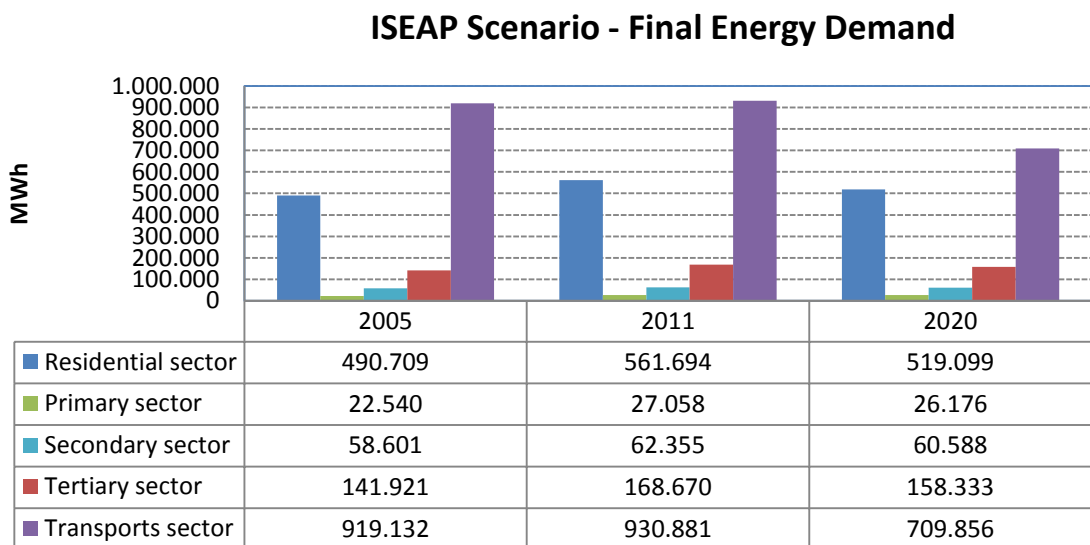


Figure 3.44. ISEAP Scenario – Final Energy Demand per activity sector

The final energy demand distribution per energy carrier and activity sector in the target year 2020 is presented in the following figures where electricity will cover a greater part (31%) of the demand in comparison to the BAU scenario (19%) replacing a significant part of the diesel consumption (31% from 41% in BAU scenario) mainly because of introducing efficient heat pumps to cover the space heating demand will traditionally is produced from stand-alone oil burners. The additional electricity demand will be covered by introducing locally produced electricity from wind and solar power stations. Electricity and diesel remains the dominant energy carriers accounting for 62% of the total demand, followed by gasoline (24%). The residential and tertiary sectors remain the largest consumers.

In

Energy carrier		Residential [MWh]	Primary sector [MWh]	Secondary sector [MWh]	Tertiary sector [MWh]	Transports [MWh]	TOTAL [MWh]
Centralized Energy services	Electricity	216.150	18.863	22.402	110.668	91.246	459.328
Fossil fuels	Fueloil			8.914			8.914
	Diesel	142.959	3.415	9.317	39.358	261.900	456.949
	Gasoline					356.710	356.710
	LPG	30.032		940	369		31.342
Renewable Energy sources	Solar	60.037		529	7.664		68.230
	Biomass	69.922	3.898	18.486	275		92.581
TOTAL		519.099	26.176	60.588	158.333	709.856	1.474.053

Table 3.14 is presented a summary of the expected final energy demand distribution per energy carrier and activity sector for the target year 2020 after the implementation of the ISEAP.

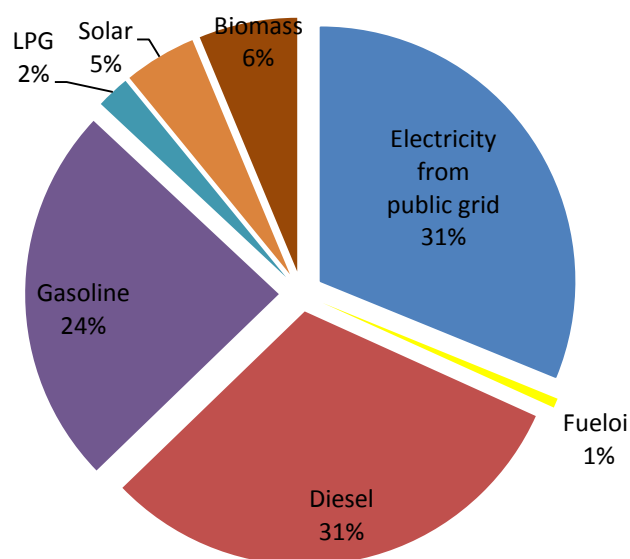


Figure 3.45. ISEAP Scenario – Final Energy Demand per energy carrier in 2020

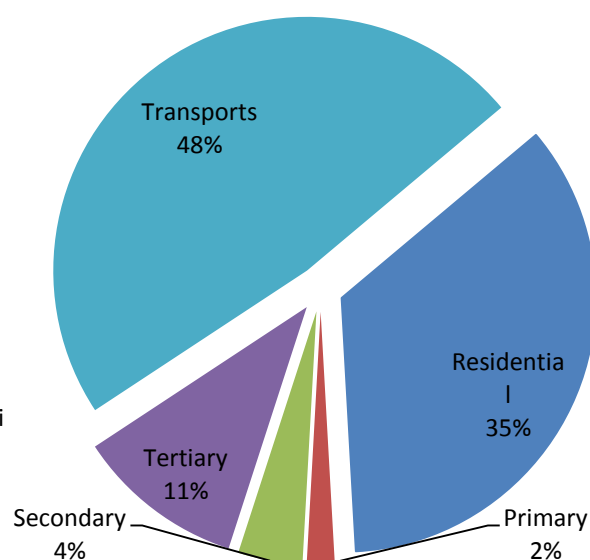


Figure 3.46. ISEAP Scenario – Final Energy Demand per sector in 2020

Energy carrier		Residential [MWh]	Primary sector [MWh]	Secondary sector [MWh]	Tertiary sector [MWh]	Transports [MWh]	TOTAL [MWh]
Centralized Energy services	Electricity	216.150	18.863	22.402	110.668	91.246	459.328
	Fueloil			8.914			8.914
Fossil fuels	Diesel	142.959	3.415	9.317	39.358	261.900	456.949
	Gasoline					356.710	356.710
	LPG	30.032		940	369		31.342
Renewable Energy sources	Solar	60.037		529	7.664		68.230
	Biomass	69.922	3.898	18.486	275		92.581
TOTAL		519.099	26.176	60.588	158.333	709.856	1.474.053

Table 3.14. ISEAP Scenario final energy demand per sector and energy carrier in 2020

3.3.2. Energy conversion

The introduction of locally produced electricity from different renewable energy sources (wind, PV, geothermal, wind-hydro with pumped storage and biomass) is foreseen in the ISEAP scenario. By 2020 the island is expected to cover almost 45% of the electricity demand from locally exploited renewable energy sources.

ISEAP Scenario - Secondary Energy Conversion

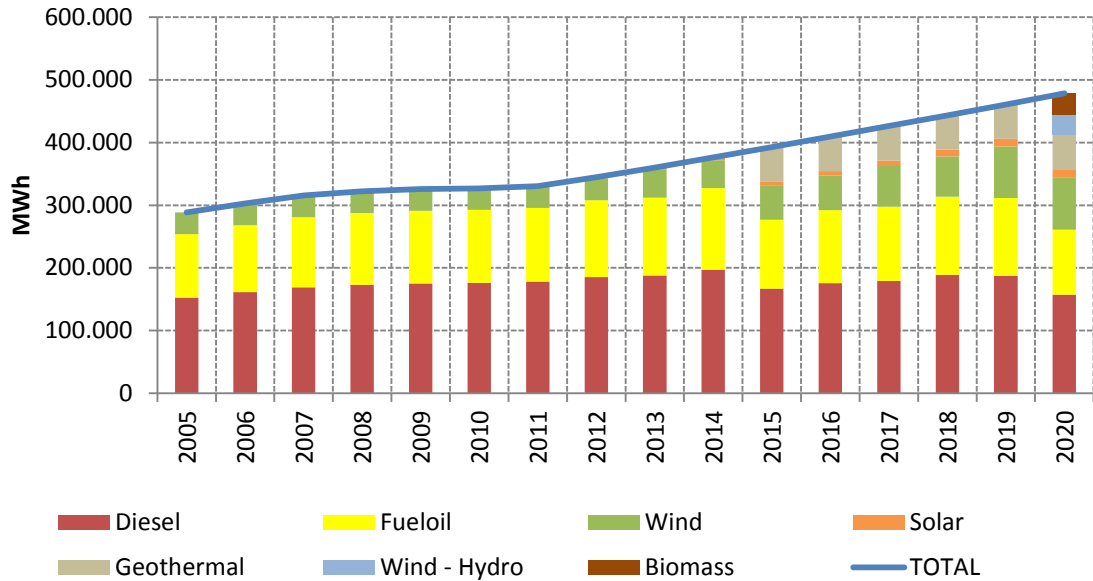


Figure 3.47. ISEAP Scenario – Growth trend of Secondary Energy Conversion

ISEAP Scenario - Secondary Energy Conversion

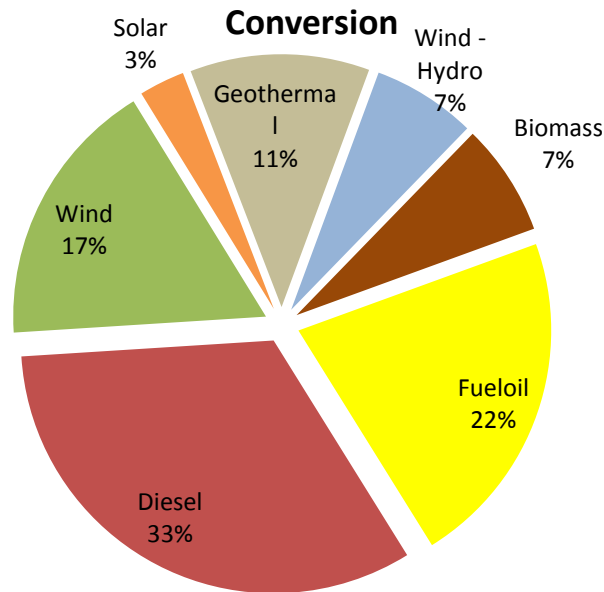


Figure 3.48. ISEAP Scenario – Secondary Energy Conversion per energy carrier in 2020

3.3.3. Primary energy demand

In the following figures the ISEAP scenario projection of the primary energy demand and the respective shares per energy carrier in the year 2020 are presented.

The use of fossil fuels is decreased because of the introduction of wind and solar energy for electricity production as locally exploited energy sources.

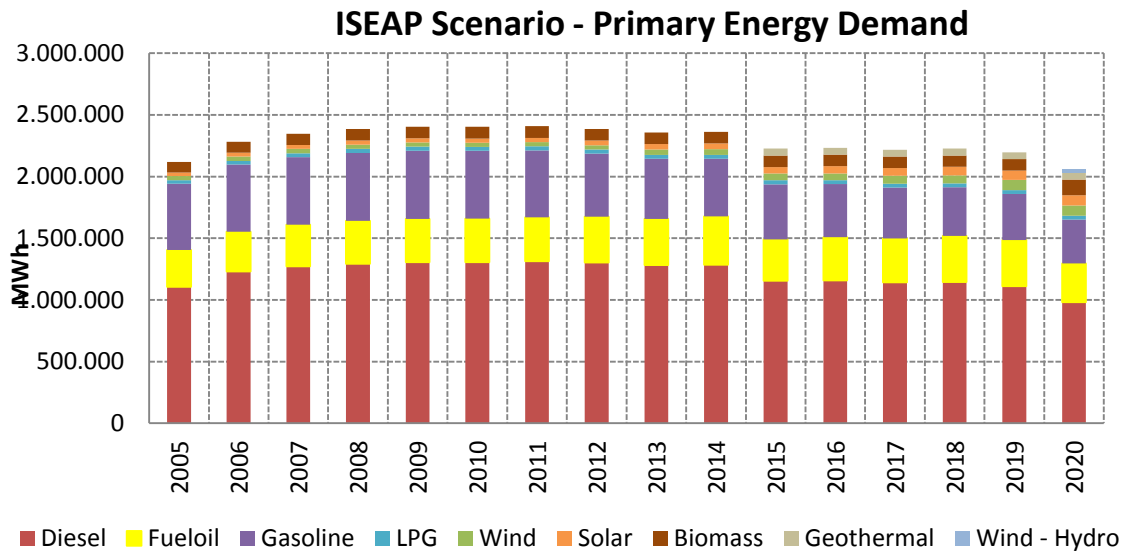


Figure 3.49. ISEAP Scenario – Growth trend of Primary Energy Demand per energy carrier

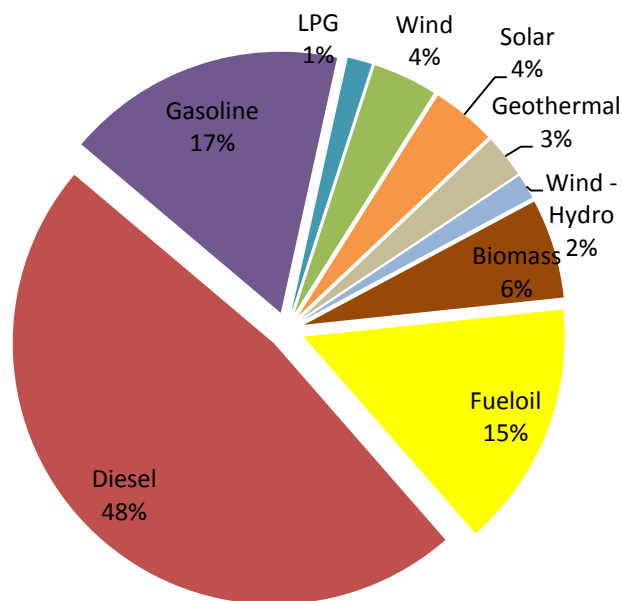


Figure 3.50. ISEAP Scenario – Primary Energy Demand per energy carrier in 2020

3.3.4. Emissions of carbon dioxide

In the following figures and tables the ISEAP scenario CO₂ emissions from final use per energy carrier and activity sector are presented. The share of CO₂ emissions resulting from the use of electricity (50%) is slightly increased in comparison to the BAU scenario

(45%) mainly because of the rapid decrease in the use of diesel for heating and the introduction of electrical vehicles.

ISEAP Scenario - CO2 emissions from final use

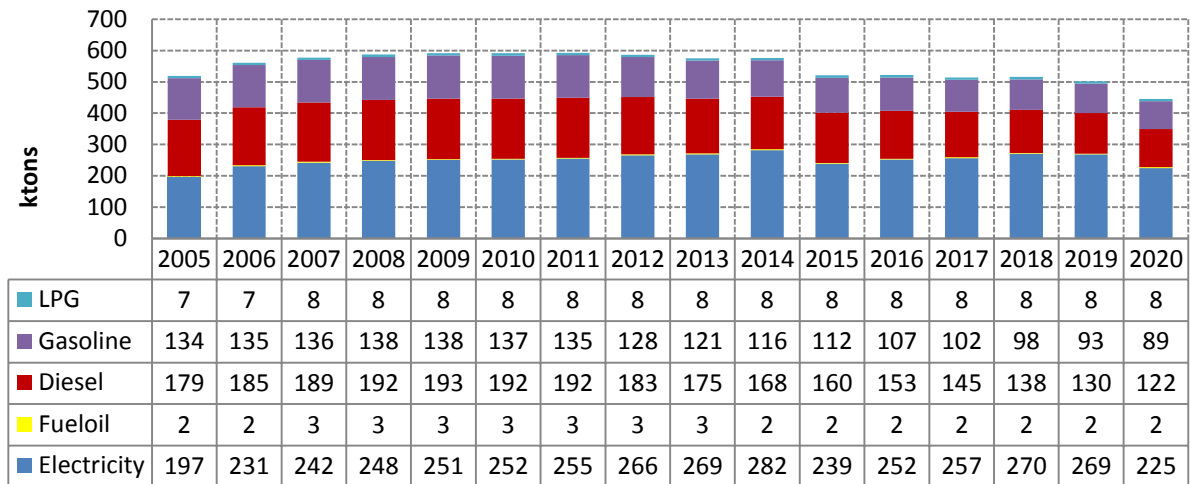


Figure 3.51. ISEAP Scenario – Growth trend of CO₂ emissions from final use per energy carrier

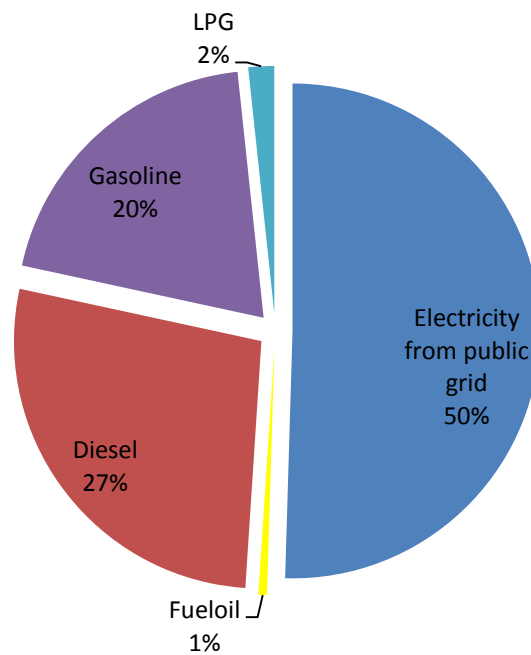


Figure 3.52. ISEAP Scenario – CO₂ emissions from final use per energy carrier in 2020

ISEAP Scenario - CO2 emissions from final use

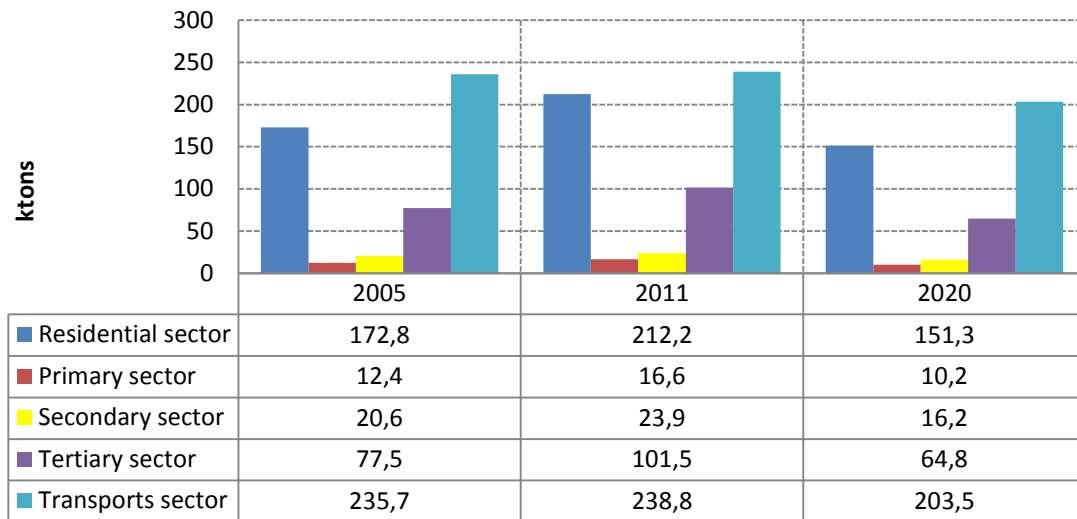


Figure 3.53. ISEAP Scenario – CO₂ emissions from final use projections per sector

The contribution of each activity sector in the reduction of CO₂ emissions is depicted in the following figures (Figure 3.54 to Figure 3.59) with the residential and tertiary sectors from the end use side along with the secondary energy conversion sector (i.e. the electricity production from RES units) are the most significant ones.

CO2 emissions reduction - Residential sector

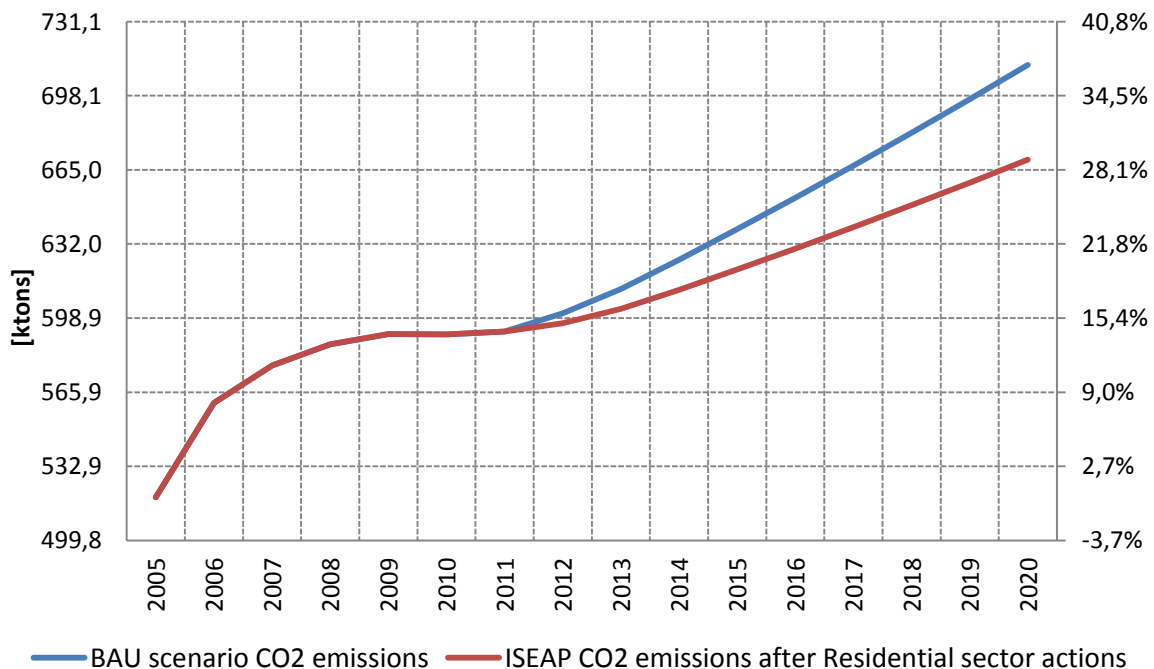


Figure 3.54. Comparison of CO₂ emissions from final use between BAU and ISEAP Scenarios in the residential sector

CO₂ emissions reduction - Primary sector

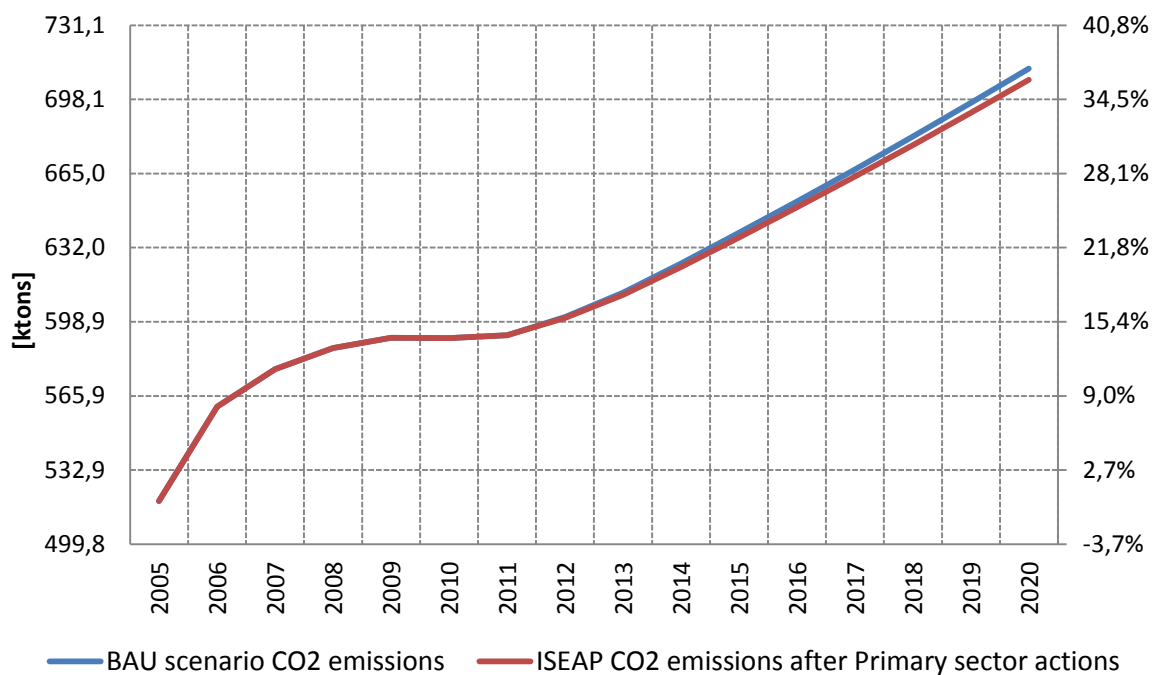


Figure 3.55. Comparison of CO₂ emissions from final use between BAU and ISEAP Scenarios in the primary sector

CO₂ emissions reduction - Secondary sector

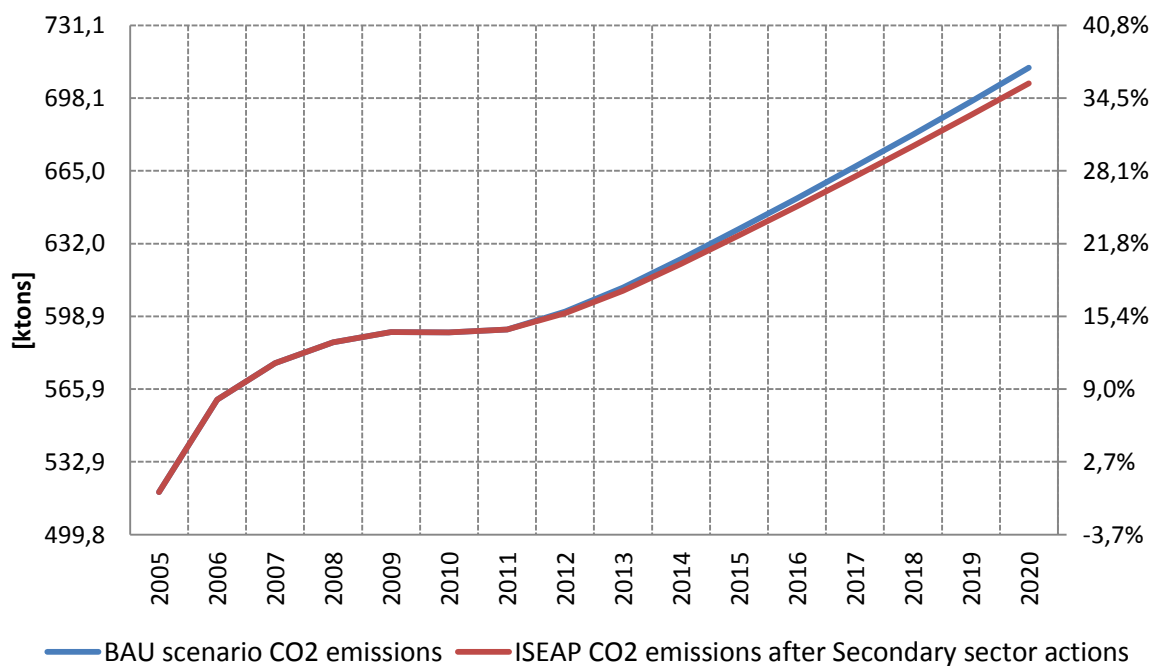


Figure 3.56. Comparison of CO₂ emissions from final use between BAU and ISEAP Scenarios in the secondary sector

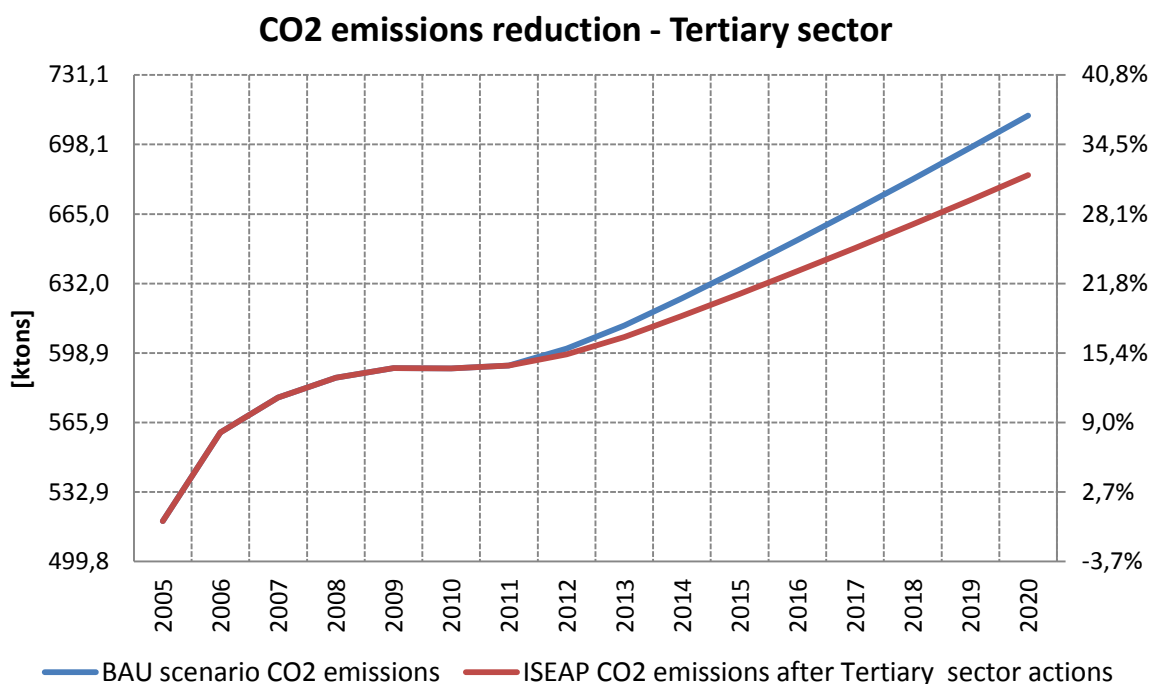


Figure 3.57. Comparison of CO₂ emissions from final use between BAU and ISEAP Scenarios in the tertiary sector

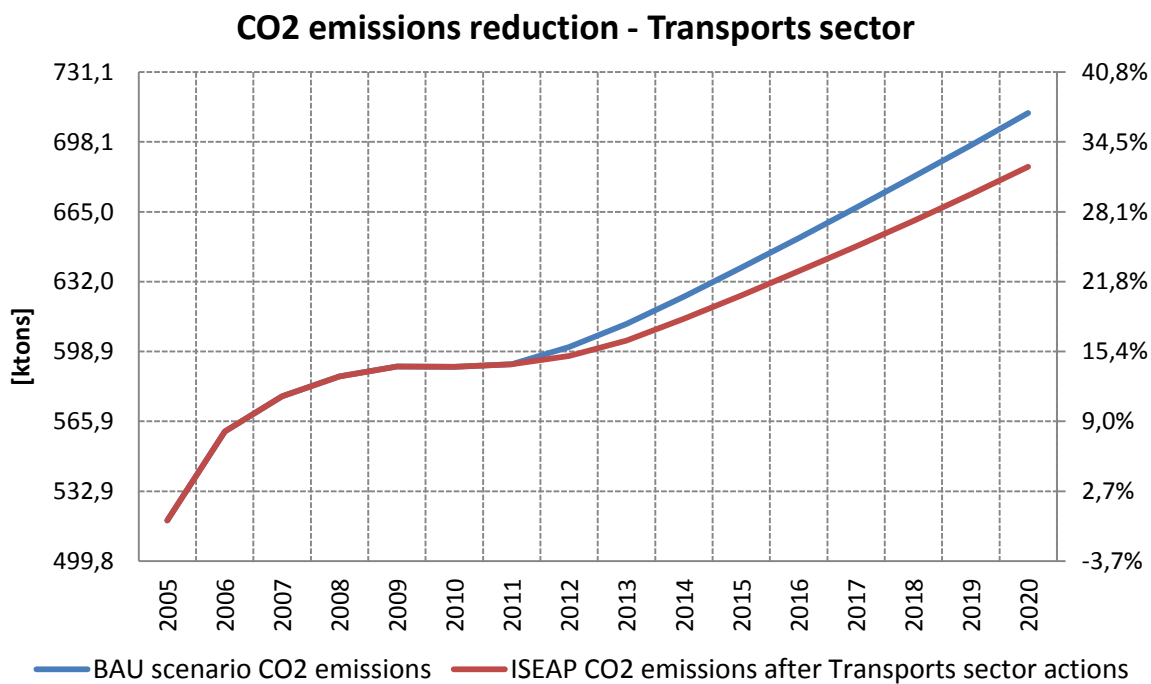


Figure 3.58. Comparison of CO₂ emissions from final use between BAU and ISEAP Scenarios in the transports sector

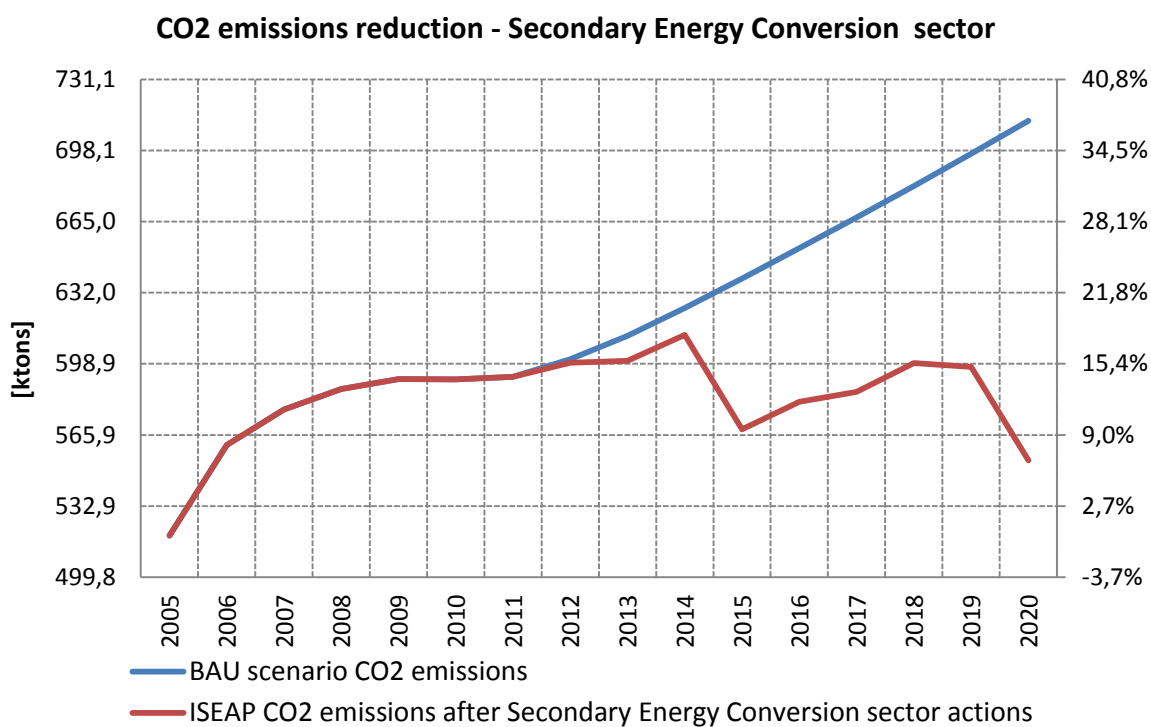


Figure 3.59. Comparison of CO₂ emissions from final use between BAU and ISEAP Scenarios in the secondary energy conversion sector

The following table summarizes the contribution of each sector in the reduction of CO₂ in comparison to the BAU scenario in the target year 2020.

Action Sectors	CO ₂ emissions reduction
Residential	8,1%
Primary	1,0%
Secondary	1,4%
Tertiary	5,5%
Transports	4,9%
Electricity production	30,4%
TOTAL	56,39%

Table 3.15. Contribution in the CO₂ emissions reduction of each sector in comparison to the BAU scenario in 2020

4. ACTIONS

The ISEAP of Lesvos is developed in order to ensure the active contribution of the municipality, the citizens and stakeholders in reaching the national and European targets for greenhouse gases reduction until 2020. The long-term vision of the Municipality of Lesvos is to succeed into restricting the rapidly increasing CO₂ emissions of the island by introducing the maximum amount of renewable energy sources on the energy production and demand side and by promoting the adoption of energy saving and efficiency in all activity sectors.

A wide range of actions is included in the action plan dealing with all the major activity sectors of the island. The selection of actions was carried out after considering several alternative scenarios with the scope to maximize the emissions reduction target with the minimum cost in the given time framework considering also the lately formulated national and local economic conditions.

For the public related sectors the municipality will function as an example for the rest of the island implementing energy saving and efficiency measures. For the rest of the activity sectors the municipality will promote respective horizontal actions while for the electricity production the aim is to maximize the local electricity production from RES in order to minimize the electricity imports to the mainland.

In the following table the expected results through the implementation of the ISEAP are summarized in terms of energy savings, renewable energy production and reduction of CO₂ emissions. The demand side management actions are contributing equally with actions for secondary energy production from RES in reaching the targets set for the island's CO₂ emissions. More details for the specific actions in each sector are presented in the following chapters.

SECTOR	ENERGY SAVINGS TARGET IN 2020 [MWh/year]	RENEWABLE ENERGY PRODUCTION TARGET IN 2020 [MWh/year]	CO ₂ REDUCTION TARGET IN 2020 [ton/year]
RESIDENTIAL	16.880	854	4.692
PRIMARY	2.155	-	552
SECONDARY	3.478	-	784
TERTIARY	11.648	25	3.154
TRANSPORTS	13.070	-	2.843
SECONDARY ENERGY PRODUCTION	-	20.319	17.523
TOTAL	47.232	21.198	29.548

Table 4.1. ISEAP expected results in 2020 for every activity sector

4.1. Residential

In the following tables details of the actions planned for the residential sector are presented. The main focus is given on the promotion of energy saving and energy efficiency in everyday energy behaviour of the citizens but also in the use of renewable energy sources for the production of space and water heating. Also in some cases the substitution of fossil fuels consumption by electricity is promoted considering the fact that the local production of electricity from RES will be also promoted through the ISEAP.

SECTORS AND FIELDS OF ACTION	ACTIONS	RESPONSIBLE FOR IMPLEMENTATION	EXPECTED ENERGY SAVINGS [MWh/year]	EXPECTED RENEWABLE ENERGY PRODUCTION [MWh/year]	EXPECTED CO2 REDUCTION [ton/year]
RESIDENTIAL SECTOR					
Hot water	Reduce the annual hot water energy demand growth rate by 10% by promoting every day energy saving measures from the consumers	Municipality of Lesvos	509		109
	Increase to 50% the total hot water energy demand supplied from solar thermal by 2020	Municipality of Lesvos	3.466	3.001	1.749
Heating and cooling	Reduce the annual space heating energy demand growth rate by 10% by promoting every day energy saving measures from the consumers	Municipality of Lesvos	1.292		302
	Increase by 20% the total space heating energy demand supplied from heat pumps by 2020	Municipality of Lesvos	-13.958		-3.844
	Reduce the annual space cooling energy demand growth rate by 10% by promoting every day energy saving measures from the consumers	Municipality of Lesvos	1.292		302
	Increase by 30% the energy efficiency of air-conditioning systems by 2020 through the promotion of air-conditioning with inverter	Municipality of Lesvos	11.900		2.783
Lighting	Reduce the annual lighting energy demand growth rate by 10% by promoting every day energy saving measures from the consumers	Municipality of Lesvos	268		73
	Increase by 20% the energy efficiency of lighting systems by 2020 through the promotion of energy efficient lamps	Municipality of Lesvos	3.699		1.004
Cooking	Reduce the annual cooking energy demand growth rate by 10% by promoting every day energy saving measures from the consumers	Municipality of Lesvos	249		59

	Increase by 20% the energy efficiency of cooking appliances by 2020 through the promotion of old devices substitution with more efficient ones	Municipality of Lesvos	2.296		543
Refrigerator and freezers	Reduce the annual electrical appliances energy demand growth rate by 10% by promoting every day energy saving measures from the consumers	Municipality of Lesvos	263		71
	Increase by 20% the energy efficiency of electrical appliances by 2020 through the promotion of old devices substitution with more efficient ones	Municipality of Lesvos	2.419		657
Laundry machines and dryers	Reduce the annual electrical appliances energy demand growth rate by 10% by promoting every day energy saving measures from the consumers	Municipality of Lesvos	16		4
	Increase by 20% the energy efficiency of electrical appliances by 2020 through the promotion of old devices substitution with more efficient ones	Municipality of Lesvos	147		40
Dish washing	Reduce the annual electrical appliances energy demand growth rate by 10% by promoting every day energy saving measures from the consumers	Municipality of Lesvos	22		6
	Increase by 20% the energy efficiency of electrical appliances by 2020 through the promotion of old devices substitution with more efficient ones	Municipality of Lesvos	206		56
TV sets	Reduce the annual electrical appliances energy demand growth rate by 10% by promoting every day energy saving measures from the consumers	Municipality of Lesvos	21		6
	Increase by 20% the energy efficiency of electrical appliances by 2020 through the promotion of old devices substitution with more efficient ones	Municipality of Lesvos	191		52
Other electric appliances	Reduce the annual electrical appliances energy demand growth rate by 10% by promoting every day energy saving measures from the consumers	Municipality of Lesvos	187		51
	Increase by 20% the energy efficiency of electrical appliances by 2020 through the promotion of old devices substitution with more efficient ones	Municipality of Lesvos	1.723		468

Table 4.2. Details for the actions planned in the residential sector

ENERGY SAVINGS TARGET IN 2020 [MWh/year]	RENEWABLE ENERGY PRODUCTION TARGET IN 2020 [MWh/year]	CO2 REDUCTION TARGET IN 2020 [ton/year]
RESIDENTIAL SECTOR		
16.880	854	4.692

Table 4.3. Summary table of the actions planned in the residential sector

4.2. Primary sector

In the following tables details of the actions planned for the primary sector are presented. The actions focus on the agricultural sector aiming to the reduction of energy consumption by the professionals and to the energy efficiency upgrade of irrigation systems.

SECTORS AND FIELDS OF ACTION	ACTIONS	RESPONSIBLE FOR IMPLEMENTATION	EXPECTED ENERGY SAVINGS [MWh/year]	EXPECTED RENEWABLE ENERGY PRODUCTION [MWh/year]	EXPECTED CO2 REDUCTION [ton/year]
PRIMARY SECTOR					
Agriculture, forestry and fishing	Reduce the annual agricultural, forestry and fishing energy demand growth rate by 10% by promoting every day energy saving measures from the professionals	Municipality of Lesvos - Local association	215		55
	Increase by 20% the energy efficiency of agricultural irrigation systems by 2020 through the promotion of old irrigation systems substitution with new more efficient ones	Municipality of Lesvos - Local association	1.983		508

Table 4.4. Details for the actions planned in the primary sector

ENERGY SAVINGS TARGET IN 2020 [MWh/year]	RENEWABLE ENERGY PRODUCTION TARGET IN 2020 [MWh/year]	CO2 REDUCTION TARGET IN 2020 [ton/year]
PRIMARY SECTOR		
2.155		552

Table 4.5. Summary table of the actions planned in the primary sector

4.3. Secondary sector

In the following tables details of the actions planned for the secondary sector are presented. The main focus is given on the collaboration among the municipality and local associations to commit the local companies into setting initial mainstream targets for energy saving and increasing energy efficiency of their equipment and services. Concerning the water supply, sewerage and waste management activities supplied by the municipality actions concerning the energy consumption of the systems are planned and will be carried out by the municipality's own personnel and funding.

SECTORS AND FIELDS OF ACTION	ACTIONS	RESPONSIBLE FOR IMPLEMENTATION	EXPECTED ENERGY SAVINGS [MWh/year]	EXPECTED RENEWABLE ENERGY PRODUCTION [MWh/year]	EXPECTED CO2 REDUCTION [ton/year]
SECONDARY SECTOR					
Manufacturing	Reduce the annual manufacturing energy demand growth rate by 10% by promoting every day energy saving measures from the professionals	Municipality of Lesvos - Local association	231		46
	Increase by 20% the energy efficiency of manufacturing technologies by 2020 through the promotion of old systems substitution with new more efficient ones	Municipality of Lesvos - Local association	2.083		418
Water supply, sewerage, waste management and remediation activities	Reduce the annual water supply, waste management and remediation activities energy demand growth rate by 10% by promoting every day energy saving measures from the consumers	Municipality of Lesvos	67		18
	Increase by 20% the energy efficiency of the pumping stations operating for the support of the sector by 2020 through the introduction of inverters to existing pumping stations or substitution of old stations with new efficient ones	Municipality of Lesvos	607		165
Construction	Reduce the annual construction energy demand growth rate by 10% by promoting every day energy saving measures from the professionals	Municipality of Lesvos - Local association	56		15
	Increase by 20% the energy efficiency of construction	Municipality of Lesvos - Local	505		137

	technologies by 2020 through the promotion of old systems substitution with new more efficient ones	association			
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Table 4.6. Details for the actions planned in the secondary sector

ENERGY SAVINGS TARGET IN 2020 [MWh/year]	RENEWABLE ENERGY PRODUCTION TARGET IN 2020 [MWh/year]	CO2 REDUCTION TARGET IN 2020 [ton/year]
SECONDARY SECTOR		
3.478		784

Table 4.7. Summary table of the actions planned in the secondary sector

4.4. Tertiary sector

In the following tables details of the actions planned for the tertiary sector are presented. The main focus is given on the collaboration among the municipality and local business associations to commit the local companies into setting initial mainstream targets for energy saving and increasing energy efficiency of their equipment and services.

Especially for the accommodation and food services service activities, considering the importance of tourism for the island, a wide range of actions are planned in order to reduce the seasonal increased CO₂ emissions during the touristic periods.

For the sub-sectors managed by the municipality (general administration, education, human health activities and public lighting) the actions concerning the energy consumption of the respective buildings (ex. town hall, schools, health centre, street lighting, etc.) and systems are planned and will be carried out in most cases by the municipality's own personnel and funding.

SECTORS AND FIELDS OF ACTION	ACTIONS	RESPONSIBLE FOR IMPLEMENTATION	EXPECTED ENERGY SAVINGS [MWh/year]	EXPECTED RENEWABLE ENERGY PRODUCTION [MWh/year]	EXPECTED CO2 REDUCTION [ton/year]
TERTIARY SECTOR					
Wholesale and retail trade; repair of motor vehicles and	Reduce the annual wholesale and retail trade energy demand growth rate by 10% by promoting every day energy saving measures from the professionals	Municipality of Lesvos - Local association	721		193

motorcycles	Energy efficiency measures - Increase by 30% the energy efficiency of air-conditioning systems by 2020 through the promotion of air-conditioning with inverter - Increase by 20% the energy efficiency of electrical appliances by 2020 through the promotion of old devices substitution with more efficient ones	Municipality of Lesvos - Local association	2.997		801
	Increase by 20% the total space heating energy demand supplied from heat pumps by 2020	Municipality of Lesvos - Local association	-366		-101
Accommodation and food service activities	Reduce the annual accommodation service activities energy demand growth rate by 10% by promoting every day energy saving measures from the owners, personnel and the visitors	Municipality of Lesvos - Local association	430		111
	Energy efficiency measures - Increase by 30% the energy efficiency of air-conditioning systems by 2020 through the promotion of air-conditioning with inverter and door deactivating sensors - Increase by 30% the energy efficiency of electrical appliances by 2020 through the promotion of old devices substitution with more efficient ones and by introducing the key card electricity deactivating system	Municipality of Lesvos - Local association	1.847		479
	Increase by 20% the total space heating energy demand supplied from heat pumps by 2020 - Increase by 20% the total hot water energy demand supplied from solar thermal by 2020	Municipality of Lesvos - Local association	61	115	47
	Reduce the food service activities energy demand growth rate by 10% by promoting every day energy saving measures from the owners and personnel	Municipality of Lesvos - Local association	430		111

	<p>Energy efficiency measures</p> <ul style="list-style-type: none"> - Increase by 30% the energy efficiency of air-conditioning systems by 2020 through the promotion of air-conditioning with inverter - Increase by 30% the energy efficiency of electrical appliances by 2020 through the promotion of old devices substitution with more efficient ones and by introducing motion sensors for the toilet lighting - Increase by 30% the energy efficiency of cooking appliances by 2020 through the promotion of old devices substitution with more efficient ones 	Municipality of Lesvos - Local association	1.847		479
	Increase by 20% the total space heating demand supplied from heat pumps by 2020 - Increase by 20% the total hot water energy demand supplied from solar thermal by 2020	Municipality of Lesvos - Local association	-65	52	-4
	Reduce the annual general public administration and social security energy demand growth rate by 10% by promoting every day energy saving measures from the employees	Municipality of Lesvos	282		77
General public administration and social security	<p>Energy efficiency measures</p> <ul style="list-style-type: none"> - Increase by 30% the energy efficiency of air-conditioning systems by 2020 through the introduction of air-conditioning with inverter - Increase by 30% the energy efficiency of electrical appliances by 2020 through the substitution of old devices with more efficient ones (green procurement) and by introducing motion sensors for the toilet lighting - Increase by 30% the energy efficiency of heating systems by 2020 through the replacement of old window and door frames of public buildings with more efficient ones 	Municipality of Lesvos	1.659		450
	Increase to 30% the total space heating demand supplied from heat pumps by 2020	Municipality of Lesvos	-359		-99
Education	Reduce the annual education energy demand growth rate by 10% by promoting every day energy saving measures from the professors and students	Municipality of Lesvos - School boards	188		51

	<p>Energy efficiency measures</p> <ul style="list-style-type: none"> - Increase by 30% the energy efficiency of electrical appliances by 2020 through the substitution of old devices with more efficient ones (green procurement) and by introducing motion sensors for the toilet lighting - Increase by 30% the energy efficiency of heating systems by 2020 through the replacement of old window and door frames of public buildings with more efficient ones 	Municipality of Lesvos - School boards	1.144		310
	Increase to 30% the total space heating energy demand supplied from heat pumps by 2020	Municipality of Lesvos - School boards	-1.332		-362
Human health and social work activities	Reduce the annual human health and social work activities energy demand growth rate by 10% by promoting every day energy saving measures from the employees and visitors	Municipality of Lesvos - Health centers - Hospital	36		10
	<p>Energy efficiency measures</p> <ul style="list-style-type: none"> - Increase by 30% the energy efficiency of air-conditioning systems by 2020 through the introduction of air-conditioning with inverter - Increase by 30% the energy efficiency of electrical appliances by 2020 through the substitution of old devices with more efficient ones (green procurement) and by introducing motion sensors for the toilet lighting - Increase by 30% the energy efficiency of heating systems by 2020 through the replacement of old window and door frames of public buildings with more efficient ones 	Municipality of Lesvos - Health centers - Hospital	189		51
	Increase to 30% the total space heating energy demand supplied from heat pumps by 2020 - Increase to 30% the total hot water energy demand supplied from solar thermal by 2020	Municipality of Lesvos - Health center	-55	144	23
Other services	Reduce the annual other services energy demand growth rate by 10% by promoting every day energy saving measures from the professionals	Municipality of Lesvos - Local association	361		96

	Energy efficiency measures - Increase by 30% the energy efficiency of air-conditioning systems by 2020 through the promotion of air-conditioning with inverter - Increase by 20% the energy efficiency of electrical appliances by 2020 through the promotion of old devices substitution with more efficient ones	Municipality of Lesvos - Local association	1.498		400
	Increase by 20% the total space heating energy demand supplied from heat pumps by 2020	Municipality of Lesvos - Local association	-206		-57
Public lighting	Reduce the annual public lighting energy demand growth rate by 10% through the promotion of energy saving measures from the local authorities.	Municipality of Lesvos - PPC	135		37
	Increase by 20% the energy efficiency of public lighting systems by 2020 through the spatial and technical optimization of the lighting network.	Municipality of Lesvos - PPC	725		197

Table 4.8. Details for the actions planned in the tertiary sector

ENERGY SAVINGS TARGET IN 2020 [MWh/year]	RENEWABLE ENERGY PRODUCTION TARGET IN 2020 [MWh/year]	CO2 REDUCTION TARGET IN 2020 [ton/year]
TERTIARY SECTOR		
11.648	25	3.154

Table 4.9. Summary table of the actions planned in the tertiary sector

4.5. Transports

In the following tables details of the actions planned for the transports sector are presented. The main focus is given on the promotion of eco-driving techniques by the respective users and the introduction of electric vehicles (EVs) in the island's fleet in collaboration to companies relevant to each sub-sector (buses, taxis, etc.) and the citizens. The increase of electricity consumption through the use of EVs leading to a reduction of fossil fuels is promoted considering the fact that the local production of electricity from RES will be also promoted through the ISEAP.

The municipality will function as an example for the rest of the transports sector being the first to implement the proposed actions to the public fleet.

SECTORS AND FIELDS OF ACTION	ACTIONS	RESPONSIBLE FOR IMPLEMENTATION	EXPECTED ENERGY SAVINGS [MWh/year]	EXPECTED RENEWABLE ENERGY PRODUCTION [MWh/year]	EXPECTED CO2 REDUCTION [ton/year]
TRANSPORTS SECTOR					
Passenger transport by road (public transport, taxi, tourism, transfers, etc.)	Double the annual passenger transport by road energy demand growth rate in favour of public transport by 2020 by assuring the quality offered by the public transports and promoting its use and by constructing bike roads.	Municipality of Lesvos - Lesvos KTEL	-47		-12
	Increase by 20% the energy efficiency of passenger transports by road by 2020 through the promotion of eco-driving practices.	Municipality of Lesvos - Transfer operators - Taxis	113		30
	Increase to 10% the passenger transport by road energy demand supplied from electricity by 2020 through the introduction of hybrid – electrical buses	Municipality of Lesvos	-89		-24
Other fleet for public and private services	Increase by 20% the energy efficiency of other fleet for public and private services by 2020 through the promotion of eco-driving practices.	Municipality of Lesvos	13.696		3.611
	Increase to 10% the other fleet for public and private services energy demand supplied from electricity by 2020 through the introduction – promotion of hybrid – electrical vehicles.	Municipality of Lesvos	-10.847		-2.981
Freight transport by road and removal services	Increase by 20% the energy efficiency of Freight transport by road and removal services by 2020 through the promotion of eco-driving practices.	Municipality of Lesvos	665		167
	Increase to 10% the passenger transport by road energy demand supplied from electricity by 2020 through the promotion of hybrid – electrical trucks.	Municipality of Lesvos	-395		-111
Private transports	Reduce to half the annual private transports energy demand growth rate by 2020 through the promotion of sustainable transports (public transports, bicycle).	Municipality of Lesvos	-8.443		-2.126
	Increase by 20% the energy efficiency of private transports by 2020 through the promotion of eco-driving practices.	Municipality of Lesvos	27.110		6.826

Increase to 10% the private transports energy demand supplied from electricity by 2020 through the promotion of hybrid – electrical vehicles	Municipality of Lesvos	-16.105	-4.508
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Table 4.10. Details for the actions planned in the transports sector

ENERGY SAVINGS TARGET IN 2020 [MWh/year]	RENEWABLE ENERGY PRODUCTION TARGET IN 2020 [MWh/year]	CO2 REDUCTION TARGET IN 2020 [ton/year]
TRANSPORTS SECTOR		
13.070		2.843

Table 4.11. Summary table of the actions planned in the transports sector

4.6. Secondary energy production and energy fluxes

In the following tables details of the actions planned for the secondary energy production and energy fluxes sector are presented. The municipality will promote the installation of renewable energy sources, specifically wind and PV parks, either in small or medium scale projects reassuring the respect to the island's spatial planning and the local ecosystem. The municipality will also function as a hub of information and potential collaboration with investors interested to fund such projects.

SECTORS AND FIELDS OF ACTION	ACTIONS	RESPONSIBLE FOR IMPLEMENTATION	EXPECTED ENERGY SAVINGS [MWh/year]	EXPECTED RENEWABLE ENERGY PRODUCTION [MWh/year]	EXPECTED CO2 REDUCTION [ton/year]
SECONDARY ENERGY PRODUCTION AND ENERGY FLUXES					
Wind	Promotion of wind turbines installation	Municipality of Lesvos		4.863	4.297
Solar	Promotion of PV installation on the ground and on the roofs	Municipality of Lesvos		902	797
Geothermal	Promotion of geothermal energy exploitation for electricity and heat production	Municipality of Lesvos		6.105	5.265
Wind - Hydro hybrid	Promotion of the installation of a wind - hydro hybrid station with pumped storage to substitute part of the conventional power	Municipality of Lesvos		3.530	3.045
Biomass	Promotion of biomass exploitation from agricultural and urban residues for electricity production	Municipality of Lesvos		3.815	3.290

Table 4.12. Details for the actions planned in the secondary energy production sector

ENERGY SAVINGS TARGET IN 2020 [MWh/year]	RENEWABLE ENERGY PRODUCTION TARGET IN 2020 [MWh/year]	CO2 REDUCTION TARGET IN 2020 [ton/year]
SECONDARY ENERGY PRODUCTION AND ENERGY FLUXES		
	20.319	17.523

Table 4.13. Summary table of the actions planned in the secondary energy production sector

4.7. Land use planning

On this stage of the ISEAP development there are not included actions concerning the land use planning. However, the local authorities in collaboration also with the regional authorities will proceed to concrete land use planning studies in the near future resulting to actions to be included to the ISEAP on a next planning phase.

4.8. Public procurement of products and services

On this stage of the ISEAP development there are not included specific actions concerning the definition of standards for the public procurement of products and services. However, an initial phase of developing relevant actions are considered actions planned under the tertiary sector and especially the equipment for municipal buildings and public lighting focusing on the procurement of energy efficient units. On a next action planning phase it is expected these actions to be materialized also to specific procurement standards.

4.9. Citizen and stakeholders

Several actions planned under the residential, primary, secondary, tertiary and transports sectors are focusing on raising awareness of the citizens and stakeholders in order to contribute in reaching the ambitious targets of the ISEAP. The maximization of their involvement in the implementation of the ISEAP and their support and commitment to it is considered a key use for a success.

5. ORGANIZATIONAL AND FINANCIAL MECHANISMS

The success of the ISEAP besides the good planning and estimation of resources relies heavily on the organizational and financial mechanisms to be established. Specific coordination and organizational structures will be formulated and supported by staff allocated to carry out the different phases of the ISEAP implementation and monitoring. The citizens and stakeholders through their involvement to the ISEAP processes will also constitute a valuable organizational mechanism, critical for the success of this effort. However, in order for all these efforts to be materialized concrete budget allocations should be ensured by taking advantage of all possible financing sources and instruments.

5.1. Coordination and organizational structures

A two level coordination and organizational structure is decided in order to ensure the efficient implementation of the ISEAP. The steering committee on the one hand will take over the coordination during the ISEAP's different phases while on the other hand the work group will mainly focus on the realization of the actions, the monitoring of the ISEAP and the possible updating of the ISEAP contents.

Steering Committee:

- The Mayor of Lesvos
- DAFNI (Network of Aegean Islands for Sustainability)

Work group:

- The energy representative of the municipality
- The technical department of the municipality
- DAFNI (Network of Aegean Islands for Sustainability)

5.2. Staff capacity

It is absolutely clear that the ISEAP implementation and monitoring will require the allocation of devoted and committed staff that will be able to set the ISEAP as their occupation priority. The staff is consisted of:

- The energy representative of the Municipality of Lesvos (1 person)
- The technical department of the Municipality of Lesvos (2 persons)

Furthermore, it is of the municipality's main pursuit to involve the most of the citizens and especially school students in the process of the ISEAP implementation on a volunteering base, especially for the period when energy audits and intense monitoring processes will be taking place.

5.3. Involvement of stakeholders

In order to reassure the active involvement of stakeholders in the implementation of the ISEAP frequent ISEAP info days and conferences will be organized.

Further involvement of the citizens is expected since periodically they will be asked to fill in energy audits in order to monitor the progress and change in their energy behaviours.

Also, specialized meetings and discussions will be held among the steering committee and the stakeholders related to specific sectors in all steps of the ISEAP implementation in order to maintain their interest and commitment to the ISEAP targets.

5.4. Budget

(The budget will be finalized upon the final approval of the ISEAP)

5.5. Financing sources and instruments

Securing the necessary financing sources and instruments for the successful implementation of the ISEAP will be one of the major challenges for the municipality. In the following list some of the expected financing sources are presented.

- Municipal budget allocations
- Regional budget allocations
- Loans
- Revolving funds
- NSRF (National Strategic Reference Framework)
- European Investment Bank
- Private investments
- Citizen cooperatives
- Third party financing
- Public and private sector partnerships

5.6. Monitoring and follow-up

The Energy - CO₂ and ISEAP monitoring tools developed under the ISLE-PACT project will be used in combination to energy audits in order to monitor the success of the ISEAP and the development of Lesvos' energy profile. The monitoring task will be taken over by the work group. An ISEAP monitoring template and a respective report will be submitted at least every two years to the European Commission in order to highlight the progress in the ISEAP implementation.

Bibliography

Elaboration:



Local and regional authorities:

Municipality of Lesvos



ΠΕΡΙΦΕΡΕΙΑ ΝΟΤΙΟΥ ΑΙΓΑΙΟΥ
ΕΝΔΙΑΜΕΣΗ ΔΙΑΧΕΙΡΙΣΤΙΚΗ ΑΡΧΗ

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