CEP-REC
Regional Energy Concepts

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Introduction of Regional Energy Concepts

REPORT ON ENERGY DEMAND SIDE ASSESSMENT IN THE PROVINCE OF TORINO

PROVINCIA DI TORINO

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Summary

1 Consideration for energy demand modelling

1.1 DESCRIPTION OF THE CONCEPT REGION

Description of the Concept Region	*Name: Province of Turin*
position within the European Union division per NUTS	*NUTS2 : Piedmont – ITC1* *NUTS 3 : Torino ITC11*
Population profile – number of inhabitants	*2.247.780 (year 2011-ISTAT)*

Among Italia provinces, Turin is one of the wider and the one with the greatest number of municipalities (316 in total). The larger part of Municipalities are very small and 113 of them do not even reach the 1,000 inhabitants and grouping the 2.57% of the overall provincial population. The resident population (equal to half of the Piedmont's population, 52%, and about 4% of the whole National country) is focused mainly in a few larger towns located on the plain territory. The population density is very different within provincial borders, as in the main urban centers it is around 910 inhabitants/km^2, whereas in mountain areas is equal to 40 inhab./km^2. The average density value is about 328,60 inhab./km^2.
In the municipalities with more than 10,000 inhabitants (precisely 28, located mainly in the plain and at the foothills) lives approximately 75% of the overall population.
In the table below the most important demographic data about the concept region regarding the most recent year available: 2011 is reported.

Index	Male	Female	Total
Total population	1081298	1166482	2247780
Births	2400	2295	4695
Deaths	2649	2873	5522
Natural balance	-249	-578	-827
Registered from other municipalities	6944	7136	14080
Registered from foreign countries	1564	1827	3391
Other registration	495	360	855
Deleted to other municipalities	7274	7383	14657
Deleted to foreign countries	369	310	679
Other deletion	3501	3060	6561
Net migration and other reasons	-2141	-1430	-3571
Resident population in family	1073309	1155242	2228551
Resident population living in cohabitation	5599	9232	14831
Number of household	1053615		
Number of cohabitation	1214		
Average number of members per household	2.12		

Table 1.1 – Demographic balance of province of Turin 2011.(Source: ISTAT)

The dynamic recorded in the last 10 years and shown in the table and chart below, presents a little increase of the total population of the concept region from the 2001 to the 2010 with a single drop during the last year (2011).

Year	Residential population	Variation	Percentual variation
2001	2.165.299	-	-
2002	2.172.226	6.927	0,32%
2003	2.191.960	19.734	0,91%
2004	2.236.941	44.981	2,05%
2005	2.242.775	5.834	0,26%
2006	2.248.955	6.180	0,28%
2007	2.277.686	28.731	1,28%
2008	2.290.990	13.304	0,58%
2009	2.297.598	6.608	0,29%
2010	2.302.353	4.755	0,21%
2011	2.247.780	-59.031	-2,56%

Table 1.2 – Demographic trend about resident population of the region

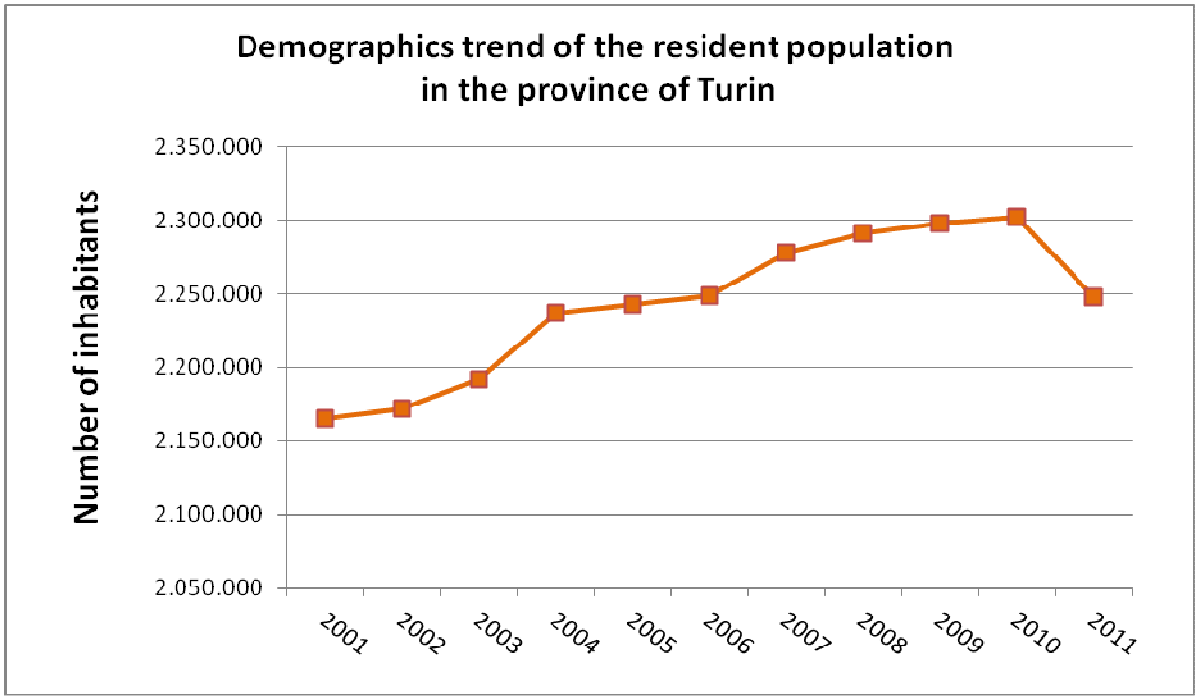


Figure 1.1 – Demographic trend about resident population of the region. (Source: ISTAT)

The table below shows the number of transfer of residence to and from the province of Turin in recent years (from 2002 to 2011). The changes of residence are listed as registered and deleted from the municipalities of the province.

Year	Registered			Deleted			Net migration with foreign countries	Total net migration rate
	From other municipalities	From foreign countries	For other reasons	To other municipalities	To foreign countries	For other reasons		
2002	59.104	8.791	4.779	59.627	1.364	1.803	7.427	9.880
2003	56.910	26.673	5.084	60.418	1.620	2.802	25.053	23.827
2004	63.685	18.066	35.874	66.186	1.769	3.212	16.297	46.458
2005	62.039	13.881	3.195	66.322	2.038	2.447	11.843	8.308
2006	67.259	11.978	1.880	69.515	2.078	1.304	9.900	8.220
2007	68.567	36.706	1.462	72.188	2.202	1.777	34.504	30.568
2008	68.322	23.963	970	70.411	3.081	4.527	20.882	15.236
2009	63.195	18.243	1.237	64.069	3.189	6.146	15.054	9.271
2010	64.613	16.918	1.983	64.642	2.971	8.460	13.947	7.441
2011	50.520	11.747	1.743	49.666	2.331	4.758	9.416	7.255

Table 1.3 - Detail of the migratory behavior from 2002 to 2011. (Source of data: ISTAT)

From the demographic point of view, Turin province is an area where the population is not growing and it has a high rate of aging. From the peak reached in 1981, the population of the province has contracted, and then resume growing in recent years. According to ISTAT estimates this data is intended to remain stable over the next few decades, mainly due to the effect of migration.

Regarding the housing situation of the concept region, the table below shows how many buildings are used to residential purposes (about 300 thousand) and also the fact that the number of dwellings available through the entire territory is almost the same of the number of families (1053615 – table 1). Besides 67% of houses are owned by the resident people, whereas the rest 33% are rented.

Index	Value
residential buildings	297.330
dwellings in residential buildings	1.077.023
average number of rooms per dwelling	3,54
average size of dwelling	82,87
dwellings occupied by residents	920.264
dwellings occupied by residents in property	614.191
dwellings occupied by residents for rent	240.898

Table 1.4 - Detail of the housing situation in the province of Turin.

It's a very important province in terms of real estate and about 55% of all the real estate trade in the region are published in the province. The average price of homes is 1800 €/m^2, lower than the Piedmont average price. As far as trade for sale is concerned, the type most traded consists in flat apartments with a total of 47941 ads, followed by single family houses (17752 ads). The type most traded for rent instead consists in small apartments. The largest number of real estate listings is published in the municipality of Turin (45%).

1.2 GEOGRAPHIC

Name of the Concept Region:	*Province of Turin*
Position of the region and its bordering regions including inland and neighbouring countries if applicable.	*Italy, Piedmont Region..* *West border: France, north border: Valle d'Aosta, east border: Province of Biella, Asti, Vercelli and Alessandria, south: province of Cuneo.*
Neighbouring countries EU distance	*West :France, north: Austria, east: Slovenia, south: Mediterrean Sea.*
Neighbouring countries distance non-EU	*North: Switzerland*
Network connections (pipeline, transmission networks, grid networks)	*---See the paragraph and figures below---*

The concept region is located in the north-west part of the country and it is bordered to the west by France for 186 km (36% of the French-Italian border), to the north by Valle d'Aosta Region, to the east with the Province of Biella, Asti, Vercelli and Alessandria and to the south with the Province of Cuneo.

The Province of Turin covers an area of 6,830 km^2 (equivalent to more than a quarter of the region and to 2.26% of the entire national territory) and it's the one with the greatest number of municipalities among the Italian provinces (316, year 2013).

It's possible to have all the information about the municipalities in the attachment (named "*Province of Turin – Municipalities data 2011-12")*. The morphogenetic processes and climatic-biological changes shaped over the millennia a highly diversified territory, characterized by ridges, watersheds, valley lines, edges terrace, contributing to the formation of three distinct macro-systems: mountain (52%), hill (21%) and plain (27%) as shown in the next table and in figure 1.3.

Figure 1.2 – Location of the Province of Turin at national level.

ISTAT – altimeter class	Surface area (km^2)	Surface area (%)	Number of municipalities
Mountain	3581	52,43	107
Hill	1428	20,90	126
Plain	1821	26,67	83
Total	**6830**	**100 %**	**316**

Table 1.5 – Macro-systems and their surface area. (Source: PTC2 – data from ISTAT)

Regarding the main infrastructure for mobility of the Province of Turin, the map under figure 1.4 provide a general overview. From this map it could be understood the fact that the Turin metropolitan area is the centre of the concept region and attracts all the relevant infrastructure due to its dominant economic rule. Moreover the plain part of this territory is very infrastructured , instead the other parts (in particular mountain) are more free because of their morphological problems.
The territory is crossed by 3895 km of roads (considering the national-provincial roads and highways) with a rate of 0,57 km per sqkm of the surface area of the province. The transport demand has grown due to changes in consumption patterns and processes of outsourcing and decentralization of businesses.

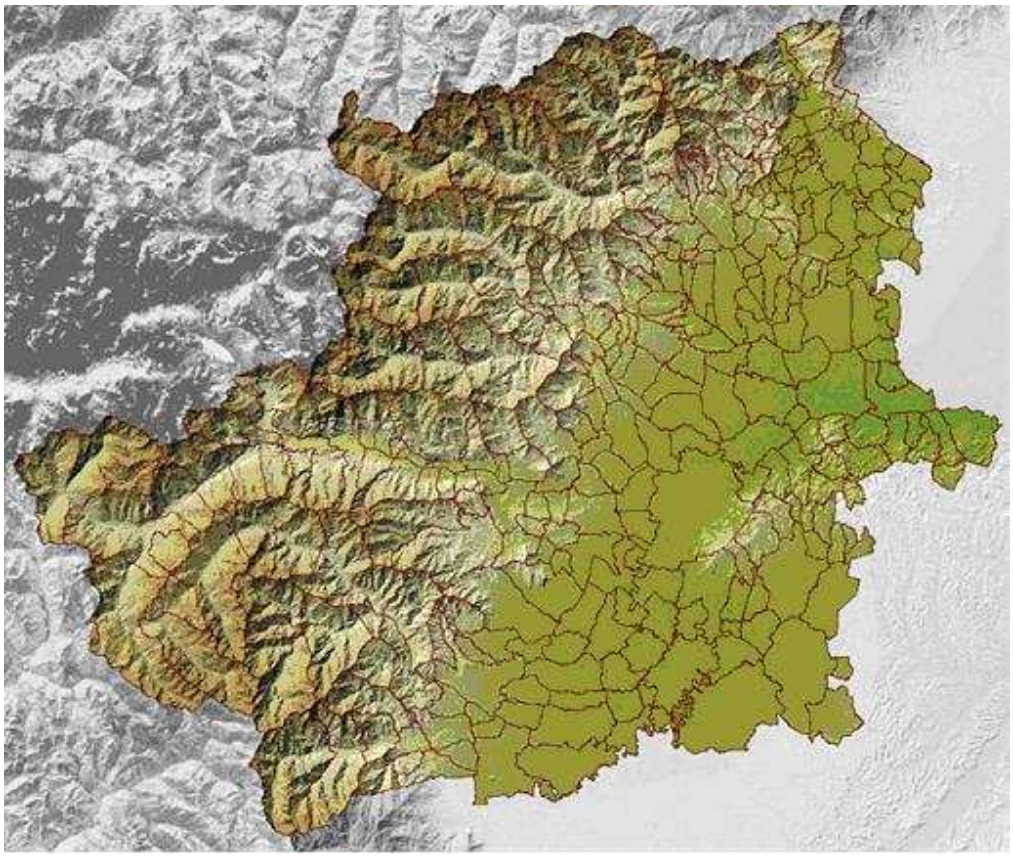


Figure 1.3 – Morphological map of the concept region with municipalities' borders. (Source: PTC2)

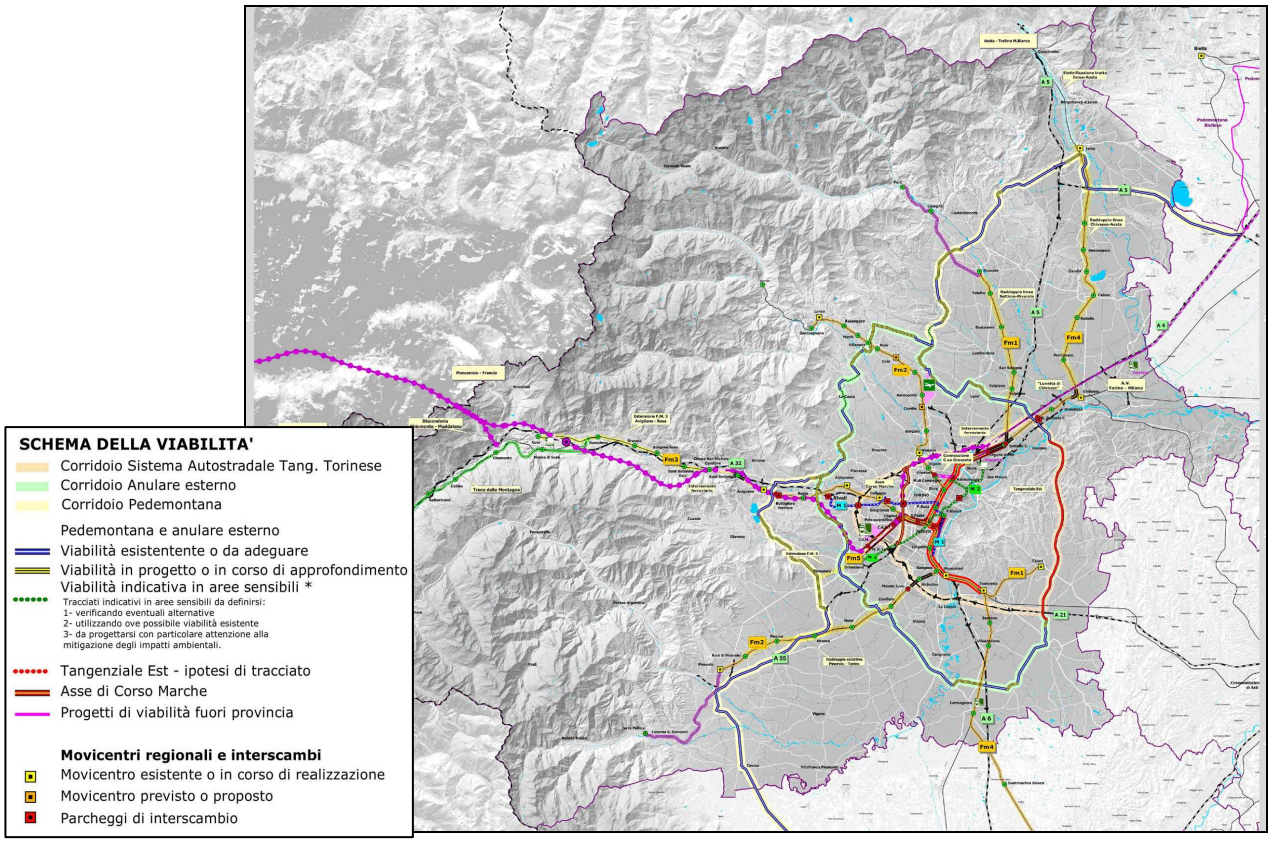


Figure 1.4 – Infrastructures map of the concept region. (Source: PTC2- table 4.1)

Between 1990 and 2010, there was an overall decrease in the mobility, but during last years (2006, 2008, 2010) it's possible to see a little increase (figure 1.5).
Compared to 2008, the population of the concept region uses more the motorized vehicles, about +7%; non-motorized mobility decreases by 3.8%. In 2010, it's possible to find a revival of the market share of public transport in and around Turin Province although with different intensity and in the presence of variations in volume. Infact the 34% of residents used public transportation in Turin-city. The market share from 2008 marks a recovery. In the metropolitan area, the movement increases a lot but not the market share that is stable on 16%.
The analysis of the current volume of passenger and freight traffic confirms the absolute predominance of road transport, with the following features:
- high concentration of traffic on some critical guidelines;
- unbalanced geographical distribution of demand;
- high rate of movement of goods and passengers over short and medium distances.

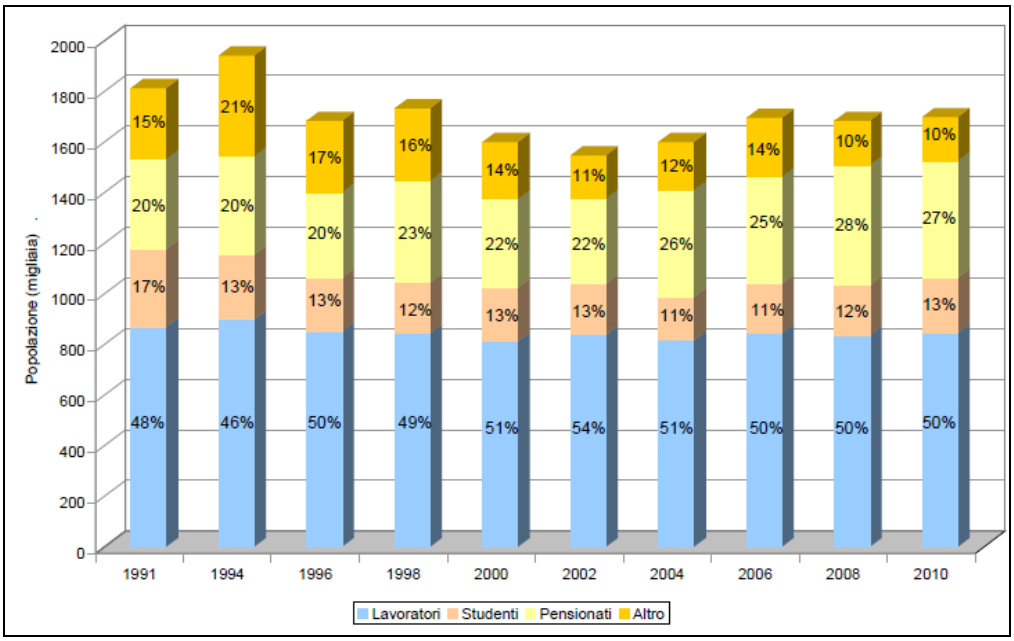


Figure 1.5 – Trend of population movement divided by categories (Workers, students, retired)

Finally regarding the energy networks connections, it's possible to point out that the region is well served by the foreign lines. As Italy id highly dependent from foreign supplies and the province of Torino, being a border region, have important connections with France about electricity and with Switzerland (Netherlands and Norway to be precise) and Russia for natural gas supply (from Tarvisio gate).
The following maps show the described situation (figure 1.6, and 1.7).

About the concept region, in 2011, only the 7% of total consumption comes from domestic production. It's in fact confirmed the strong dependence of the provincial energy from foreign supplies (about 93%), in particular natural gas, accounting for 66%. This percentage is almost equal to the average of the last five years and are not observed the important processes of transition to other energy sources. Because of the lack of fossil energy reserves, the only way to limit the external supply and consumption of natural gas is to resort to a more consistent use of renewable energy.

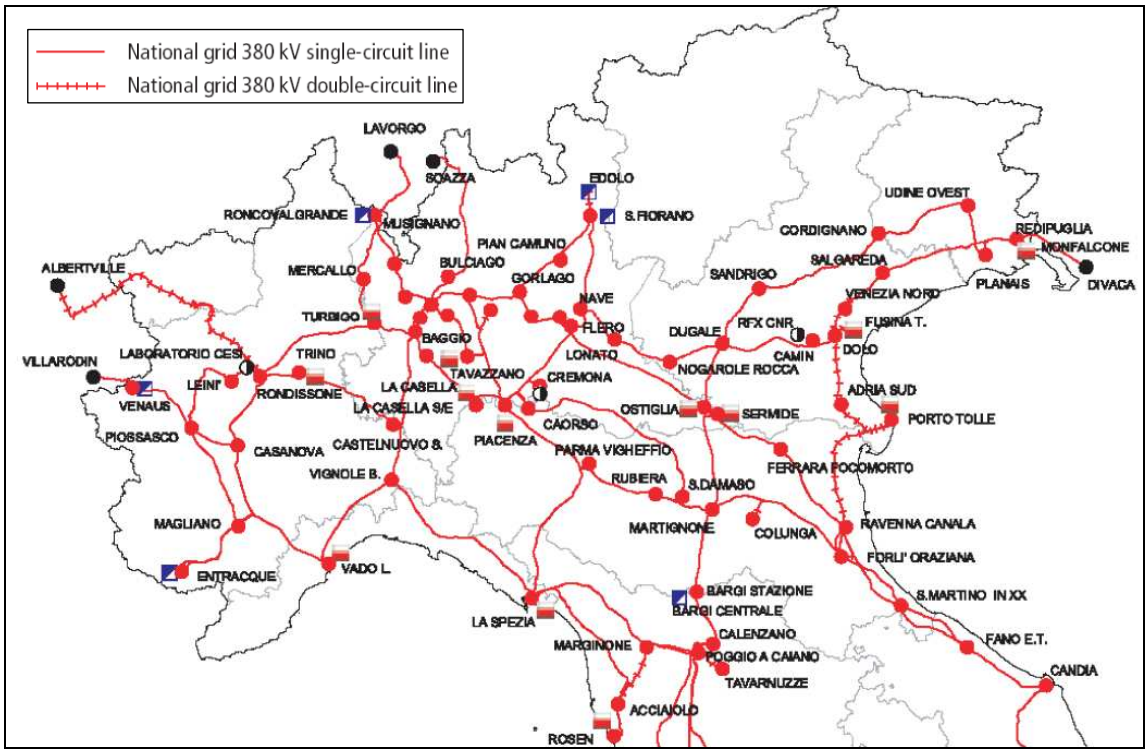


Figure 1.6 – Electricity networks map of the North of Italy

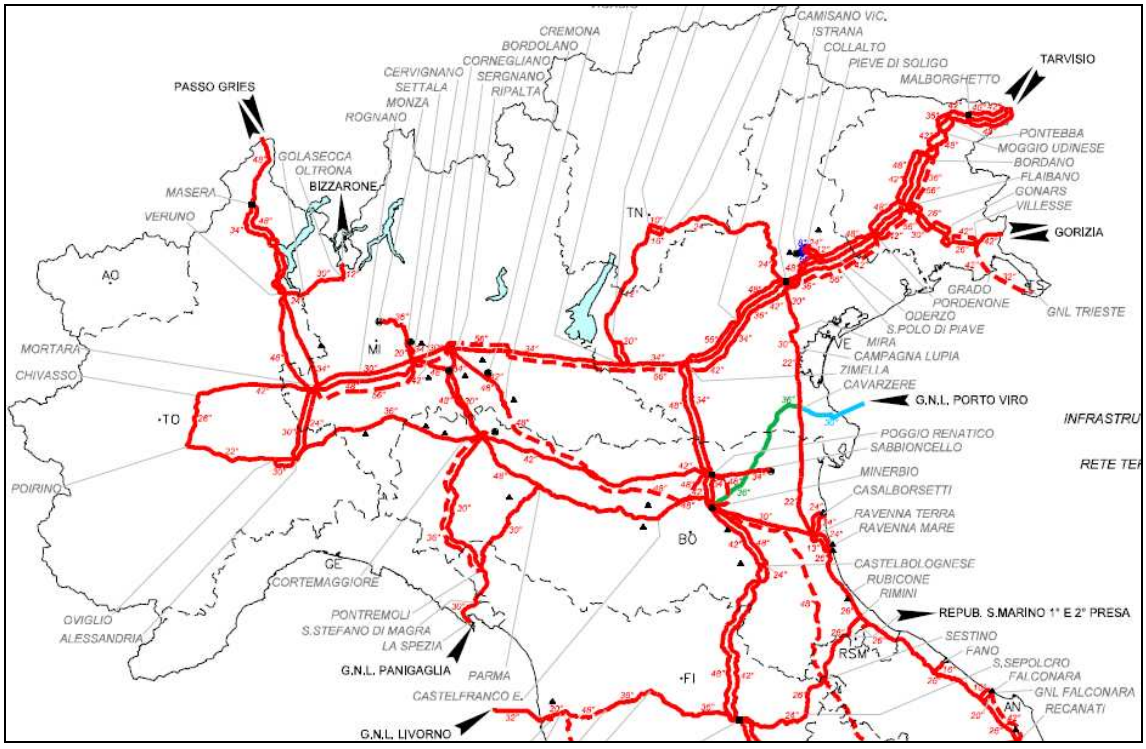


Figure 1.7 – Pipeline networks map of the North of Italy

1.3 ECONOMIC

Economic index	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
Statistics on the scale of economy Added Value (million €)	56.618	58.296	59.356	54.360	58.646	57.976
Total population	2.248.955	2.277.686	2.290.990	2.297.598	2.302.353	2.247.780
Statistics on the scale of economy Added Value per capita (€)	25.175	25.594	25.908	23.659	25.472	25.792
Statistics on Added Value as per cent of the country	4,27%	4,22%	4,21%	3,98%	4,20%	4,10%
Agriculture business share of the total added value	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*
Commercial/services share of the total added value	*70%*	*69%*	*71%*	*73%*	*71%*	*73%*
Industries share of the total added value	*29%*	*30%*	*28%*	*26%*	*28%*	*26%*

In the Province of Turin, in the last fifty years, the economic structure has changed dramatically: the relationship between industry and the tertiary sector is literally upside down: in 1951 the industry provided the 69% of the value-added, and the services the 28%. The strong process of outsourcing has helped to create new jobs and reduce unemployment that is aligned generally around average values of the North-centre of Italy, but remained very high for young people. The growth of wealth per capita was less than the average of industrial areas of North. Although nowadays it is still higher than the national average, in the last decade it increased less than the rest of the country. In the early 90s, towards the middle of the decade, with the recovery of some key sectors such as the automotive and mechanics, and with the affirmation of the “new economy”, there was new demand for "non-traditional" sectors, more related to services. The industrial production of the concept region, after being dropped by -18.4% in 2009, much more than the regional level, expressed in 2011 a constant tendency to recovery compared to the corresponding levels in 2009, with a gradual recovery, which reached the 8.3% annual average. In the manufacturing sector, the production level remains below 10% compared to value of 2007, before the crisis. The dynamics of 2011 was still higher than the regional average. The growth in export value, although decelerating compared the previous year, continued to increase in value close to 10%, recovering completely lost ground during the crisis (2009). The export of the province is slightly below the regional average in 2011 and it grew by 9.6% in comparison to previous years, partly recovering the strong decrease faced in 2009 and 20110. Such growth was concentrated mainly towards Germany, France and the UK (around 10%); whereas exports to Poland, the third market of the province, decreased (-1.5%). Outside Europe, it’s possible to note a slowdown in exports compared to the sustained growth of the previous year. Export to Japan and BRIC decreased, whereas to the United States rose by 13.7%. Finally regarding one of the most relevant economic sector, the automotive, the exports of motor vehicles decreased by 11, 8%, while the components has seen a substantial stability (+1%) of export values from 2010 (the export self represents 13% of the province's total, the components more than 21%).

Percentual variation of:	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Industrial production	-2,90	-6,10	-3,70	-5,10	-3,30	-3,80	3,20	-3,60	-18,40	8,30	5,10
Export	2,60	-5,10	0,10	-0,10	-0,80	7,40	4,60	4,30	-24,50	14,00	9,60

Table 1.6 – Percentual variation of Industrial production and export. (Source: IRES Piemonte)

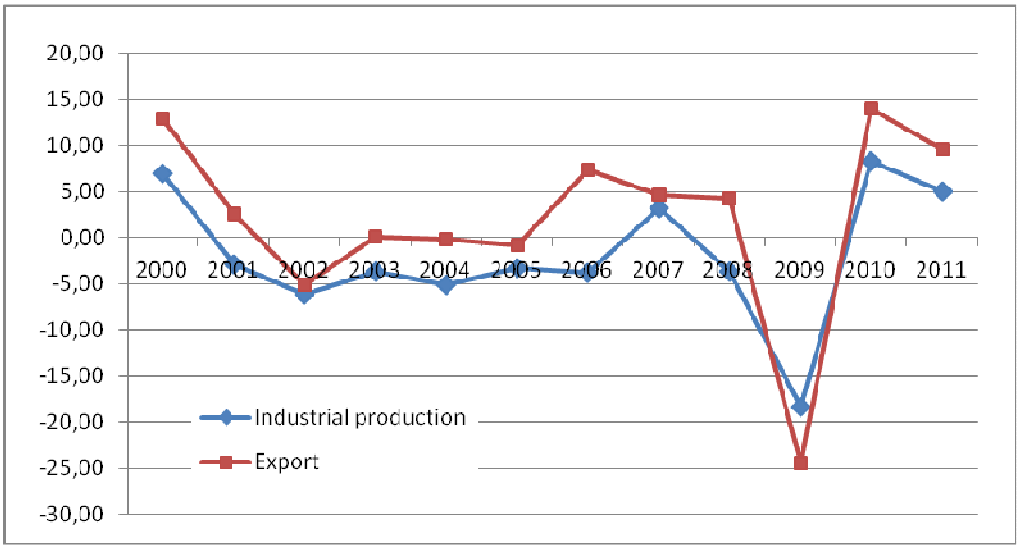
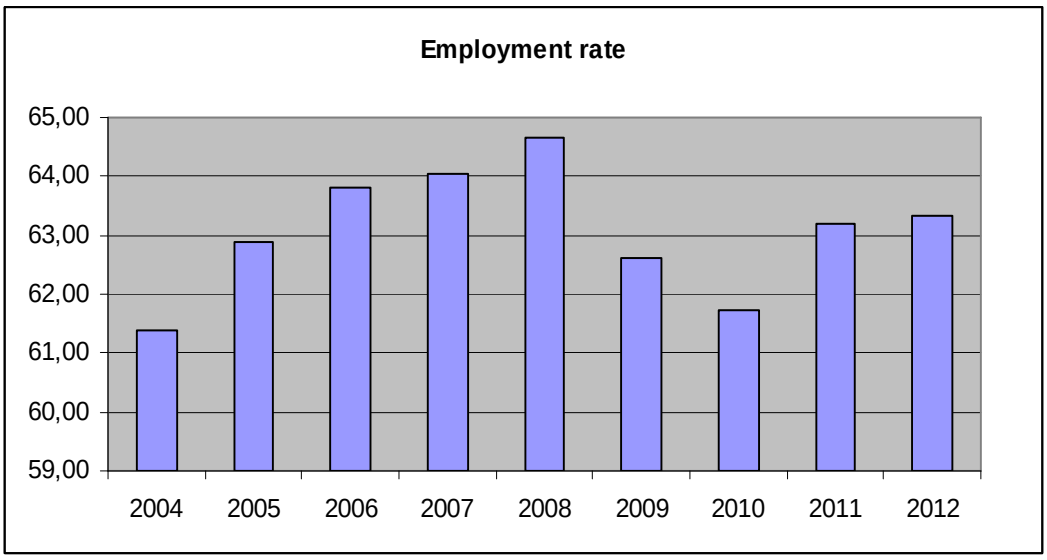


Figure 1.8 – Percentual variation of Industrial production and export

Regards the labour market, the concept region confirms, however, a more worrying situation compared to other territories in Piedmont region and the unemployment rate keeps being considerably above the regional average. Despite this worrying rate, in the province of Turin focuses almost the entire increase of regional employment in 2011 (about 22 000 additional employees in the province). The rate now, in 2013, is still above 9% and it's not falling down.

Province of Turin	2004	2005	2006	2007	2008	2009	2010	2011
Employment rate	61,39	62,89	63,81	64,03	64,67	62,61	61,74	63,20
Unemployment rate	6,11	4,83	4,13	4,69	5,61	8,32	9,43	9,16

Table 1.7 – Employment and Unemployment rate. (Source: ISTAT)



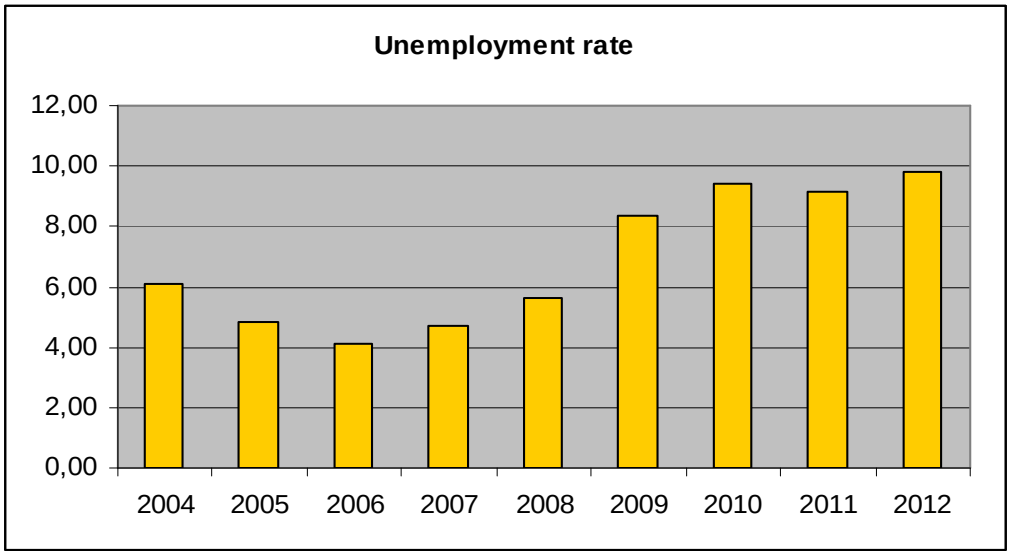


Figure 1.9 – Employment and Unemployment rate. (Source: ISTAT)

Considering the overall provincial economics, it's worth noting that the most important sector is the tertiary sector (Commerce and Services) in 2011, which provides almost 73% of the total added value. Industry comes second with the production of 26% of the total added value, whereas Agriculture counts only the 1%.

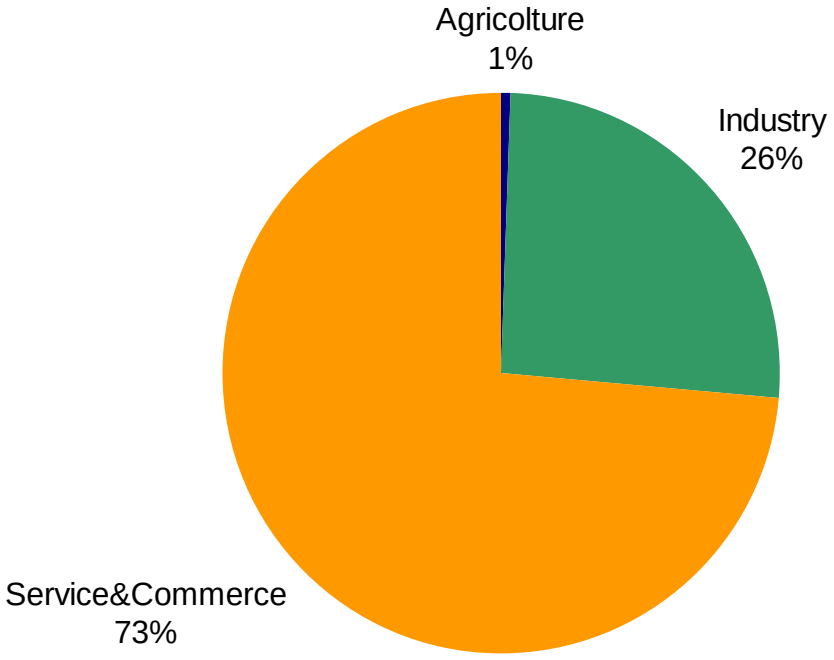


Figure 1.10 – Added value divided by sector of economy. (Source: Province of Torino)

The Provincial Plan (PTC2) places a lot of importance to the economical development if the concept region, without forgetting the environment's needs. Below it's reported a map that represents the localization of the

different areas of strategic specializations in main economical sector is reported (automotive in red, plastic-chemistry in green, textile in violet and electronics in yellow).

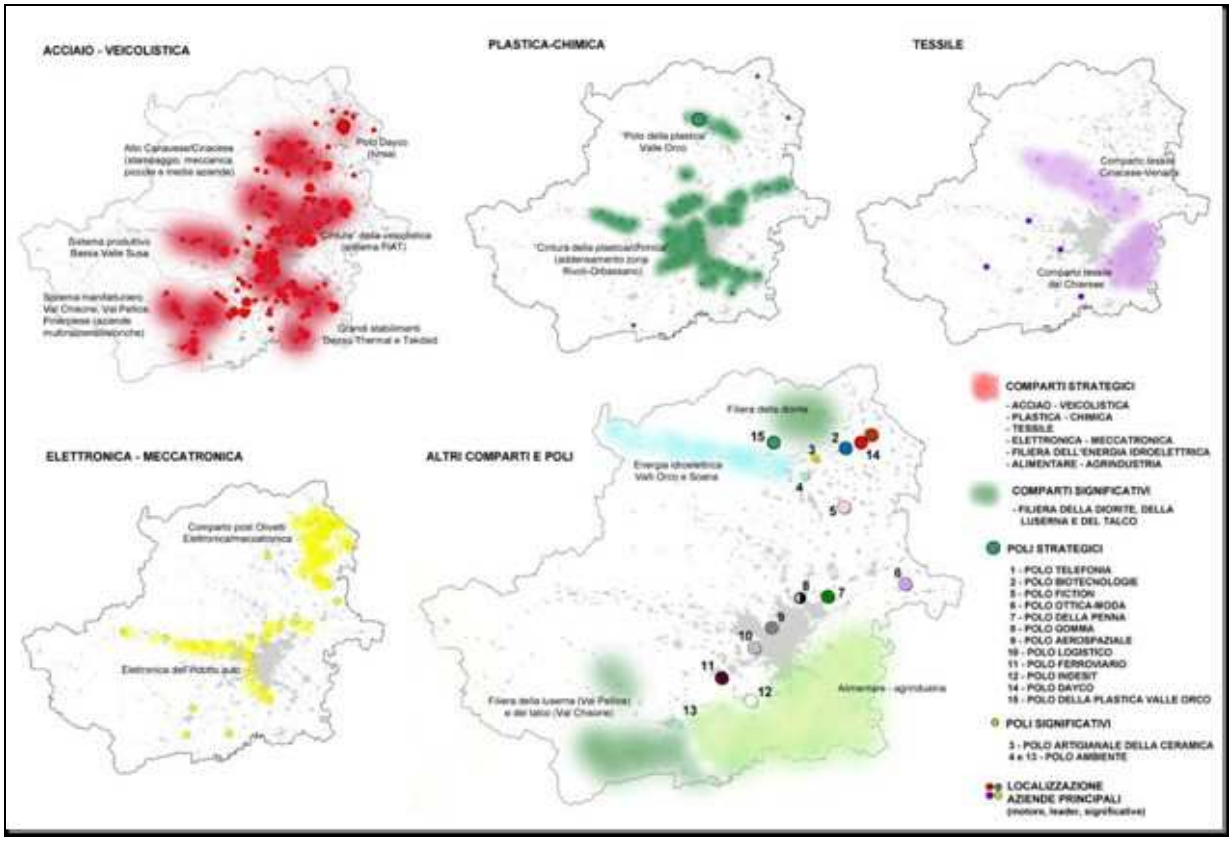


Figure 1.11 – Localization of the areas of specialization (strategic sectors and significant)

The plan has established 3 macro-objectives to pursue the development of the economical sector of the province:

1. encourage the socio-economic development of the entire territory;
2. restrain the natural resources consumption;
3. reduce the environmental pressure and improve the quality of life.

Each macro-objectives has inside some other system's objectives to reach it.

1a - strengthening the competitive position of territories (social cohesion and identity territorial);
1b - create a favourable context for the development of economic activities and capitalization of knowledge, even in the perspective of local business development;
1c - support the transition to a multipolar, diversified, specialized system.

2a - Restrain and optimize the use of land (in particular of class I and II of capacity use) and the release (sprawlig)
2b - reach the eco-efficiency of production areas.

3a - Reducing the conflict between areas for productive activities and territories with other destination, improve quality of life of citizens and quality of environment in general (landscape).

1.4 ENVIRONMENT AND CLIMATE

Name of the Concept Region:	*Province of Turin*
Describe natural environment	*For all these information see description below*
Describe climate conditions	*For all these information see description below*
Describe seasonal difference that impact the energy consumption	*For all these information see description below*
Existing water sources in m3	*For all these information see description below*
Estimated average solar radiation and wind	*For all these information see description below*

The climatic conditions of the Province of Turin are strongly influenced by the presence of Alps, whose topography is able to deflect and seal the flow of winds that reach it. According to their origin, the Alpine barrier may infact reduce the rainfall on the slope of Turin or intensify them. The plain surrounded on three sides by mountains and hills creates favourable conditions for the stagnation of cold and polluted air in winter months (thermal inversion), while in summer the local warm breezes favour the mixing of the lower layers of the atmosphere.

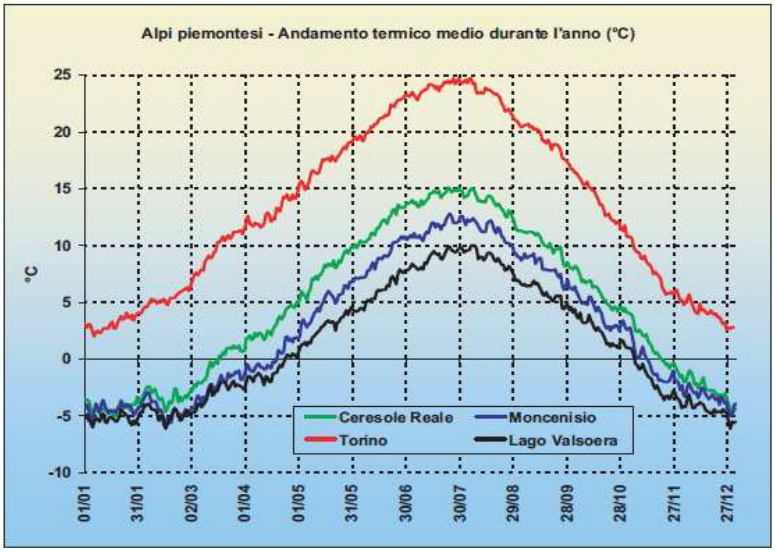


Figure 1.12 - Trend of average daily temperatures at different altitudes in Province, (Source: PTC2)

In the region, the annual average temperatures decrease by 12-13 °C of the plain to reach 0 °C on average at 2300-2500 m above sea level, according to an altitudinal gradient of about 0.6 °C per 100 m.
The coldest days of the year on average are placed in the first half of January: usually at least once a year the temperatures fall around -10 °C in the countryside outside Turin. The summer reaches its peak between late July and early August, when it is normal that the maximum day temperatures touch 30 °C in the plains.
The annual amount of rainfall will increase approaching the Alps from the plains, due to the effect of forced lifting imposed by the relief on the air coming from the humid Mediterranean air cooling that follows and vapour condensation results in increased cloud cover and precipitation.
Regarding wind situation, the protection offered by the Alps is reflected in a weak and irregular wind speeds. The frequent atlantics winds, lively on the plains north of the Alpsare felt mostly in the high mountains, while the plains and the valleys are dominated by breezes and local winds. The few days with strong wind can be attributed to Foehn wind that - especially between autumn and spring – comes dry and mild from the main ridge of the Alps towards the plain, or, in the summer months, rapid and irregular storms, capable of

significant damage but on limited areas. Almost everywhere the months from March to August are the most ventilated thanks to the contribution of the constant breezes, while from September to February the wind speed decreases.
About the solar radiation, it's possible to say that the annual average of the entire region is about 1350 kWh/sqm; that reaches optimum value (1500-1600) for all those surfaces exposed to the south and inclined between 20 ° and 40 ° with respect to the horizontal plane. During the year, summer season obviously is the best one for radiation. Infact in Turin-city it's possible to observe value of 200 kWh/sqm.

Radiation	horizontal	vertical	optimal
minimum	1234	943	1418
average	1342	1093	1582
maximum	1469	1278	1784

Table 1.8 – Annual solar radiation in Province (kWh/sqm). (Source: Quaderni del territorio, PTC2)

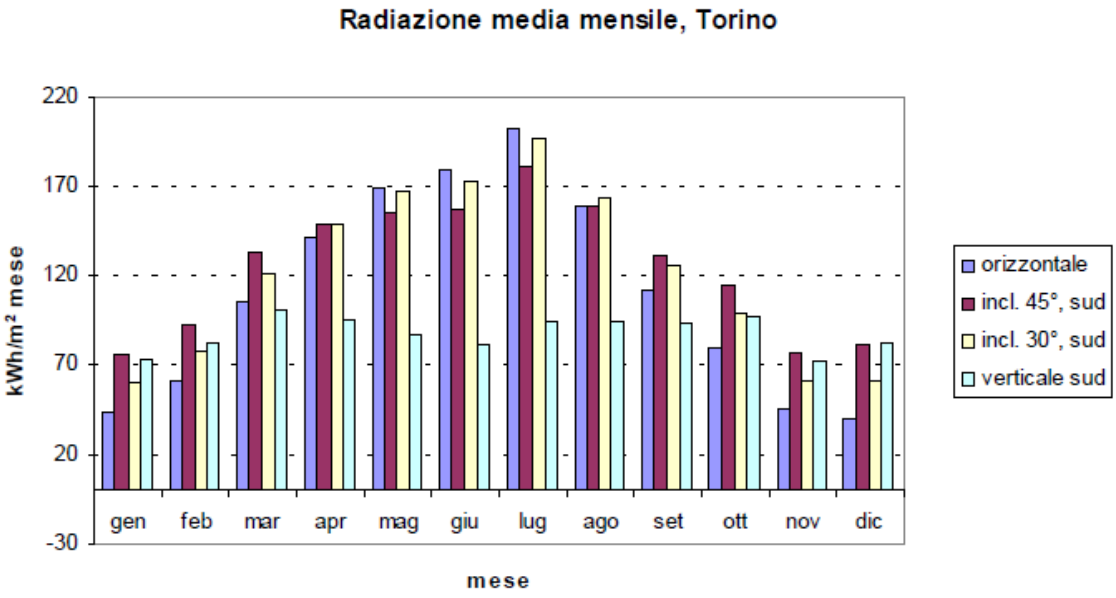


Figure 1.13 – Monthly average solar radiation in Turin-city

The Turin plain, from a hydrogeological point of view, it belongs to the immense reservoir formed by the Po Valley, and is certainly, despite the limited extension, the most conspicuous of Italy, and perhaps of the whole Europe. The territory of Turin can be divided into two parts:

- an area of the plains, which it's possible to add the Alpine valley, characterized by the presence of sediment grain size from coarse to fine and having, therefore, a variable condition of permeability. Within these deposits are various aquifers;
- an alpine area and hilly distinguished, however, by the presence of lithoid rocks essentially impermeable. Within these complexes lithoids, in correspondence of local zones of fracturing, some water circuits and sources can be present on their surface.

The chances of finding water in the two sectors, as a result of this different geo-hydrological situation, depends on the exploitation of underground aquifers through wells and on the uptake of the sources.

1.5 SOCIAL INFRASTRUCTURE

Name of the Concept Region:	*Province of Turin*
Public sector infrastructure	*number of schools: 2141 (provincia di Torino, 2011)* *number of social houses: 30.932 (2010, ATC)*
Administrative division of the region	*number of municipalities: 316 (ISTAT)* *(Excel file: "Province of Turin – Municipalities data 2011-12")*
Physical transport infrastructure in the region	*length of roads: 3895 km, 0,57 km per sqkm of surface area (provincia di Torino)*
Public lightning system in the region	*Energy consumption is 247,8 GWh/y (2011) and power installed is about 59 MW in 230.000 installations*

1.6 LEGISLATIVE SITUATION

The legislative situation of the energy sector of the Province is linked with EU directives and their national transposition. Infact nowadays they provide an accurate and detailed frame of what is to do to achieve the objectives of energy efficiency and energy saving agreed for Europe.
Below it's reported a summarization of the legislative framework with a short description of it and how the EU directives have been transposed into national, regional and local regulations.
The EU directives mentioned are:

- *Directive 2001/77/EC – on promotion of electricity produced from RES in the internal electricity market.*
- *Directive 2002/91/EC – on the energy performance of buildings*
- *Directive 2010/31/EU – on the energy performance of buildings (recast)*
- *Directive 2006/32/EC – on energy end-use efficiency and energy services and repealing Directive 93/76/EEC*
- *Directive 2009/28/EC – on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC*
- *Directive 2009/72/EC – concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC*
- *Directive 2009/125/EC – establishing a framework for the setting of eco-design requirements for energy-related products (recast).*
- *Directive 2012/27/EC – on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU, subsequently repealing Directives 2004/8/EC and 2006/32/EC.*

At national level, the transposition of these directives is almost completed through the following list of decrees:

- *D. Lgs. 29/12/2003, n.387* transpose Directive 2001/77/EC

This decree aimed to promote a greater contribution of renewable energy sources to electricity production in Italian and Community market; promote measures for achieving the national indicative targets; contribute to the creation of the basis for a future Community framework thereof and foster the development of electricity

microgeneration plants fueled by renewable sources, particularly on farms and in mountainous areas.

- *D. Lgs 19/8/2005, n.192 and D. Lgs 29/12/2006, n.311* transpose Directive 2002/91/EC – Directive 2010/31/EU and Directive 2012/27/EC.

These decrees establish criteria, conditions and procedures to improve the energy efficiency of buildings in order to promote the development, enhancement and integration of renewable; apply minimum energy performance requirements for new and existing buildings, ensure the certification of building energy performance and require the regular inspection of boilers and air conditioning systems in buildings. The Directive 2012/27/EC is too recent for a transposition so only the transposition of the others is reported.

- *D. Lgs 30 maggio 2008, n. 115* transpose Directive 2006/32/EC

This decree, in order to contribute to the improvement security of energy supply and environmental protection, establishes a framework of measures to improve energy end-use efficiency in terms of costs and benefits. It sets indicative targets, mechanisms, incentives and institutional, financial and legal framework necessary to eliminate barriers that exist on the market that impede the efficient end-use of energy.

- *D. Lgs 3 marzo 2011, n. 28* transpose Directive 2009/28/EC

This decree defines the tools, mechanisms, incentives and institutional, financial and legal framework necessary for the achievement of the objectives 2020 in relation to overall share of energy from renewable sources in gross final consumption of energy and share energy from renewable sources in transport (EU has committed itself to reach a 20% share of renewable energy in final energy consumption and a 10% share of renewable energy in transport).

- *D. Lgs. 28/06/2011, n.93* transpose Directive 2009/72/EC

This decree is aimed at introducing common rules for the generation, transmission, distribution and supply of electricity. It also lays down universal service obligations and consumer rights, and clarifies competition requirements.

- *D. Lgs. 16/02/2011, n.15* transpose Directive 2009/125/EC

This decree establishes eco-design requirements for energy-related products in the European Union. All products covered by implementing measures must bear EC marking before being placed on the market.

At the regional level, concerning energy efficiency of buildings, introduction of RES in the buildings and authorization procedure for power plants, these are typically fields where Italian Regions have a large autonomy. Infact, Regione Piemonte has been particularly active. Through this route it was able to introduce in the legislative framework higher standards of energy efficiency for buildings, specific procedure for energy performance and maintenance of domestic boilers and also authorization criteria for RES power plants. The list of most important Regional Laws and Decree are shortly described in the followings.

Regional Law n. 13, 28 maggio 2007
(regional transposition of D.Lgs 19/8/2005, n.192 and D.Lgs 29/12/2006, n.311 and Directive 2002/91/EC)

1. The law design the framework for the Regional energy performance certification system of buildings:
   - Terms and conditions for the application of the energy performance certification
   - Professionals able to deliver the energy performance certification
   - Sanctions and checks
2. The law design the framework for the energy performance and maintenance of domestic boilers (Deadlines for maintenance procedure, qualification procedure for the maintenance activities, …)

3. As for energy efficiency standards for buildings, the law promote the insulation of buildings and the centralized systems for the space heating of buildings
4. As for RES in buildings the law promote the integration of solar energy in buildings. Solar thermal energy is compulsory in new buildings and in buildings under renovation with more than 1000 square meters of floor area (60% of hot domestic water should be provided). If solar energy is not possible, due to technical reasons, another RES must be adopted.
   RES plants for electricity production are compulsory in new buildings and in buildings under renovation with more than 1000 square meters of floor area (as requested by the Law Decree n.192/2005, annex I paragraph 13) .
5. For new and under renovation buildings with more than 1000 square meters of floor area and with more than 4 units is compulsory to install a central heating system for the production of hot domestic water and for winter heating (with some exception specified in art. 19, 2nd paragraph).
6. If the owner doesn't install solar thermal or other RES plants as specified in the law he's subjected to economic sanctions. Violations are detected by the competent municipality.

Decree 4 August 2009, n. 43-11965

1. EPCs are compulsory for new buildings, for buildings under renovations. It's to be attached to the agreements for sale and must be provided during rental agreements
2. All professionals registered to a Professional Order can deliver the EPCs
3. For those who are not qualified, the qualification can be obtained overcoming an official regional test. Training sessions can be organised by Professional Orders, Energy Agencies and Universities
4. Methodologies for the calculation of the energy performance of Buildings is described
5. A web based procedure for the delivery of the EPCs is managed by Piedmont Region.

For existing buildings, in the EPC the annual consumption data of fuel, electricity and energy from renewable sources are reported (1 year requested).

Decree 4 August 2009, n. 45-11967

1. At least 60% of hot domestic water must be provided by solar thermal energy in new buildings and in existing buildings under renovation with more than 1000 square meters. If solar energy is not possible, due to technical reasons, another RES must be adopted. The Decree obliges some categories of buildings to cover the expected energy demand with solar thermal panels: public buildings hosting offices are an example.
2. During the planning stage is necessary to project the buildings with a particular attention to the orientation of the roof, maximizing the sun radiation and the available surface for the panels.
3. A list of sheets show how the integration of solar energy panels is possible in buildings (in case of pitched roof the solar thermal panels have to follow the same orientation and tilt angle of the pitch and the tank can't be placed on the roof). Municipalities can define in their Buildings Codes some specifications about the minimum level of the architectural integration of solar panels in buildings.
4. All windows that get direct sun radiation must be shaded by external shading systems able to prevent the 70% of summer irradiation to get in the building
5. Municipalities must define in their Buildings Codes the compulsoriness of PV systems for buildings, but solar thermal energy must be the first choice.

Solar greenhouses are promoted with constructive facilitation.

Decree 4 August 2009, n. 46-11968

The decree fix important standard in different topic.

Boilers: A minimum global seasonal energy performance for new boilers or for existing boilers under renovation is fixed as follows:

ή = 77 + 3 Log(Pn) (condensing boilers fulfill this requirement). Whenever there is the change of an existing boilers, a new boilers is installed or a new connection to a district heating system occurs, it's compulsory to have a thermostatic valve on each radiator and a heat counter for each flat. Anyway, by the 1st of September 2012 each flat of each building must adopt this technology. Furthermore it's not possible to turn an existing central heating system into different single boilers and it's compulsory to have a central heating system whenever there are more than 4 flat in a building. A low temperature distribution is strongly recommended
Insulation of building envelope: For new buildings or existing buildings with a heated surface over 1.000 m2 under renovation, U-values (W/m2K) must be: 0,33 for walls – 0,30 for ceilings – 2 for windows – 2,8 for commercial windows. For existing buildings with a heated surface up to 1.000 m2 under renovation U-values (W/m2K) must be: 0,43 for walls – 0,39 for ceilings – 2 for windows – 2,8 for commercial windows. U-values (W/m2K) below approximately 20% standard values can grant specific financial support. Whenever an extraordinary maintenance is undertaken on existing buildings, U-values (W/m2K) can be 30% higher than those for new buildings. Whenever there is a painting of the external walls, it's compulsory to insulate the walls as well.
*RES in buildings***:** For new building or for existing building under renovation it's compulsory to produce, at least, 60% of the hot domestic water with solar collectors, or whenever not possible use another renewable energy source. For new shopping centre at least 10% of space heating must be provided by solar energy (solar thermal or photovoltaic as well). It's strongly recommended the use of heat pump with a Operational Performance Coefficient generally higher than 4. For new building or for existing building under renovation It's compulsory to install a photovoltaic plant, although the solar thermal plant is the priority.
Energy Retrofit of existing building: Domestic existing building with more than 50 flats and with a thermal need of the external envelope higher than 200 kWh/m2 or other building bigger than 10.000 m3 and a thermal need of the external envelope higher than 70 kWh/m3 must be retrofitted within 31st of December 2016 in order to provide energy savings higher than 35% of primary energy.
Heat pumps: energy performance standards for heat pumps are fixed, too.

D.G.R. 14 dicembre 2010, n. 3-1183 (National *D. Lgs. 29/12/2003, n.387*)
This disposition establishes to identify areas and sites not suitable for the installation of photovoltaic systems on the ground in accordance with paragraph 17.3. "Guidelines for the authorization of plants powered by renewable sources" referred to in the Ministerial Decree of 10 September 2010.

2 Definition of the methodological mix of the survey

2.1 DESK RESEARCH DEFINITION

Name of the Concept Region: Province of Torino	*Tick out*	*Description:*
Collected data from public bodies	*X*	*See description in chapter 2.1*
Collected data from municipalities	*X*	*See description in chapter 2.1*
Collected data from statistic offices	*X*	*See description in chapter 2.1*
Collected data from energy suppliers	*X*	*See description in chapter 2.1*
Collected data from national or regional grid	*X*	*See description in chapter 2.1*
Collected data from regional heating system	*X*	*See description in chapter 2.1*
Used existing sources from energy agencies		
Used existing sources in chamber of commerce		
Used data from Association of consumers *Any non-documented demand*		*(private photovoltaic units, geothermal waters, other homemade technologies)*
Use smart-metering data, if available		
Used data of monitoring and collecting data		*(property management companies, supply measuring companies producing metres for monitoring and measuring energy consumption)*

2.2 DEFINITION OF SOURCES OF INFORMATION

Information for socio-economic data comes from the following sources:

- ISTAT, National Institute of Statistics, website: www.istat.it; www.demo.istat.it;
- Piemonte in cifre, Regional yearbook of statistics, website: www.piemonteincifre.it;
- IRES Piemonte – research institute, Annual report on regional socio-economic trends;
- Socio-economical analysis of the Province of Turin, Report on Energy;
- Energy and environmental action plan of the Province of Turin, www.provincia.torino.gov.it/ambiente/energia/programm;
- PTC2 – Spatial provincial plan, explanatory report www.provincia.torino.gov.it/territorio/sezioni/pian_territoriale/presentazione;
- Real estate observatory of Turin - www.oict.polito.it;
- Provincial Added Values – Istituto Tagliacarne ed elaborazioni IRES Piemonte;
- IMQ2010 - Survey on the mobility of people and the quality of transport, Agenzia Mobilità Metropolitana Torino;
- Climate change and spatial government in Province of Turin – Società meteorologica Subalpina.

The content of the energy demand is mainly taken from the Energy Report of the Province of Torino, which is edited every two years by the Province itself: (www.provincia.torino.gov.it/ambiente/energia/programm/8_rapporto).
Energy information have been collected with a mixed top-down/bottom-up approach (from local and national utilities) for more than a decade. The collection of energy data is updated every 2 year and it is currently working. Estimation for thermal solar energy, biomass and geothermal energy comes from studies carried out within EU Renerfor project (www.renerfor.eu) co-financed by EU under Alcotra Program.

Information about mobility comes from the Annual report edited by the "Agenzia per la Mobilità Metropolitana Torino" (www.mtm.torino.it/it/dati-statistiche/indagini).
List of National sources of information (Top-down approach) which provide information at provincial level:

- Ministry for Economic Development for oil products sales
- Terna and GSE for electricity production and consumptions
- SNAM RETE GAS for natural gas consumptions

List of local sources of information (bottom-up approach) which provide information at municipal level:

Gas distributors:

- Italia Energetica Srl
- Metan Alpi Sestriere
- Metan Alpi Val Chisone
- Società Italiana Per Il Gas
- AEG
- SOMET
- Metanprogetti
- Acea Pinerolese Industriale Spa
- SIME Spa
- ITALCOGIM
- Enel Rete Gas Spa
- Edigas
- AES
- 21GAS INFRASTRUTTURA ITALIANA GAS)
- BRAGAS SRL

Electricity Distributors:

- ENEL Distribuzione
- Comune Salbertrand
- Comune Valprato Soana
- Comune di Exilles
- Comune di Ronco Canavese
- AEM Chiomonte
- Comune di Novalesa
- Iren Energia and La Bruzolese Energia

2.3 DEFINITION OF SAMPLE OF RESPONDENTS

Name of the Concept Region: Province of Torino
Industrial energy demand *includes total demand of all legal entities delivering economic activities in the sectors of agriculture, production, retail services*
Public sector *(ownership of public or state institutions in the region), total demand of the municipalities and public/state institutions if any in the CR*
Transport energy demand *of the CR region comprises all public and private transport, private transport expenses on energies(air transport, railway, water/road transport)*
Households energy demand *includes the demand for private residence purposes (non-economic activities): what type of household (ownership, how many generations are sharing one household)*

Industrial energy demand includes total demand of all legal entities delivering economic activities in the sectors of agriculture, production, retail services. Energy consumptions deals with:

- Natural gas consumption for heating and for generating heat process
- Oil products (fuel oil, diesel) burned for heating and for generating heat process
- Heating coming from district heating system
- Renewable energy sources (solar thermal, geothermal and biomass) used for heating and for generating heat process
- Self produced electricity from RES (mainly PV plants and hydropower) and from Combined Heat and Power (CHP) plants fed by natural gas
- Self produced heating coming from CHP plants
- Electricity taken from the local of national grid

Public sector energy demand includes total demand of municipalities and public state institutions. Since such statistics are not available for the production of heating, several assumptions have been made in order to have a rough estimation. The starting point was the assessment of data collected among the signatories of the Covenant of Mayor Initiative. As the Province of Torino is a territorial coordinator of the Covenant of Mayor Initiative, energy consumptions collected from Municipalities comes from such supporting activity. Those Municipalities using Enercloud system are part of the survey and the group is very representative of the average situation in the province of Torino. The assessment of their energy consumption was used as the basis for the estimation of the public sector (for heating consumption). Energy heating consumption for public buildings not belonging to local municipalities (National institutions, hospitals, healthcare buildings and so on) have been estimated on the basis of the Turin Action Plan for Energy (http://www.comune.torino.it/ambiente/bm~doc/tape-3.pdf). Considering electricity consumptions, official statistics provide detailed data regarding Public Administration and Public Lightning, so no further estimations has been necessary.

2.4 SAMPLE APPROACH

The energy data gathered from Municipalities have been taken from the Enercloud program (http://www.provincia.torino.gov.it/ambiente/energia/progetti/Enercloud/index), a web-based application for the collection of energy bills of public buildings, lightning systems and facilities. This tool is based on the data-mining system. No software has to be installed in the local end-users computers and only a online login/password is required. ENERCLOUD give an immediate description of the energy status of the facility under assessment thanks to a benchmarking approach. This application is used either for the elaboration of the baseline emission inventory for the energy public consumption and for the day-to-day energy management of the properties. The stored information refers to electricity and heating consumptions, cost paid for bills and geometric values for buildings and lightning systems, such as heated volumes, surface and number and quality of lamps installed.
Another source from which information have been gathered is the survey made on public buildings in the framework of Renerfor project, done in collaboration with the Polytechnic of Torino.
List of Municipalities belonging to the sample is attached to this document in Annex 1.
The survey in industry was conducted by Environment Park on a sample of 229 enterprises belonging to different sectors: automotive (33), bulding industry (125), manufacturing (71). The questionnaire was made on the basis of the two types of survey proposed in the guidelines in order to create an easy document coherent to the Italian reality and to get information on final energy demand and on the potentiality of RES. In the attachment (Annex 2) an overview of the results of the survey conducted on private companies and Municipalities is enclosed.

3 Final energy demand

In the last decade, in Province of Torino, energy consumptions in final uses decreased by more than 15% with a strong reduction recorded in 2009 and 2011. In 2011 the overall energy demand dropped down 50.000 GWh, far away from the top peak data of 2001 (nearly 58.5 TWh). As shown in the following tables and images Economy and Transport both gave the mayor contribution to the decrease (respectively –22% and –25%). On the contrary Private households sector is quite constant along the decade with a slight decrease only in the last year and Public sector recorded an increase of 12%. As if Industry is loosing importance in provincial economics since the Nineties the decrease of energy consumption of Transport is quite surprising and has to be put in connection with the economic crisis which deeply affected the transport of goods from 2008 on. As a consequence, if in 2001 Productive activities were responsible for 35% of total energy demand, followed very closely by Private household sector (34.6%) and Transport (28%), in 2011 the situation is quite different as Industry and Transport sectors lost importance, giving further space to Households (40%). Public sector remains around 2.5% of total energy demand. It is to say that Industry is the main responsible of the decrease of energy consumption of productive activities as Trade&Commerce keep on growing giving contribution up to 71% of total Added Value of the Province of Torino.
Natural gas is the main energy carrier demanded (37% in 2011), followed by the Fossil liquid (28%) and electricity (22%). Oil products decreased a lot replaced by other energy carriers for space heating and other civil uses, but keep on being irreplaceable in transport sector. It's worth noting that the heating recovered by CHP plants and distributed by district heating systems stand for more than 8% of total energy demand. As for renewable energy sources (RES), main contribution in final uses is coming from biomass (hugely used in domestic boilers), but if we consider that a good share of electricity is coming from a domestic production of RES plants, we can quantify in more than 10% the share of those sources to the final energy consumption with an increasing contribution along the years.

Finally, in two different maps the geographical distribution of electricity and natural gas consumptions is provided at municipal level. In such maps it is possible to highlight the main energy demanding areas on the concept region.

Energy carrier	**2001**	**2002**	**2003**	**2004**	**2005**
District heating	3.537.650	3.614.330	3.636.484	3.656.648	3.595.148
Electricity	11.868.967	11.352.675	11.525.172	11.666.967	11.505.278
Fossil gaseous	20.273.493	20.738.176	20.787.867	20.594.195	21.064.118
Fossil liquid	20.835.528	18.767.370	17.605.960	17.771.437	17.620.032
Renewable	1.922.574	1.960.668	2.002.557	2.033.948	2.068.646
Total	**58.438.212**	**56.433.219**	**55.558.040**	**55.723.196**	**55.853.221**
Sector	**2001**	**2002**	**2003**	**2004**	**2005**
Households	20.245.587	19.888.170	19.659.988	20.198.740	20.490.788
Industry/Commerce	20.535.336	20.155.791	20.091.073	19.437.320	19.428.431
Public sector	1.100.908	1.091.919	1.129.862	1.109.317	1.158.997
Transport	16.556.381	15.297.339	14.677.117	14.977.820	14.775.005
Total	**58.438.212**	**56.433.219**	**55.558.040**	**55.723.196**	**55.853.221**

Energy carrier	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
District heating	3.131.823	3.211.326	4.172.271	4.161.824	4.302.994	3.727.485
Electricity	11.956.324	11.926.433	11.675.161	10.686.083	10.879.693	10.847.739

Fossil gaseous	21.237.623	19.692.108	19.611.272	19.421.408	21.482.992	18.468.185
Fossil liquid	16.953.639	16.893.159	14.571.099	14.315.980	14.867.763	13.900.853
Renewable	2.164.577	2.212.594	2.261.156	2.329.536	2.390.282	2.453.029
Total	**55.443.985**	**53.935.620**	**52.290.960**	**50.914.831**	**53.923.725**	**49.397.292**
Sector	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Households	19.790.366	19.045.849	19.478.274	19.611.157	21.928.695	19.679.829
Industry/Commerce	19.675.783	18.986.059	18.558.402	17.480.524	17.708.575	16.074.361
Public sector	1.223.596	1.179.245	1.199.561	1.138.799	1.310.554	1.235.890
Transport	14.754.240	14.724.466	13.054.723	12.684.351	12.975.901	12.407.213
Total	**55.443.985**	**53.935.620**	**52.290.960**	**50.914.831**	**53.923.725**	**49.397.292**

Table 3.1 - Final energy demand in province of Torino - Unit: MWh

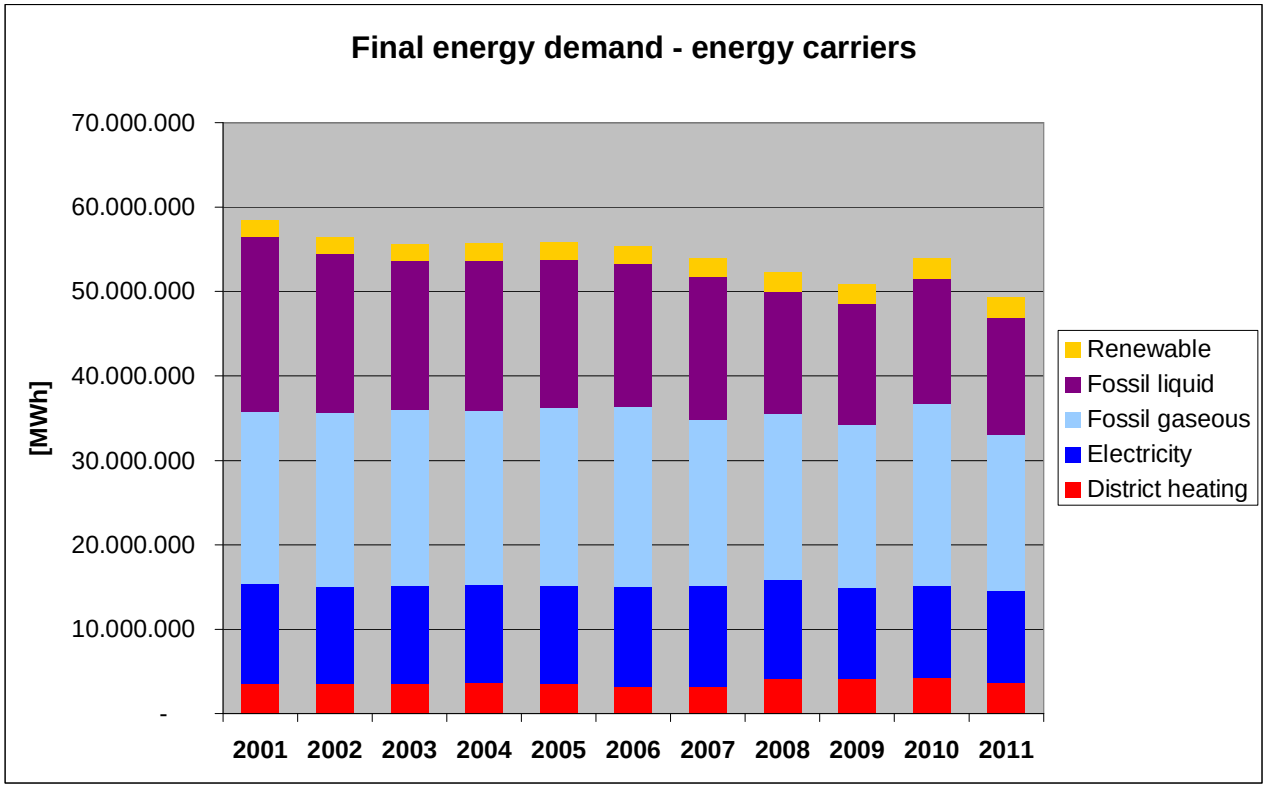


Figure 3.1 – Final energy demand divided into energy carriers

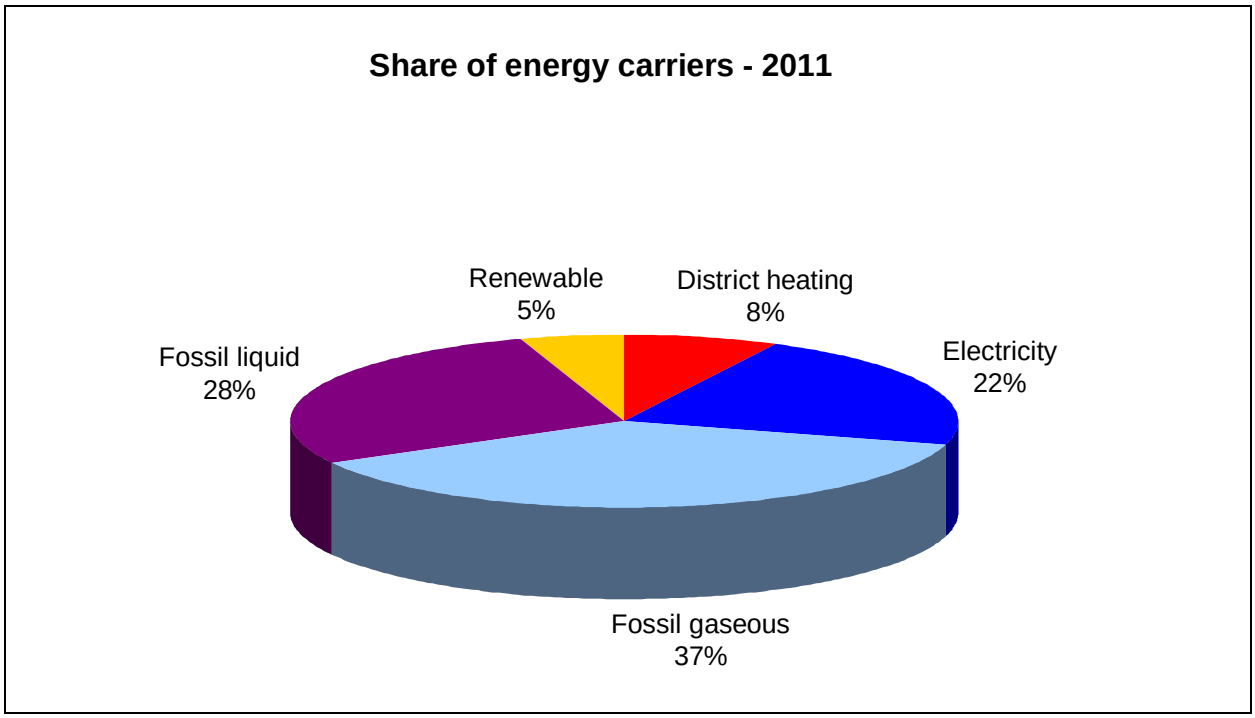


Figure 3.2 – Final energy demand, share of energy carriers

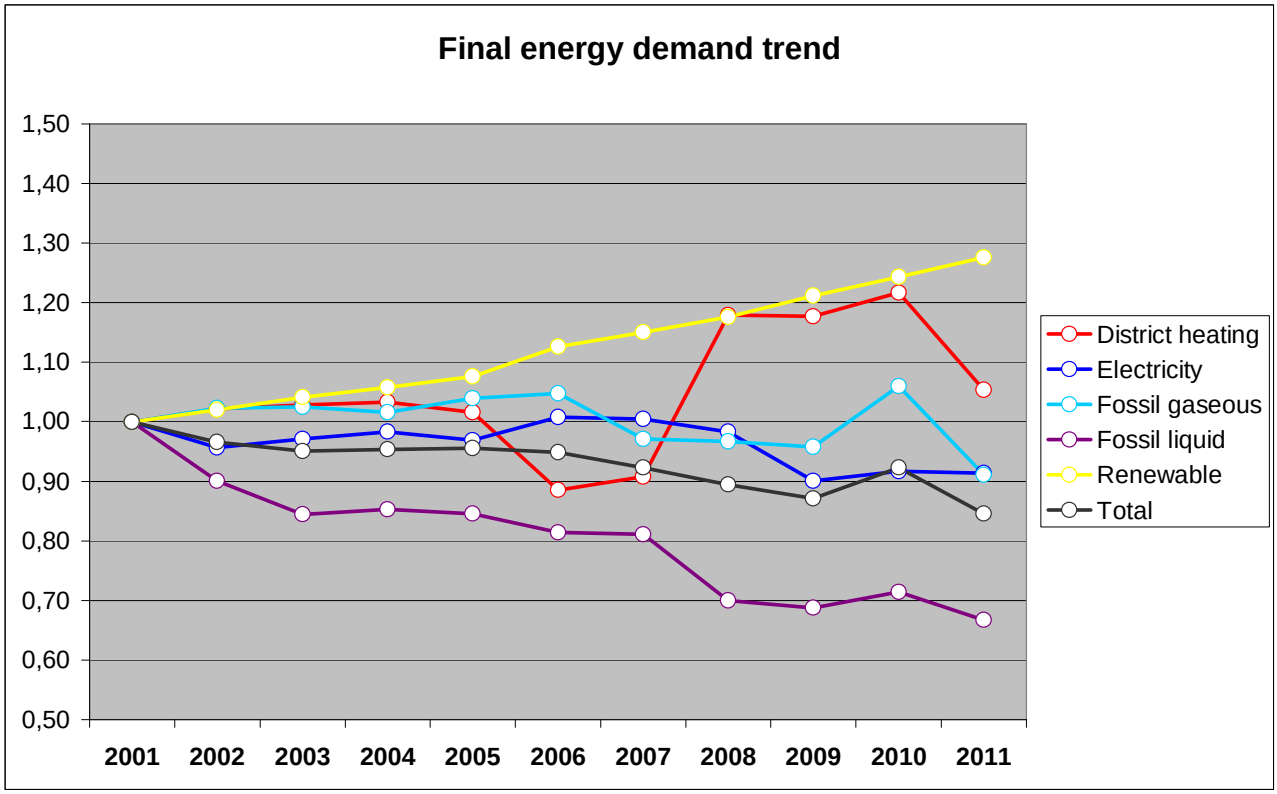


Figure 3.3 – Final energy demand trend

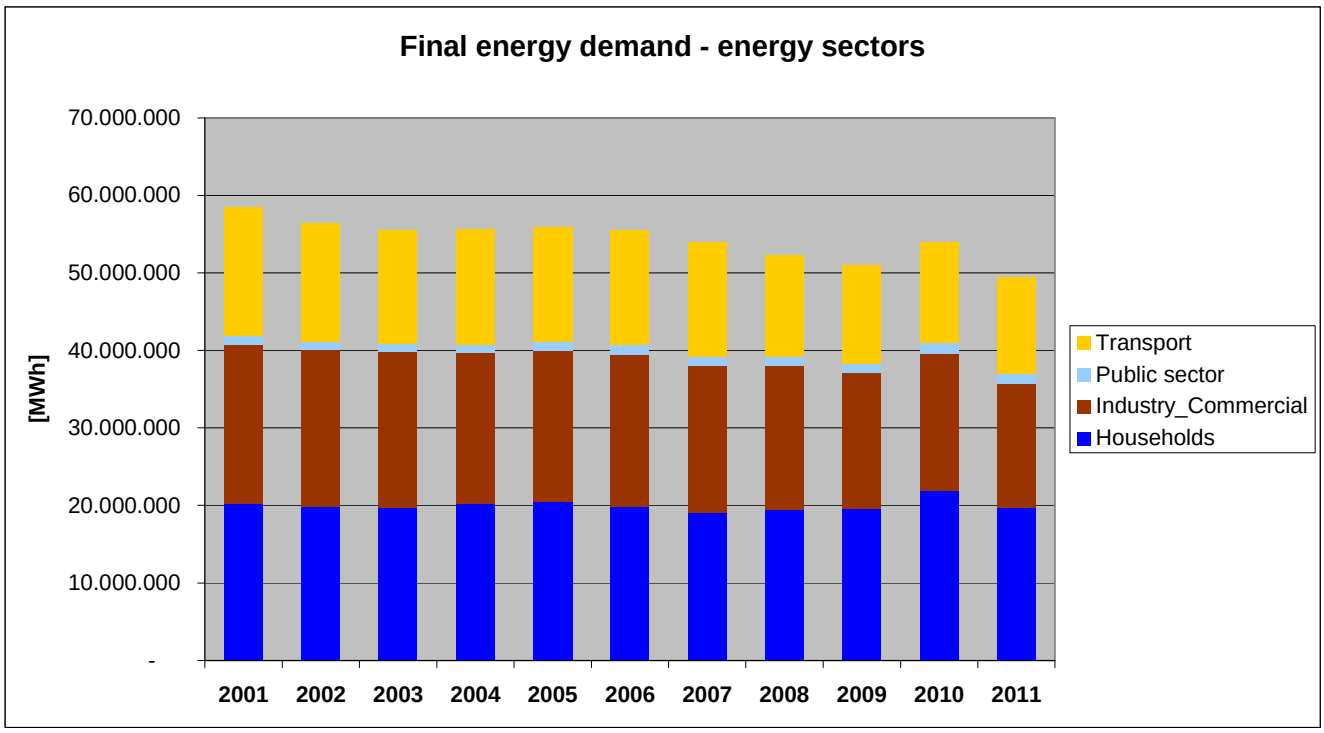


Figure 3.4 – Final energy demand divided into final sectors

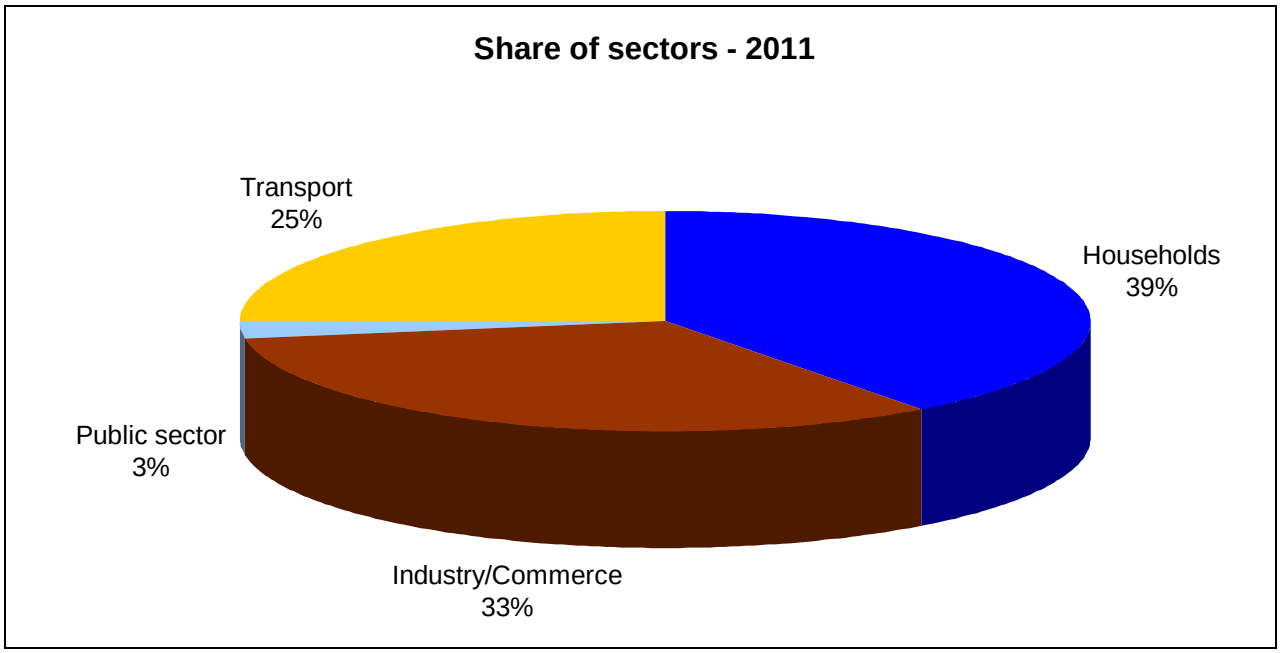


Figure 3.5 – Final energy demand – share of final sectors

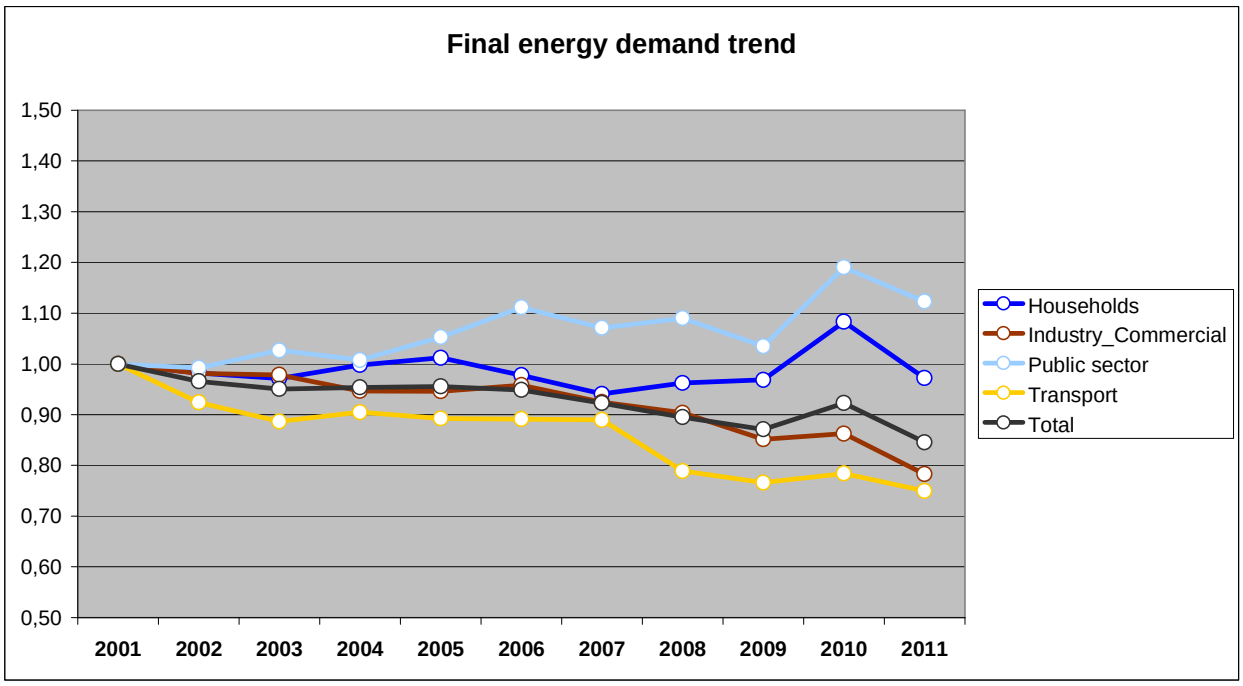


Figure 3.6 – Final energy demand trend by sectors

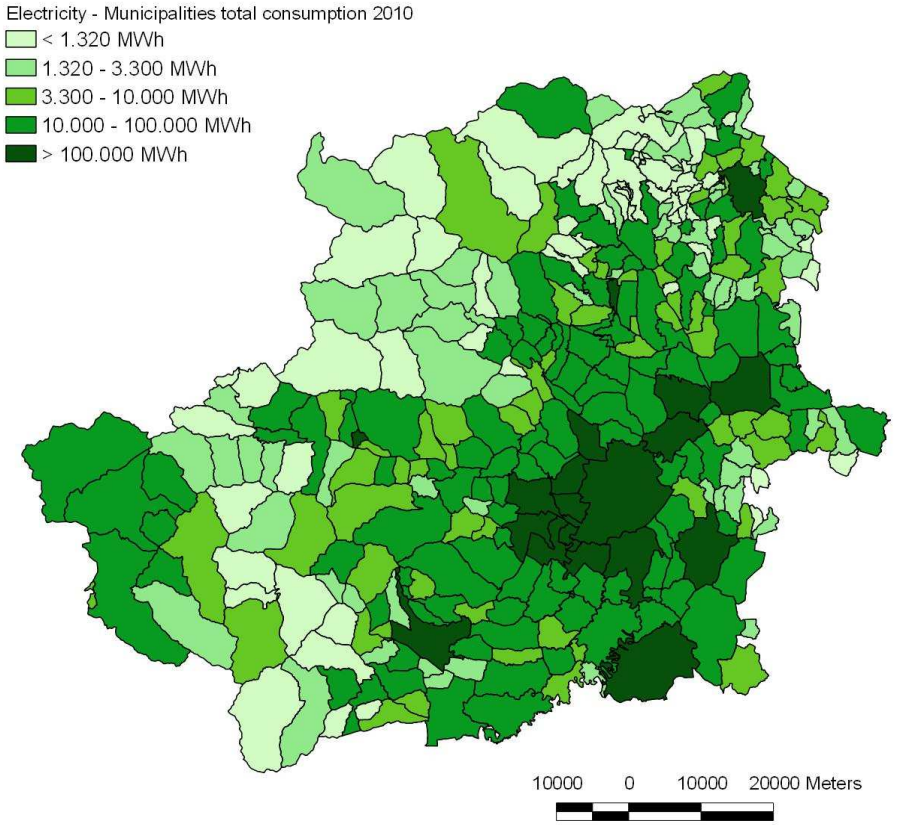


Figure 3.7 – Geographical distribution of electricity consumption in 2010.

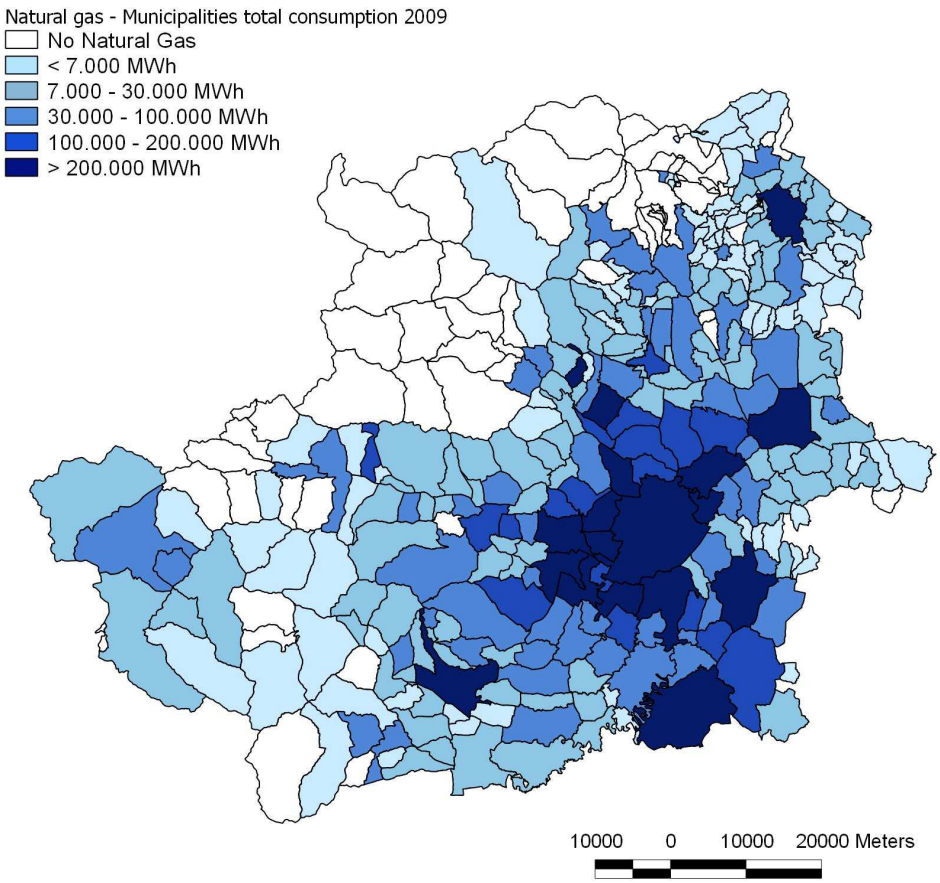


Figure 3.8 – Geographical distribution of natural gas consumption in 2009.

3.1 HOUSEHOLD ENERGY DEMAND

Private Households represent ~~worth~~ almost 40% of total energy demand, thus being the most important sector of final uses of energy. Energy performance of building stock is a key issue in order to set up Action Plan boosting the reduction of primary energy consumptions, promoting the use of renewable energy sources or cutting Greenhouses gases emissions. In 2011 energy consumptions of this sector amounted to 19.7 TWh, 2,8% less than 2001. The sector trend in the reference decade ~~under assessment~~ is thus quite stable and the yearly fluctuation~~s~~ is mainly due to climatic variations. If we consider only thermal consumptions (heating plus hot domestic water production), it is worth noting that such use of energy decreased by 4%, mainly in last five years.

More than 84% of total consumptions refers to space~~deals with~~ heating and production of hot domestic water, 13% comes from electric lightning and appliances and 3% from cooking.

Natural gas is the main energy carrier used in Private Households with more than 59% of total demand, followed by electricity (13%) and renewable wood (12%). The consumption of natural gas remains quite constant in all decades, since the development of the gas grid was pushed in previous decades and the potential spread out of it is already run out. An extraordinary data is the one recorded in 2010 which has been a very cold year and that is not to be taken into account. On the contrary electric consumptions are increasing by 3% per year and biomass even more (by an average value of 1.7% per year). The heating recovered by

CHP and distributed thorough district heating systems nearly doubled from 2001 to 2011, becoming 11% of all sector demand. Forecast for this carrier says that its share will grow in the short period since the district heating system of the City of Torino and the surrounding municipalities is enlarging a lot. This situation will have a positive impact on the CO2 emissions of Private Households which will be reduced by consequence. In the next future we might expect to have a reduction in natural gas demand, in fact the spread out of District heating will be possible only in this direction, as nowadays diesel has only a residual impact in the energy demand of Private Households. In fact diesel consumptions fell from 2.300 GWh of 2001 to 270 GWh in 2011. Liquid Petroleum Gas is the only fossil liquid that keeps on growing and in 2011 was more than 2.5 times higher than diesel, showing an opposite situation to what was happening ten years earlier. The spreading use of this carrier was concentrated mainly in those municipalities or areas not reached by the natural gas grid. The use of oil is very limited and it will disappear in the next few years since boilers using this product will be out of market in the next future, as they're not complying with environmental standards introduced by Regional Laws.
As for renewable energy sources, a part from biomass which use is traditionally very important, solar thermal energy show an important growing trend even though its contribution to the overall demand is still marginal (0,2%). Even more residual is the contribution of geothermal source.
In the province of Torino 15 utilities are operating in gas distribution service, with a grid which is widespread. Only some mountain municipalities are not reached by it, representing only 1% of total population. The situation of the gas distributors, which is very chaotic and not rational up to now, will change in the next 3-5 years since optimized basin for the management of the gas grid will be introduced. By consequence only 5 gas distributers will operate the service. Total consumption of natural gas is mainly concentrated in the City of Torino and the surrounding Municipalities, even though the per capita consumptions show a different situation with several mountain municipalities having top peak consumptions due to climatic conditions and their tourist peculiarities.
As far as the local electric grid is concerned, in Province of Torino we have 2 big utilities which cover almost the overall territory a part from few municipalities which are operating the service directly with its own utility.

Type of demand	2001	2002	2003	2004	2005	2006
District heating	1.154.323	1.160.958	1.235.970	1.306.002	1.351.894	1.352.229
Cooking	577.112	598.122	598.420	622.519	629.970	612.143
Electricity demand	2.459.649	2.444.341	2.458.689	2.557.797	2.553.503	2.592.000
Space/water heating	16.054.504	15.684.749	15.366.909	15.712.422	15.955.421	15.233.994
Total	**20.245.587**	**19.888.170**	**19.659.988**	**20.198.740**	**20.490.788**	**19.790.366**

Type of demand	2007	2008	2009	2010	2011
District heating	1.426.814	1.807.195	1.935.852	2.262.111	2.080.913
Cooking	576.198	594.311	587.056	671.405	583.364
Electricity demand	2.516.900	2.562.000	2.580.400	2.624.214	2.560.580
Space/water heating	14.525.937	14.514.767	14.507.848	16.370.964	14.454.972
Total	**19.045.849**	**19.478.274**	**19.611.157**	**21.928.695**	**19.679.829**

Energy carrier	2001	2002	2003	2004	2005	2006
Fossil Gaseous	*11.542.231*	*11.962.444*	*11.968.404*	*12.450.386*	*12.599.403*	*12.242.868*
Fossil Liquid	*3.202.656*	*2.404.468*	*2.051.003*	*1.908.670*	*1.980.139*	*1.507.741*
Renewable Wood	*1.883.198*	*1.910.846*	*1.939.226*	*1.967.606*	*1.995.986*	*2.082.103*
Renewable Solar	*3.503*	*5.057*	*6.611*	*8.166*	*9.720*	*13.099*

Renewable Geothermal	*28*	*57*	*85*	*114*	*143*	*326*
Electricity	*2.459.649*	*2.444.341*	*2.458.689*	*2.557.797*	*2.553.503*	*2.592.000*
District heating	*1.154.323*	*1.160.958*	*1.235.970*	*1.306.002*	*1.351.894*	*1.352.229*
Total	***20.245.587***	***19.888.170***	***19.659.988***	***20.198.740***	***20.490.788***	***19.790.366***

Energy carrier	2007	2008	2009	2010	2011
Fossil Gaseous	*11.523.963*	*11.886.229*	*11.741.128*	*13.428.108*	*11.667.273*
Fossil Liquid	*1.439.492*	*1.043.072*	*1.113.325*	*1.322.674*	*1.021.915*
Renewable Wood	*2.117.419*	*2.148.696*	*2.198.345*	*2.235.683*	*2.282.346*
Renewable Solar	*20.359*	*29.362*	*39.635*	*52.008*	*61.855*
Renewable Geothermal	*902*	*1.718*	*2.472*	*3.897*	*4.947*
Electricity	*2.516.900*	*2.562.000*	*2.580.400*	*2.624.214*	*2.560.580*
District heating	*1.426.814*	*1.807.195*	*1.935.852*	*2.262.111*	*2.080.913*
Total	***19.045.849***	***19.478.274***	***19.611.157***	***21.928.695***	***19.679.829***

Table 3.2 – Household: type of demand and share of energy carriers - Units: MWh

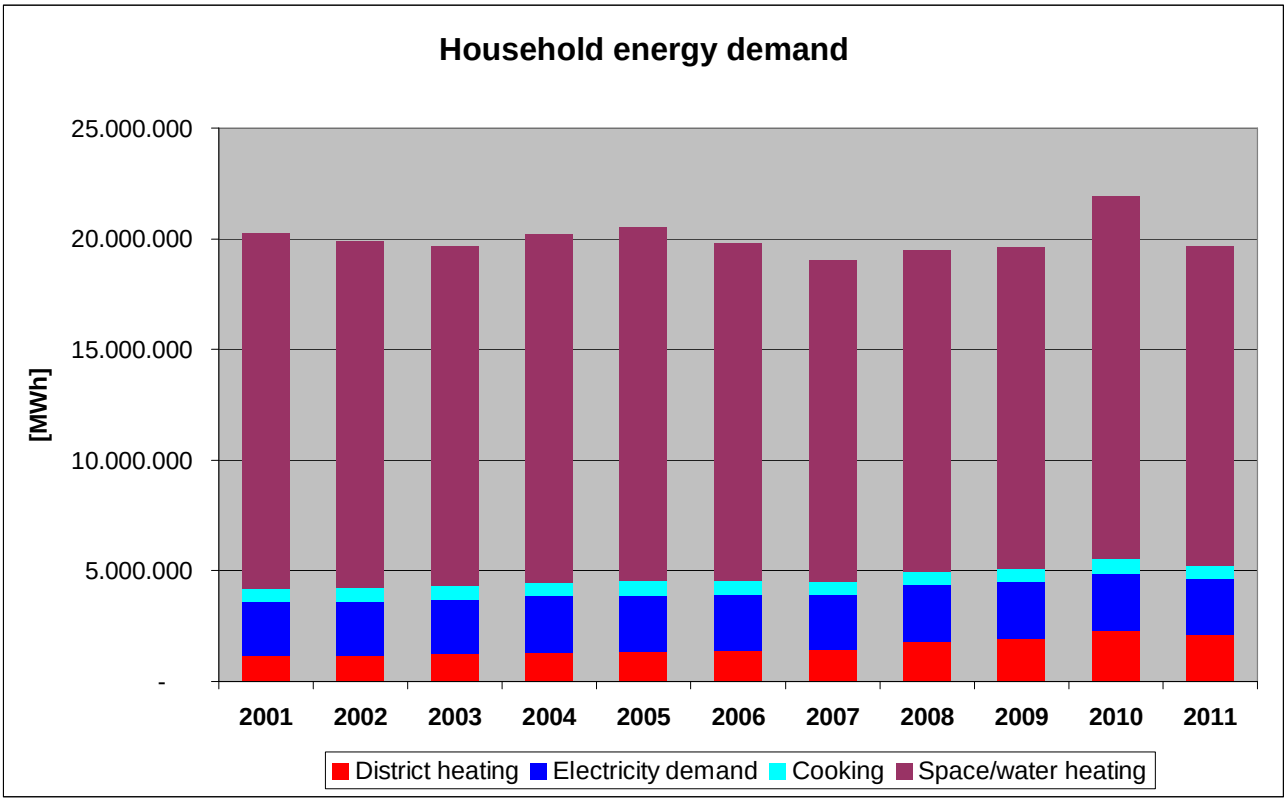


Figure 3.9 – Households energy demand

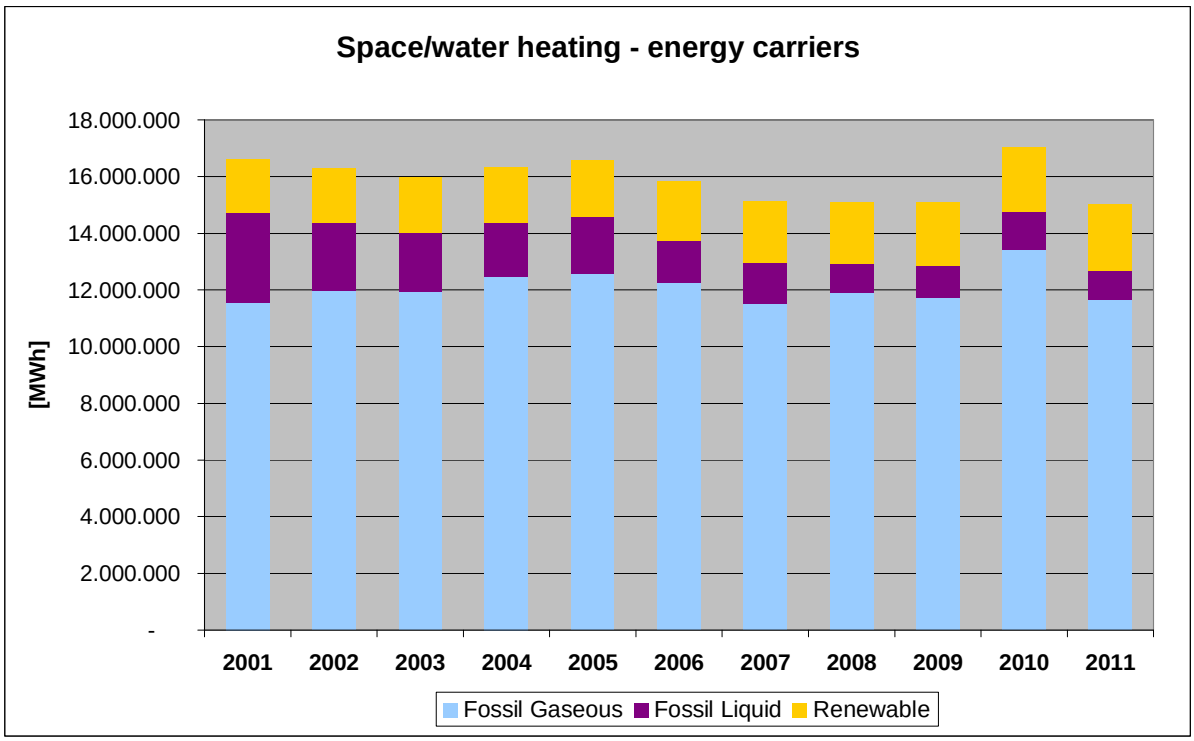


Figure 3.10 – Space/water heating in households divided into energy carriers

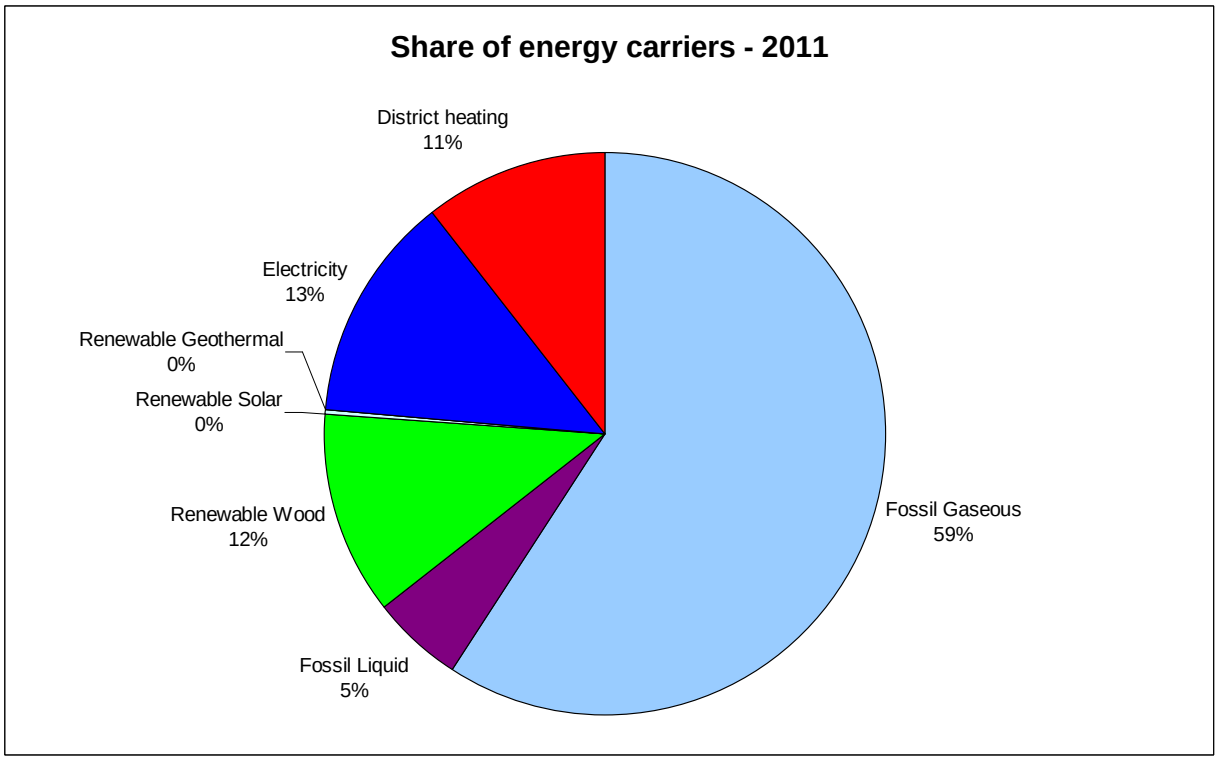


Figure 3.11 – Final energy demand of households - share of energy carriers (2011)

3.2 INDUSTRIAL AND COMMERCIAL ENERGY DEMAND

In 2011, Economy sector worth 32.5% of total energy demand and its importance in the energy balance of the Province of Torino is decreasing year by year. Ten years before its energy demand was much higher with a share of 35%. Up to 4.500 GWh were lost in this sector in ten years, mostly in natural gas consumptions. The decrease of this sector was mainly evident in the last five years under assessment, where industry demanded 3.600 GWh less. The reasons of this decrease are to be found in the economic crisis which affected the whole region and moreover the car industry, which is traditionally the core productive activity of Torino. Delocalization policies carried on by FIAT company affected the economics and the employment of the region which is nowadays much more devoted to Trade&Services than Industry. The economic crises occurred in the last decade~~o f the end of the decade was~~ immediately affected ~~reflected in~~ the energy demand, thus accelerating a natural trend. Even the heating recovered by combined heat and power plants, which in the recent past was the only energy carrier keeping on growing faced a reduction in the last two years.

The main energy carrier demanded is electricity with nearly 47% of total consumptions, followed by natural gas (38%). The heat recovered by CHP (other or unknown in the table) is another important carrier used by industries. In 2011 heating was 9% of total energy demand, by which 6% is coming from self production and 3% from the district heating network.

Fossil liquid are represented by oil and diesel and liquid petroleum gas. The former is still used for process heat in industry factories, but its contribution is less important year by year. Solar ~~collector are~~collectors are used only in one factory, related to food industry, which is using solar energy in order to wash tanks used for transport purposes. On the contrary the use of geothermy is increasing due to new open-loop installations using groundwater.

Among sub-sectors heavy industries and manufactures related to cars and vehicles are those suffering much more. 30% of total Added Value comes from Industry whereas 70% is related to Trade and Commerce. On the contrary Industry represents 69% of energy demand and, as a consequence, Trade and Commerce 31%. Ten years ago the shares were different with industry demanding 80% of total energy consumptions.

The importance of Trade and Commerce in the energy balance of thee Province of Torino is growing year by year. As a general comment, Trade and Commerce is the only sector with a growing demand even in the last few years in which the economic crisis is heavily affecting the productive activities of the whole region. In 2011 energy consumptions of this sub-sector increased by 23% since 2001. The increase in the decade under assessment is recording an average yearly rate of 2%. What is pushing the increase is undoubtedly electric consumptions, whereas thermal consumptions (heating plus hot domestic water production) are quite stable, following the same evolution recorded for private households.

Electricity is the main energy carrier used in Trade and Commerce, followed by natural gas (38%) and heating from CHP (6%). The growth has been very important for heating recovered by CHP and distributed thorough district heating systems, whose demand has doubled from 2001 to 2011. Forecast for this carrier are in line with the considerations carried on for Private Households sector. Fossil liquid lost their importance even in this sector and only Liquid Petroleum Gas keeps on growing for the same reasons mentioned for Private Households (widespread in area not reached by natural gas grid).

As for renewable energy sources, renewable biomass is not used whereas the contribution of geothermy is facing an interesting growth, either for open loop systems using groundwater and soil heat pumps as well. New projects are under development for ~~this systems~~these systems so that the market is likely to grow ~~seems to have a growth~~ in the future as well.~~, too.~~ Solar renewable energy ~~shows~~shows an important growing trend even though its contribution to the overall demand is still marginal.

Since Trade and Commerce is the most important sector in the economics of the province of Torino, providing more than 70% of total Added Value, it is very interesting to assess the energy intensity of the added value. The ratio between energy consumption and Added Value increased by nearly 20% in the last decade due to the spread out of electric appliances and air conditioning of offices.

Type of demand	2001	2002	2003	2004	2005	2006
District heating	363.210	382.890	403.209	423.904	420.829	423.748
Cooking	-	-	-	-	-	-
Electricity demand	7.486.586	6.920.100	7.028.976	6.828.734	6.657.538	7.198.513
Steam generation	11.487.250	11.595.228	11.363.945	10.649.437	10.835.414	10.727.513
Total	**19.337.047**	**18.898.218**	**18.796.129**	**17.902.075**	**17.913.781**	**18.349.775**

Type of demand	2007	2008	2009	2010	2011
District heating	417.733	654.474	637.719	621.534	553.462
Cooking	-	-	-	-	-
Electricity demand	8.584.473	8.245.328	7.326.996	7.382.032	7.430.267
Steam generation	9.983.854	9.658.599	9.515.809	9.705.009	8.090.632
Total	**18.986.059**	**18.558.402**	**17.480.524**	**17.708.575**	**16.074.361**

Energy carrier	2001	2002	2003	2004	2005	2006
Fossil gaseous	*8.241.001*	*8.241.700*	*8.233.124*	*7.547.742*	*7.814.984*	*8.300.105*
Fossil liquid	*1.257.897*	*1.307.248*	*1.160.324*	*1.200.495*	*1.225.291*	*1.094.091*
Renewable Wood	*2.320*	*9.075*	*9.114*	*9.114*	*9.156*	*10.219*
Renewable Solar	*2.406*	*2.553*	*2.699*	*2.845*	*2.992*	*3.310*
Renewable Geothermal	*1.250*	*2.510*	*3.777*	*5.053*	*6.337*	*11.195*
Electricity	*7.486.586*	*6.920.100*	*7.028.976*	*6.828.734*	*6.657.538*	*7.198.513*
District heating	*363.210*	*382.890*	*403.209*	*423.904*	*420.829*	*423.748*
Other or unknown	*1.982.376*	*2.032.141*	*1.954.907*	*1.884.187*	*1.776.653*	*1.308.593*
Total	***19.337.047***	***18.898.218***	***18.796.129***	***17.902.075***	***17.913.781***	***18.349.775***

Energy carrier	2007	2008	2009	2010	2011
Fossil gaseous	*7.508.123*	*7.032.896*	*6.949.208*	*7.243.199*	*6.038.936*
Fossil liquid	*1.130.006*	*939.780*	*1.005.604*	*1.073.214*	*979.302*
Renewable Wood	*10.219*	*10.160*	*10.192*	*10.192*	*10.192*
Renewable Solar	*3.994*	*4.842*	*5.810*	*6.976*	*7.904*
Renewable Geothermal	*15.349*	*21.875*	*25.287*	*33.684*	*37.906*
Electricity	*8.584.473*	*8.245.328*	*7.326.996*	*7.382.032*	*7.430.267*
District heating	*417.733*	*654.474*	*637.719*	*621.534*	*553.462*
Other or unknown	*1.316.163*	*1.649.046*	*1.519.709*	*1.337.744*	*1.016.393*
Total	***18.986.059***	***18.558.402***	***17.480.524***	***17.708.575***	***16.074.361***

Table 3.3 – Industry and commerce: type of demand and share of energy carriers. Unit: MWh

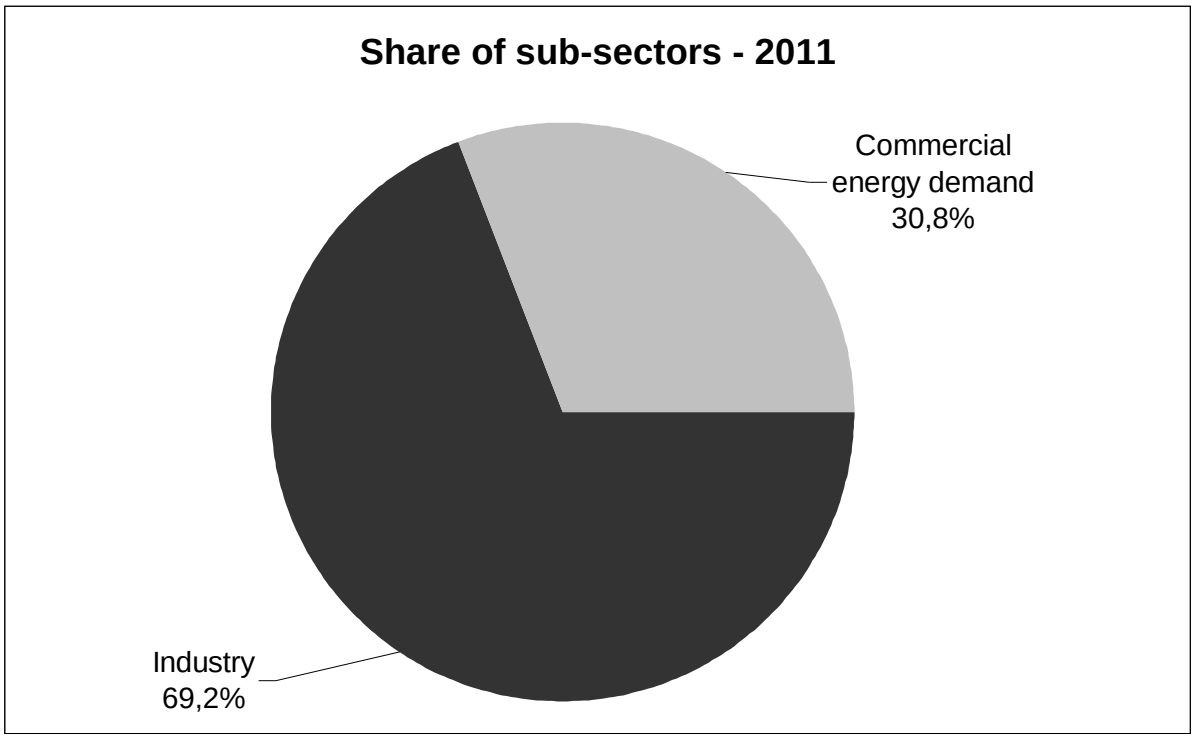


Figure 3.12 – Industrial and Commercial demand: share of sub-sectors in 2011

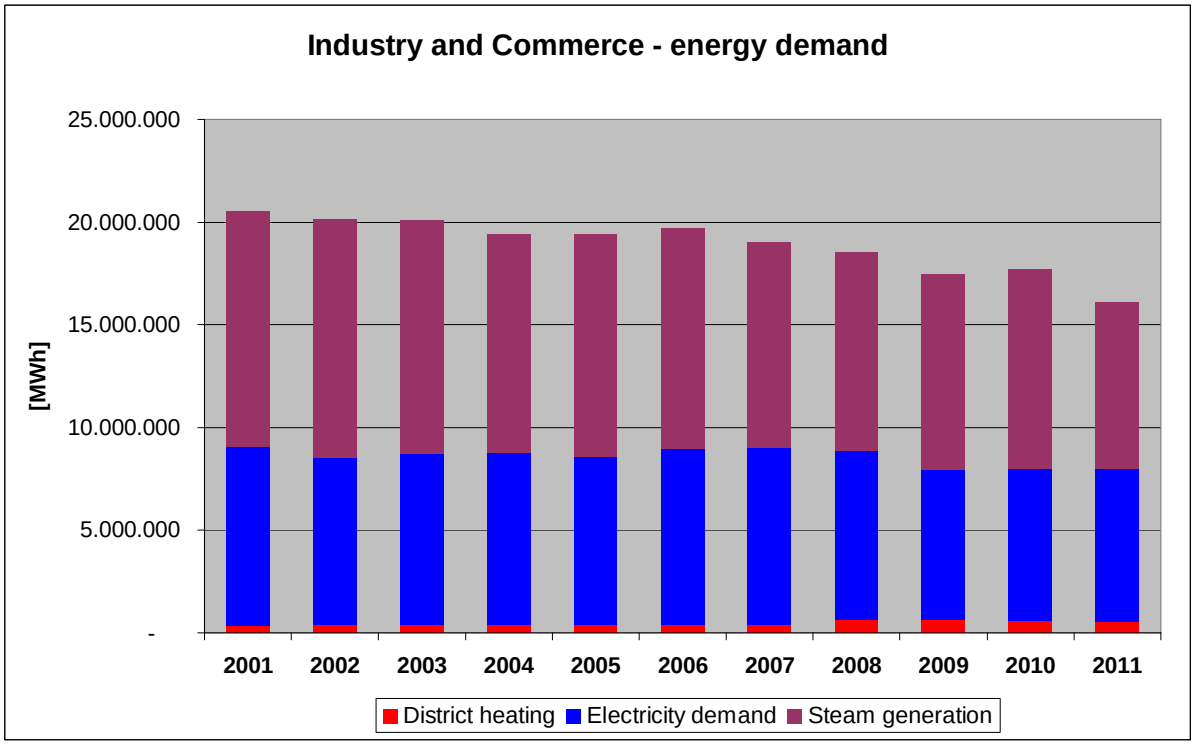


Figure 3.13 – Industrial and commercial energy demand

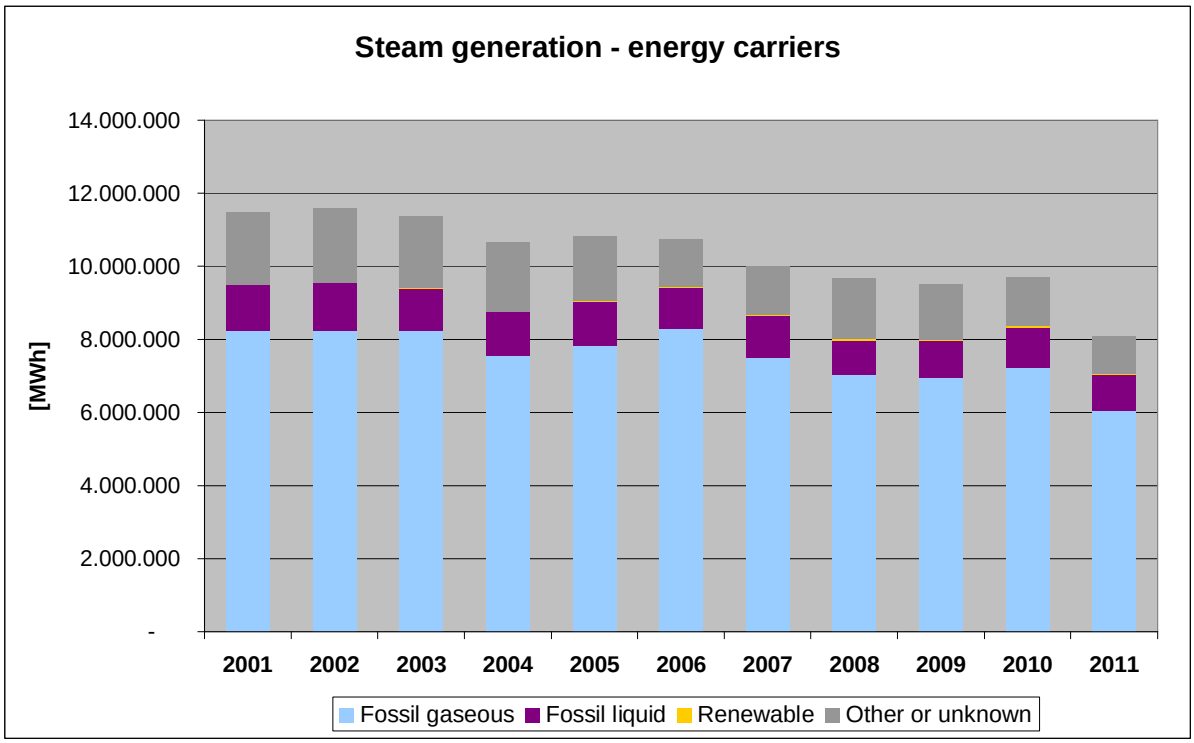


Figure 3.14 –Steam generation divided into energy carriers

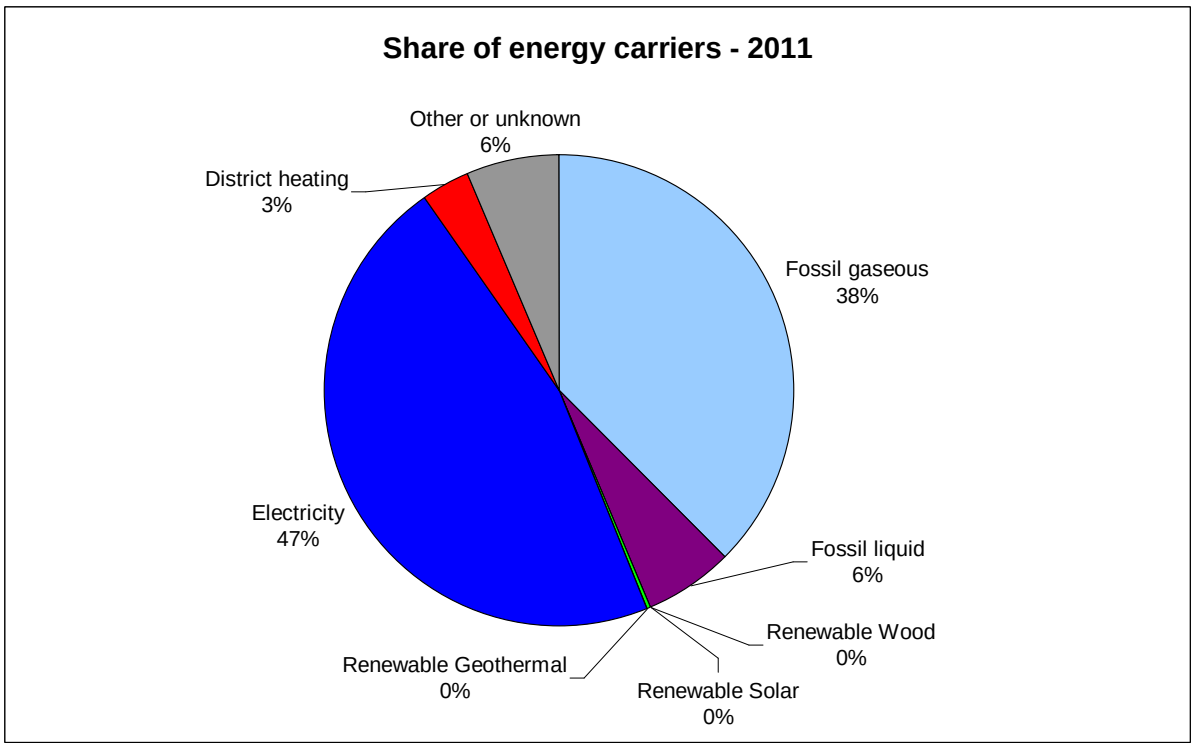


Figure 3.15 – Industrial and commercial energy demand - share of energy carriers (2011)

3.3 TRANSPORT ENERGY DEMAND

The energy demand of transport sector decreased by 25% from 2001 to 2011. The top peak consumptions were recorded in 2001 with more than 16.5 TWh and in 2011 the sector demanded less than 4 TWh. The reduction was particularly evident between 2007 and 2008 were a reduction by 10% occurred just in one year. In the last four years the situation didn't chance. More than half of consumptions are related to diesel (59%), which is by far the most important carrier. Its importance grew along the years taking place of gasoline, whose use decreased by nearly half (from 7.6 to 3.9 TWh). The preference of people moved from gasoline to diesel as prices of fuel raised up during nineties and the last decade, so that a lot of diesel cars were sold taking place of traditional gasoline ones. Assumed that situation, what is surprising is the decrease of diesel consumptions from 2008 on. This can be explained only by taking into consideration the transport of goods. Freight transport was affected by economic crisis as well as industry and this situation is clearly reflected in the energy demand. Anyway, the sum of diesel and petrol are equivalent to 91% of total energy demand coming from traffic, whereas in 2001 their share was up to 96%. This is to say that alternative fuels are recording an increasing demand. LPG and natural gas had a strong increase during this last decade, almost double themselves. In 2011 they reach the 6% of the total consumption. The increase of natural gas might be less important in the future if infrastructure investments delays, as without providing such carrier along highways people might be prevented from choosing it as an option. Electricity is nowadays related only to collective means of transport (public and trains) and it is quite stable in the last five years. It's welcome if private electric vehicle will develop in the future as this should give an important contribution to the air quality improvement of the Cities, too.

Referring to the survey of the modal transport edited by the Mobility Agency in the province of Torino, in the average working day of 2010 nearly 5 millions (4% more than 2008) of journeys have been made by people living in the province. Trips~~Those journeys made~~ by motor vehicles are more than 3,5 millions, increasing by nearly 7% from 2008. If we have a more prospective look at it, we can notice that ~~this kind of journeys are~~these kinds of journeys are quite stable in all decade. On the contrary, what it decreasing, is the public transport use.

Energy carrier	2001	2002	2003	2004	2005	2006
Petrol	7.677.236	7.152.898	6.825.361	6.421.698	5.880.558	5.463.511
Diesel	8.163.578	7.446.398	7.174.038	7.880.124	8.175.977	8.541.404
LPG, natural gas	354.724	327.181	302.855	305.907	318.984	329.023
Electricity	360.843	370.861	374.862	370.092	399.486	420.302
Total*	**16.556.381**	**15.297.339**	**14.677.117**	**14.977.820**	**14.775.005**	**14.754.240**

Energy carrier	2007	2008	2009	2010	2011
Petrol	5.088.520	4.696.812	4.440.810	4.188.728	3.895.835
Diesel	8.884.103	7.516.215	7.312.202	7.683.667	7.339.130
LPG, natural gas	336.584	400.664	497.353	667.117	740.484
Electricity	415.260	441.033	433.986	436.390	431.764
Total*	**14.724.466**	**13.054.723**	**12.684.351**	**12.975.901**	**12.407.213**

Table 3.4 - Transport energy demand - Unit: MWh

*Aviation excluded

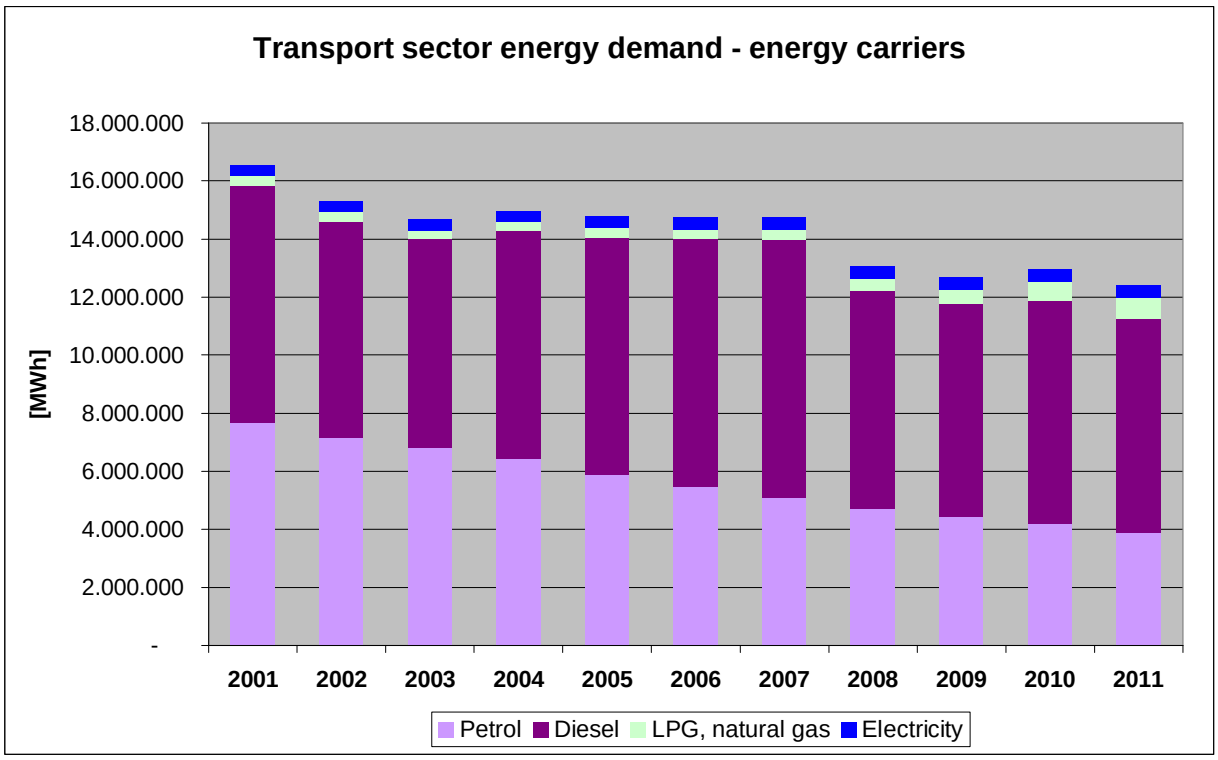


Figure 3.16 – Transport energy demand divided into energy carriers

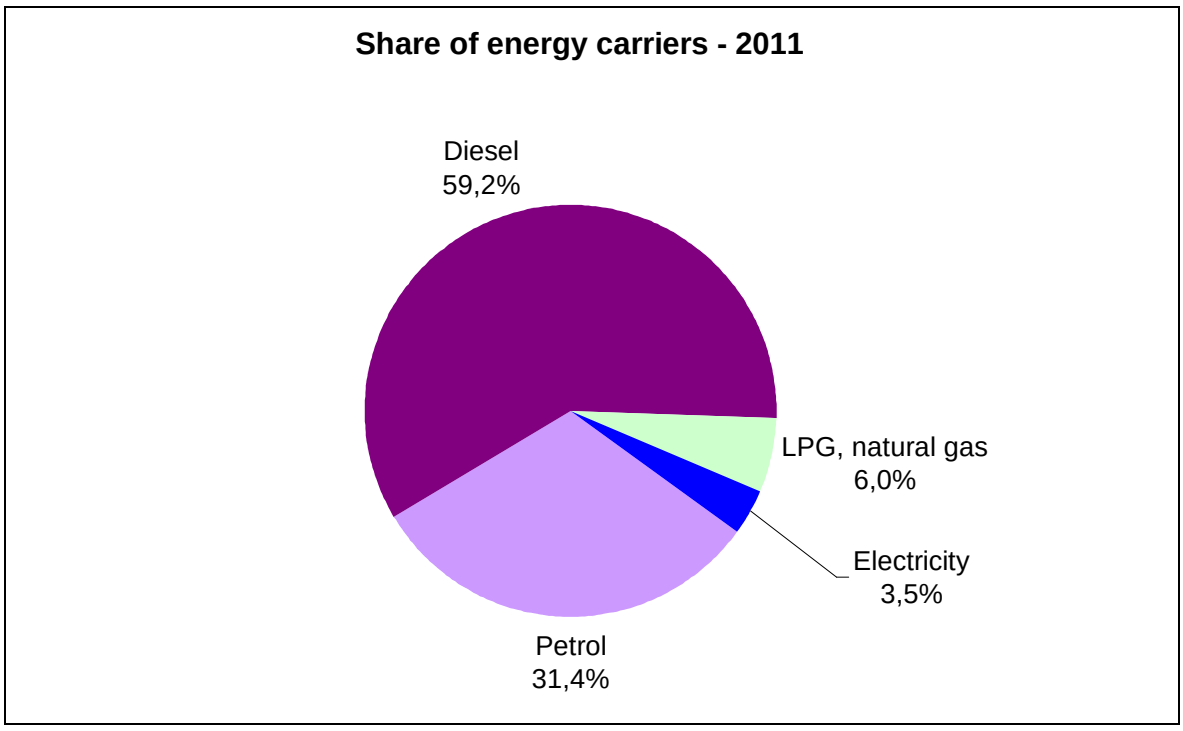


Figure 3.17 – Final energy demand of Transport - share of energy carriers (2011)

3.4 PUBLIC SECTOR ENERGY DEMAND

Public sector is responsible for 2.5% of total energy demand. Despite what is happening in other sector its energy demand is increasing during all decades (+12%). Anyway the rate of increase is half of the that recorded for private Trade and Commerce. The increase is very high in electricity (+15%), natural gas (+20%) and in heating from local district. Fossil liquids are, on the contrary decreasing a lot, mostly regarding diesel consumptions which was replaced by liquid petroleum gas, natural gas and wood. Fuel oil is only used in one big hospital and due to technical reasons its change is not under planning.
As for as renewable energy sources are concerned, biomass is used in several wood-chip boilers serving public buildings, such as schools. Even photovoltaic plants, the only way of self producing electricity available in public sector, are facing a strong increase since 2006.

Type of demand	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
District heating	37.741	38.340	42.399	42.556	45.772	47.252
Cooking	-	-	-	-	-	-
Electricity demand	363.600	359.800	367.700	375.100	380.100	419.500
Space/water heating	699.567	693.779	719.763	691.661	733.125	756.843
Total	**1.100.908**	**1.091.919**	**1.129.862**	**1.109.317**	**1.158.997**	**1.223.596**

Type of demand	**2007**	**2008**	**2009**	**2010**	**2011**
District heating	50.616	61.556	68.544	81.605	76.719
Cooking	-	-	-	-	-
Electricity demand	409.800	426.800	344.700	437.057	425.127
Space/water heating	718.829	711.205	725.555	791.892	734.044
Total	**1.179.245**	**1.199.561**	**1.138.799**	**1.310.554**	**1.235.890**

Energy carrier	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Fossil Gaseous	*473.566*	*498.838*	*525.144*	*523.569*	*553.868*	*574.715*
Fossil Liquid	*196.132*	*164.369*	*153.574*	*127.042*	*134.944*	*137.803*
Renewable Wood	*29.773*	*30.471*	*40.938*	*40.938*	*44.194*	*44.194*
Renewable Solar	*95*	*101*	*107*	*113*	*118*	*131*
Renewable Geothermal	-	-	-	-	-	-
Electricity	*363.600*	*359.800*	*367.700*	*375.100*	*380.100*	*419.500*
District heating	*37.741*	*38.340*	*42.399*	*42.556*	*45.772*	*47.252*
Total	***1.100.908***	***1.091.919***	***1.129.862***	***1.109.317***	***1.158.997***	***1.223.596***

Energy carrier	**2007**	**2008**	**2009**	**2010**	**2011**
Fossil Gaseous	*542.007*	*550.144*	*558.367*	*617.871*	*570.082*
Fossil Liquid	*132.470*	*116.559*	*119.392*	*126.178*	*116.083*
Renewable Wood	*44.194*	*44.310*	*47.567*	*47.567*	*47.567*
Renewable Solar	*158*	*191*	*230*	*276*	*313*
Renewable Geothermal	-	-	-	-	-
Electricity	*409.800*	*426.800*	*344.700*	*437.057*	*425.127*
District heating	*50.616*	*61.556*	*68.544*	*81.605*	*76.719*
Total	***1.179.245***	***1.199.561***	***1.138.799***	***1.310.554***	***1.235.890***

Table 3.5 - Public sector energy demand. Unit: MWh

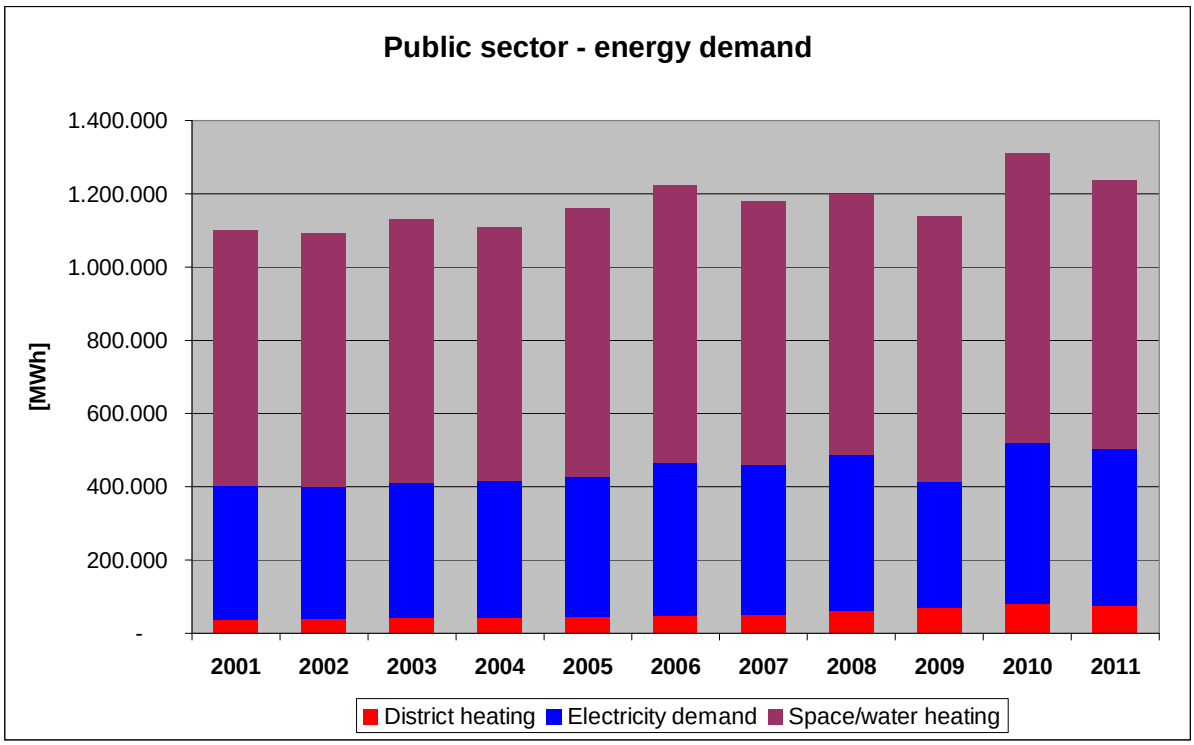


Figure 3.18 – Public sector energy demand.

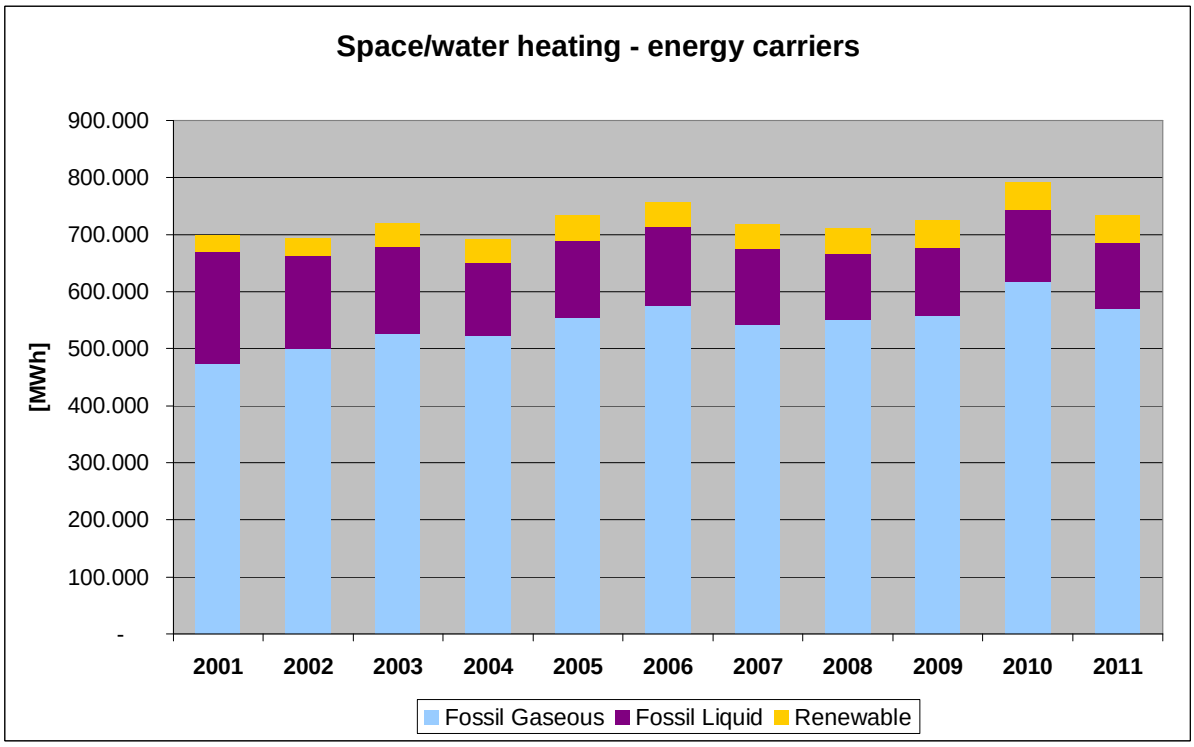


Figure 3.19 – Space/water heating in Public sector divided into energy carriers

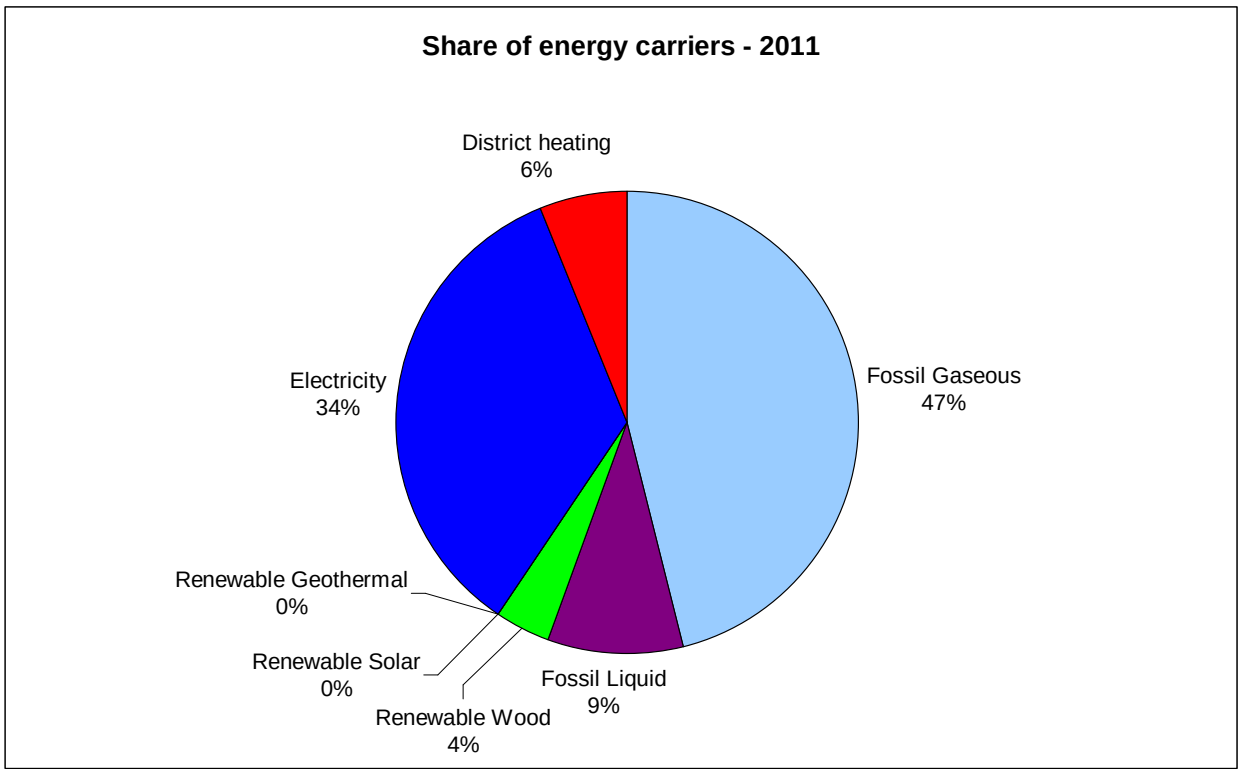


Figure 3.20 – Public sector energy demand: share of energy carriers (2011)

4 Results from the project CR based on the questionnaires

An analysis of the survey conducted among Municipalities and Companies is provided in Annex 1 and 2.

5 Analysis of risks and obstacles related to the key outcomes of the report

Type of obstacles	
Unsolicited data	
Lack of willingness for data collection	*X*
Lack of sufficient data	*X*
Lack of responsiveness	*X*
Use of different reference years or combined methodologies/ results accrued into harmonised data/values	
The regional/local data necessary to convert National data to Local level was not always available	*X*

Accurate local data from energy suppliers was not available due to confidentiality issues	
Statistics are not always reliable and the method of collecting national statistics changed, so it is difficult to compare energy balances over the years.	
In some cases, data was not up to date to obtain an accurate evaluation	

6 Recommendation and dissemination

Type of recommendations	
Lack of willingness for data collection	*X*
Increase energy monitoring tools/means in respondents	*X*
Increase responsiveness of respondents	
Develop a matrix/set for recording data	
Introduce smart metering	*X*

ANNEX 1

Survey on Municipalities

			Energy data gathered			
	Municipality	**N. of Buildings**	**Heating for buildings**	**Electricity for buildings**	**Public Ligthning**	**Energy costs**
1	Almese	20	yes	yes	yes	partial
2	Balangero	1	yes	no	no	no
3	Beinasco	15	yes	yes	no	yes
~~3~~	~~Borgaro Torinese~~	~~16~~				
4	Borgofranco	18	yes	yes	yes	yes
5	Bruino	15	yes	yes	no	yes
6	Bussoleno	~~8~~8	yes	no	no	no
7	Buttigliera	16	yes	yes	yes	partial
8	Cambiano	14	yes	yes	yes	partial
9	Canischio	1	yes	no	no	no
~~9~~	~~Cantoira~~	~~1~~				
10	Carignano	3	yes	yes	no	yes
~~10~~	~~Ceres~~	~~3~~				
11	Chieri	0	no	no	yes	yes
~~11~~	~~Coassolo~~	~~3~~				
~~12~~	~~Collegno~~	~~31~~				
12~~1~~3	Condove	17	yes	yes	yes	yes
13~~1~~4	Cuorgnè	12	yes	no	no	no
14~~1~~5	Exilles	1	yes	no	no	no
15~~1~~6	Forno Canavese	5	yes	no	no	no
16~~1~~7	Giaveno	~~17~~19	yes	no	no	no
~~18~~	~~Givoletto~~	~~6~~				
17~~1~~9	Gravere	2	yes	no	no	no
~~20~~	~~Ivrea~~	~~64~~				
18~~2~~1	Lemie	1	yes	no	no	no
19~~2~~2	Meugliano	1	yes	no	no	no
20~~2~~3	Mezzenile	2	yes	no	no	no
~~24~~	~~Moncalieri~~	~~35~~				
21~~2~~5	Nichelino	54	yes	yes	yes	partial
22~~2~~6	None	17	yes	yes	yes	yes

			Energy data gathered			
	Municipality	**N. of Buildings**	**Heating for buildings**	**Electricity for buildings**	**Public Ligthning**	**Energy costs**
23	Nomaglio	3	yes	no	no	no
24~~2~~7	Novalesa	1	yes	no	no	no
25	Orbassano	1	yes	yes	yes	partial
26~~2~~8	Oulx	7	yes	no	no	no
27	Perosa Argentina	2	yes	no	no	no
28	Piossasco	0	no	no	yes	yes
29~~2~~9	Rivoli	69	yes	yes	no	partial
30	Rosta	13	no	yes	yes	yes
~~30~~	~~Rubiana~~	~~10~~				
31~~3~~1	Rueglio	1	yes	no	no	no
32	San Giorgio Canavese	0	no	no	yes	yes
33~~3~~2	Sestriere	1	yes	yes	yes	yes
34~~3~~3	Settimo Torinese	5	yes	yes	no	yes
35~~3~~4	Traves	2	yes	yes	no	yes
36~~3~~5	Vallo T.	5	yes	yes	yes	yes
~~36~~	~~Venaus~~	~~1~~				
37	Vigone	1	yes	yes	no	yes
38	Villardora	1	yes	yes	no	yes
39~~3~~7	Villar Focchiardo	2	yes	no	no	no
40~~3~~8	Vistrorio	1	yes	no	no	no
41~~3~~9	Volvera	8	yes	no	yes	yes
	Total	~~471~~365				

Table I – List of Municipality belonging to the sample of the qualitative research in public sector

The sample is composed by about 470 buildings, managed/belonged to a public entity of the municipalities under investigation.

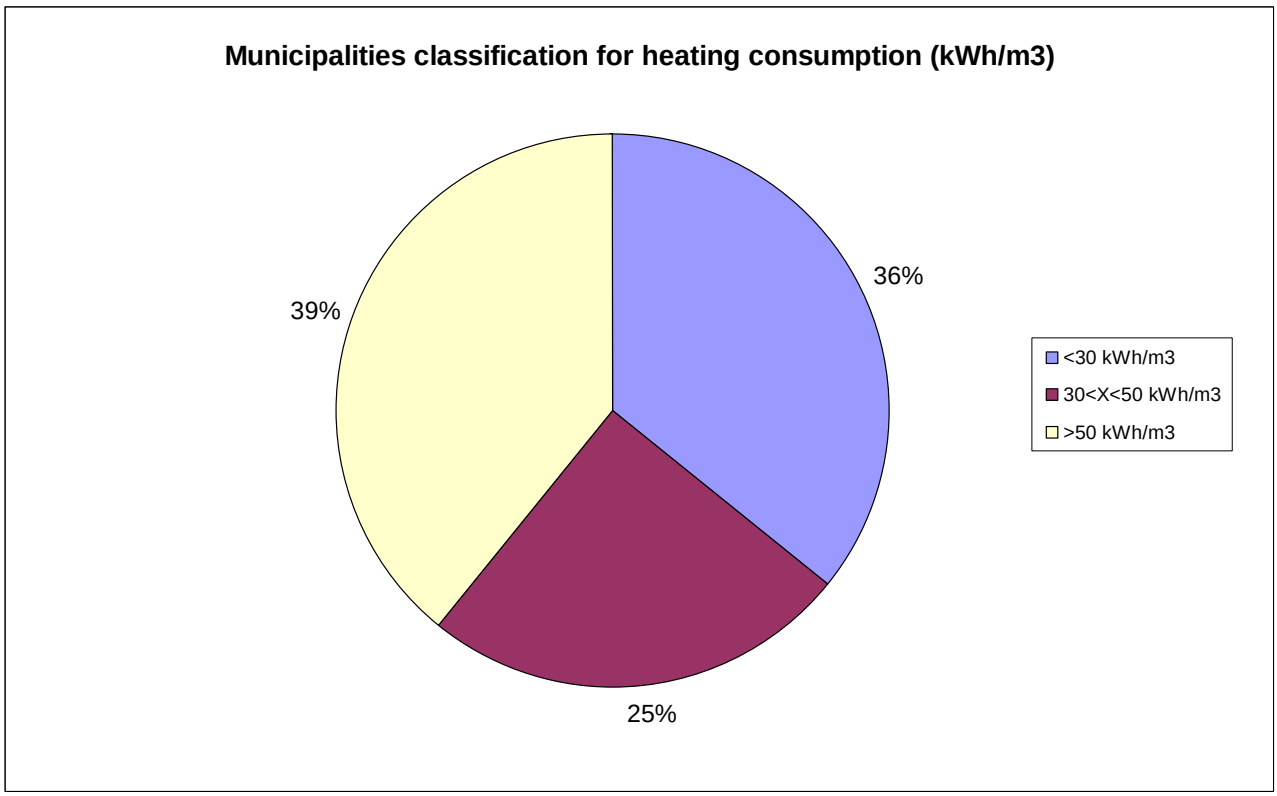


Figure I – Municipalities classification according to heating consumption

From the survey conducted and some elaborations of data, it's possible to point out the fact that regarding the heating, the situation found is quite homogeneous. About 39% of municipalities consumes more than 50 kWh/m^3 to heat its buildings, but on the other hand about 35% of them uses less than 30 kWh/m^3. The remaining 25% is located between these two amount of consumptions.
Concerning the electricity consumption, instead, we have a great number of municipalities located into the middle class (between 10 and 20 kWh/m^2): 47 %, almost half of them. Another large part (35%) is more energy-consuming, more than 20 kWh/m^2; while only 18% of the list consumes less than 10 kWh/m^2.

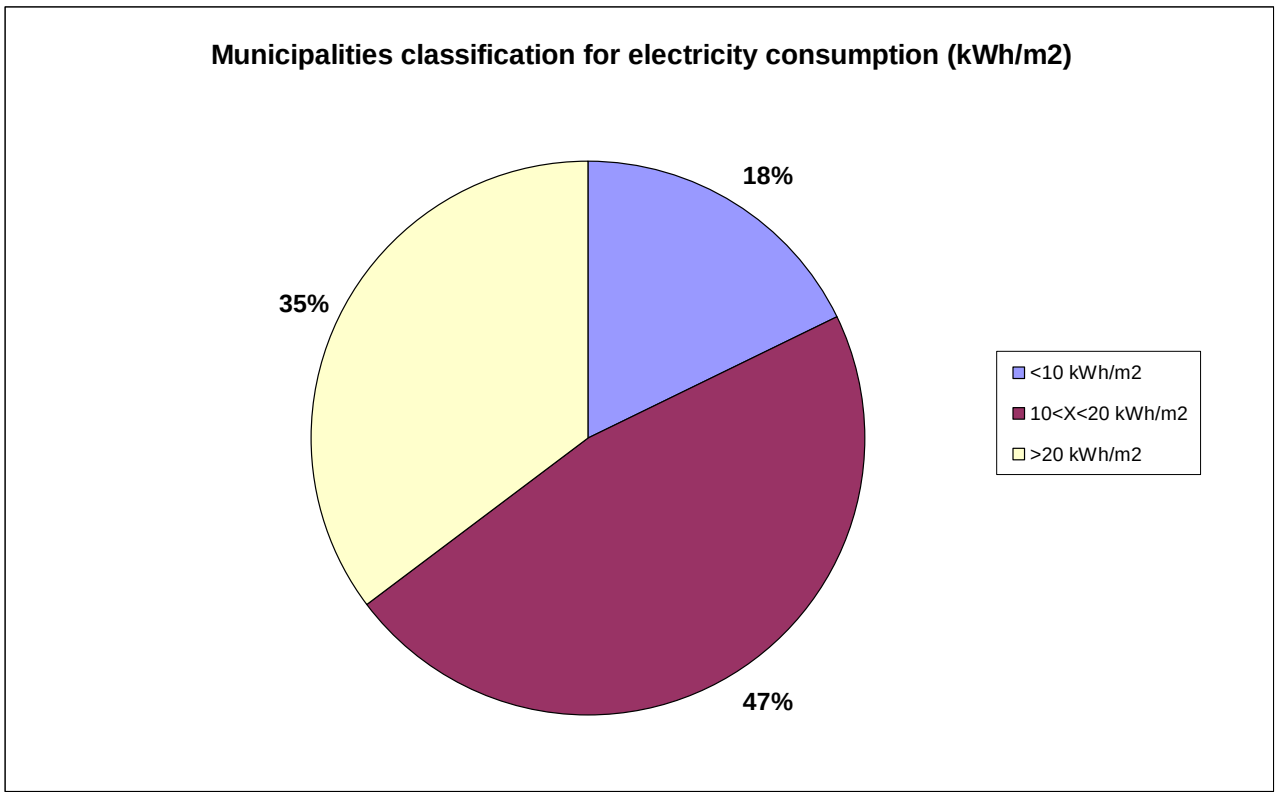


Figure II – Municipalities classification according to electricity consumption

To better analyze the heating situation, we examined the relationship between the relative consumption, such as the consumption per cubic meter (kWh/m3), and the absolute consumption, that is the total annual consumption in kWh, of every single building.
This elaboration allows to evaluate the efficiency of each building and understand on which one is necessary act with main priority and on which the priority is minor instead.
From the picture below, it' possible to divide the graph in 4 quadrants:

- the first one contains the buildings that have an high rate of relative consumption per cubic meter but a total consumption very little;
- the second one contains buildings with main priority of intervention due to a big relative and absolute consumption;
- the third, on the contrary of the first, has buildings with a low rate of relative consumption but an high total annual consumption;
- finally the fourth one has buildings with less priority because of a small relative and absolute consumption due to their small dimensions

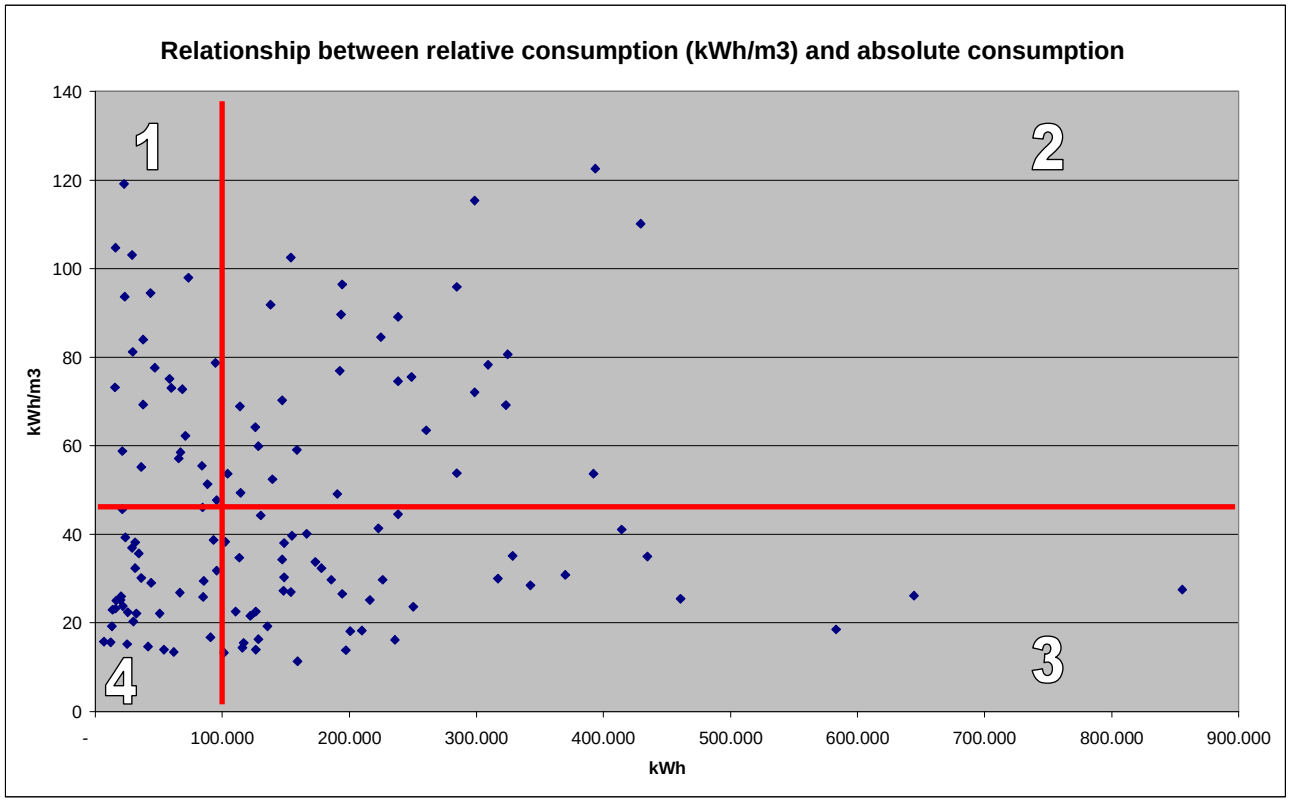


Figure III - Relationship between the relative consumption and the absolute consumption for heating

ANNEX 2 –Environment Park SpA PP11

Survey on Private companies

In succession, the list of enterprises surveyed and divided into belonging sector.

Automotive enterprises	*Bulding Industry*	*Bulding Industry*	*Bulding Industry*	*Bulding Industry*	*Manufacturing Industry*	*Manufacturing Industry*	*Manufacturing Industry*
1. SAVIO	1. A.T.MARMO SERVICE SRL	34. CRCF Centro Ricerche Per La Chimica Fine	67. I.C.A. SRL	100. ROOFINGREEN™ SRL	1. AGO RENEWABLES SPA	27. SPESSO GASKETS SRL	53.BIG DIAM SRL
2. VALERO	2. ADAMANTIO SRL	35. CYANINE TECHNOLOGIES SRL	68. I3P SCPA	101. RTM SPA	2. ASJA AMBIENTE ITALIA SPA	28. TECNODELTA SRL	54. ITT GALFER INDUSTRIE
3. CSP	3. AEG RETI DISTRIBUZIONE SRL	36. DAVIFIL SRL	69. IDROTECNICA SRL	102. SAVIO-THESAN SPA	3. AZIMUT BENETTI SPA	29. VERDERONE BATTISTA	55. RUGGER
4. BARICALLA	4. AG3 SRL	37. DE-GA SPA	70. ILTI LUCE SRL	103. SEDIS LIGHT TECHNOLOGY SRL	4. BARRICALLA SPA	30. VERDERONE INDUSTRIE SRL	56. EOC SRL
5. ENTECH	5. AGENZIA TERRITORIALE PER LA CASA DELLA PROVINCIA DI TORINO	38. DELTASOLAR SNC	71. INGENIA SRL	104. SFERA SRL	5. BIOSEARCH AMBIENTE SRL	31. GUSELLA equipment	57. ARRIGHI SRL
6. EATON	6. AGES SRL	39. DENALDI LEGNAMI SAS	72. INNOVA SPA	105. SGI ENGINEERING SRL	6. BIOSOLAR FLENCO GROUP SRL	32. FOTORECUPERI	58.SALUMIFICIO 3 VALLI
7. AVL	7. AGRINDUSTRIA SNC	40. DWA-AUTOMATION	73. INNOVASYSTEM SRL	106. SINERGICHA SRL	7. CENTRO RICERCHE FIAT SCPA	33. ITALVACUUM	59. SIGMA SAS
8. FIAT INDUSTRIES	8. ALCHERINGA SRL	41. E++ SRL	74. INNOVATION4U	107. SIRE SPA	8. COMEC SRL	34. FRESIA ALLUMINIO	60. SOFFIERA BERTOLINI SPA
9. MICROTECNICA	9. AMET SRL	42. EASYHOME.IT SRL	75. LA FOCA SRL	108. SIRECOM SRL	9. DIGISKY SRL	35. COIND	61. TECHNICAL 2 SRL
10. TESCO GO SPA	10. APR SRL	43. ECOJOULE SRL	76. LA MAISON VERTE SRL	109. SKYLINE SRL	10. ELECTRO POWER SYSTEM SPA	36. AER Robotics	62. TGR
11. TRW Automotive Italia srl	11. ARIA SRL	44. ECO-TECHNOLOGY SYSTEM SPA	77. LANDRA SRL	110. SMART-E	11. ENERCONV SRL	37. INTERECO	63. POGLIANO SRL
12. SABELT spa	12. ARTIMESTIERI	45. EDILMETALLI SRL	78. M.B.T SRL	111. SOCHIMA SPA	12. EUROLITES SPA	38. TEA ambiente	64. TAZZETTI

Automotive enterprises	Bulding Industry	Bulding Industry	Bulding Industry	Bulding Industry	Manufacturing Industry	Manufacturing Industry	Manufacturing Industry
	COOP SOC						
13. SKF INDUSTRIES	13. ASTEL SAS	46. ELETTRORAVA SPA	79. M.C.M. SPA - Manufatti Cementizi Monticone	112. SOLESA SRL	13. FERIOLI E GIANOTTI SPA (GRUPPO GENTA)	39. SOCIETà COOPERATIVA ARCOBALENO	64. NOVOZINC
14. PROTOTIPO SPA	14. ATENA SRL	47. ENNETIESSE SRL	80. M.L.L.A. SRL	113. SVILUPPO INVESTIMENTI TERRITORIO SRL	14. FLUIDO SISTEM SRL	40. LA FUMET	65. PROTEX SRL
15. MATRIX SPA	15. AUTOSTUDI SRL	48. ENTE SCUOLA C.I.P.E.-T.	81. MACCHIORLATTI DALMAS SPA	114. T.I. SRL	15. FN SPA - NUOVE TECNOLOGIE E SERVIZI AVANZ	41. GTT-GRUPPO TRASPORTI TORINO	66. RASPINI
16. CORNAGLIA	16. AZIENDA SPECIALE DELLA CAMERA DI COMMERCIO DI ASTI	49. EOLICAR SRL	82. METAL PLASTIC SNC DI POZZATO & C	115. TECNELIT SPA	16. GIACOMINI SPA	42.COSTANTINO &C.	67. ROTOSTATIC
17. BRACCO	17. BATTERFLAI SRL	50. EPROM SRL	83. METAN ALPI SESTRIERE SRL	116. TECNOLAB DEL LAGO MAGGIORE SRL	17. HYSYTECH SRL	43. IMPER ITALIA SPA	68. M. ZUNINO & c.
18. FIORAVANTI	18. BIESSE SISTEMI SRL	51. EUROGI SRL	84. MISTA SPA	117. TEKNO ENERGY SRL	18. M.eN.T.	44. CELLINO SRL	69. MAGNETI MARELLI
19. GENERAL MOTORS	19. BIOH SRL	52. EXE.GESI SPA	85. MODULO SAS	118. TRA SRL	19. MAGER SRL	45.DATA GB & C.	70. NOVERO SPA
20. ADVANCED ACCELERATORS	20. BLUE SOF CONSULTING SPA	53. FASSA BORTOLO SPA	86. MONET SRL	119. TRE A SRL	20. MECCANICA BICCHI SRL	46. SINOL SRL	
21. APPLICATIONS SRL	21. BORGNAGLASS SRL	54. FB SRL AUTOMAZIONE INDUSTRIALE E DOMOTICA	87. NEODELIS	120. VASS TECHNOLOGIES SRL	21. OZ FUEL CELLS SRL	47. GUARTO SRL	
22. CAMERSON SPA	22. BORIO GIACOMO IMPRESA COSTRUZIONI SRL	55. FRESIA ALLUMINIO SPA	88. NESOCELL SRL	121. VERDE MATTONE SRL	22. PRIMA ELECTRO	48. LEUMANN NOBILITAZIONI TESSILI SRL	
23. HUTCHINSONS SRL	23. BOSCHIS SPA	56. FRIGORIFERI BAVA SRL	89. NIMIX SRL	122. VIMARK SRL	23. REM SNC DI VISCA ROBERTO & C.	49. alfachimici S.p.A.	
24. PERARDI E GRESINO SRL	24. BUZZI UNICEM SPA	57. G2 MISURATORI SRL	90. OLICAR SPA	123. VINCENZO PILONE SPA	24. REM SRL	50.CONRADO SPA	
25. CRISEL INSTRUMENTS	25. CANTENE SRL	58. GALLINA SRL	91. ONLECO SRL	124. WATERTECH SPA	25. SAPIO PRODUZIONE IDROGENO OSSIGENO SRL	51. SUPERFICI PCB	
26. N.E.A. SRLù	26. CAPETTI ELETTRONICA SRL	59. GAMBARANA SRL	92. P.Q.R.S. SRL	125. ZOPPOLI E PULCHER	26. SIVE SPA	52.LIRI INDUSTRIAL	
27. ELTEK SPA	27. CAVALLO IMPRESA EDILE	60. GEOCAP SRL	93. PEGASO SRL				

Automotive enterprises	*Bulding Industry*	*Bulding Industry*	*Bulding Industry*	*Bulding Industry*	*Manufacturing Industry*	*Manufacturing Industry*	*Manufacturing Industry*
28. MERCK SERONO	28. CCS AOSTA SRL	61. GFO EUROPE SPA	94. PHITEC INGEGNERIA SRL				
29. TITANMED SRL	29. CEIT DI RUSCALLA BRUNO	62. GOLDER ASSOCIATES SRL	95. PICOTEC SNC				
30. DELPHI INDUSTRIES	30. CELLARENGO 2020 SRL	63. GOZZO IMPIANTI SPA	96. PRO S3 SRL				
31. DENSO ITALIA	31. CLUSTER SRL	64. GRUPPO SAE SRL	97. PROPLAST - CONSORZIO PER LAPROMOZIONE DELLA CULTURA PLASTICA				
32. DYTECH	32. COMAI TORINO SRL	65. GSTRAMANDINOLI SRL	98. R.E.M. SRL				
33. MUSSA E GRAZIANO SRL	33. CONFORTAREE SRL	66. HABICHER HOLZBAU SRL	99. RICREA DI CRISTINA MERLO				

Table II – List of companies contacted

Regarding the enterprises surveyed, **35** companies answer to the questionnaire proposed. The following table and chart summarize the data obtained from this sample of companies

BUILDING INDUSTRIES

Company name	electricity consumption (MWh/year)	thermal energy consumption (Tep/year)	water consumption (m3/year)
GOLDER ASSOCIATES SRL	266	42,2	1218
GOZZO IMPIANTI SPA	200	20	1000
T.I. SRL	62	40	200
STP s.r.l.	4,56	1612	510
total	532,56	1714,2	2928

MANIFACTURING INDUSTRIES

Company name	electricity consumption (MWh/year)	Company name	thermal energy consumption (M3/year)
AER Robotics		AER Robotics	
ASJA AMBIENTE ITALIA SPA	205	ASJA AMBIENTE ITALIA	32,0

SOCIETà COOPERATIVA ARCOBALENO	365	SOCIETà COOPERATIVA ARCOBALENO	267,1
GTT-GRUPPO TRASPORTI TORINO	27.000	GTT-GRUPPO TRASPORTI TORINO	4095,2
ITALVACUUM	160	ITALVACUUM	110,6
LA FUMET	1807,5	EOC SRL	27.376
EOC SRL	119,8	IMPER ITALIA SPA	18236940
IMPER ITALIA SPA	5298,0	LEUMANN NOBILITAZIONI TESSILI SRL	1.631.465
LEUMANN NOBILITAZIONI TESSILI SRL	2249,8	NOVOZINC	77.000
NOVOZINC	7000	RUGGER	659.732
RUGGER	4374,51	COSTANTINO &C	12.000.000
ALFACHIMICI S.p.a	700	ALFACHIMICI S.p.a	260.00
ARRIGHI SRL	6000	CELLINO SRL	39.074
CELLINO SRL	691,98	CONRADO SPA	270.000
DATA GB & C.	2287,4	DATA GB & C.	21.117
GUARTO SRL	800	GUARTO SRL	12.000
ITT GALFER INDUSTRIE	6100,9	ITT GALFER INDUSTRIE	173.343
LIRI INDUSTRIAL	4911,9	LIRI INDUSTRIAL	5.337.042
POGLIANO SRL	452,2	POGLIANO SRL	111.438
RASPINI	9400	RASPINI	1.050.000
SALUMIFICIO 3 VALLI	905	SALUMIFICIO 3 VALLI	147.000
SIGMA SAS	300	SIGMA SAS	7.000
SOFFIERA BERTOLINI SPA	0,3	SOFFIERA BERTOLINI SPA	2472
TECHNICAL 2 SRL	366	TECHNICAL 2 SRL	72,5
Rotostatic	647,3	Rotostatic	254.885
total	**82142,5**	**total**	**40062461,4**

Company name	water consumption (m3/year)
SOCIETà COOPERATIVA ARCOBALENO	3548
GTT-GRUPPO TRASPORTI TORINO	210.000
ITALVACUUM	5500
LA FUMET	52474
EOC SRL	2.974
IMPER ITALIA SPA	217.774
LEUMANN NOBILITAZIONI TESSILI SRL	408.244

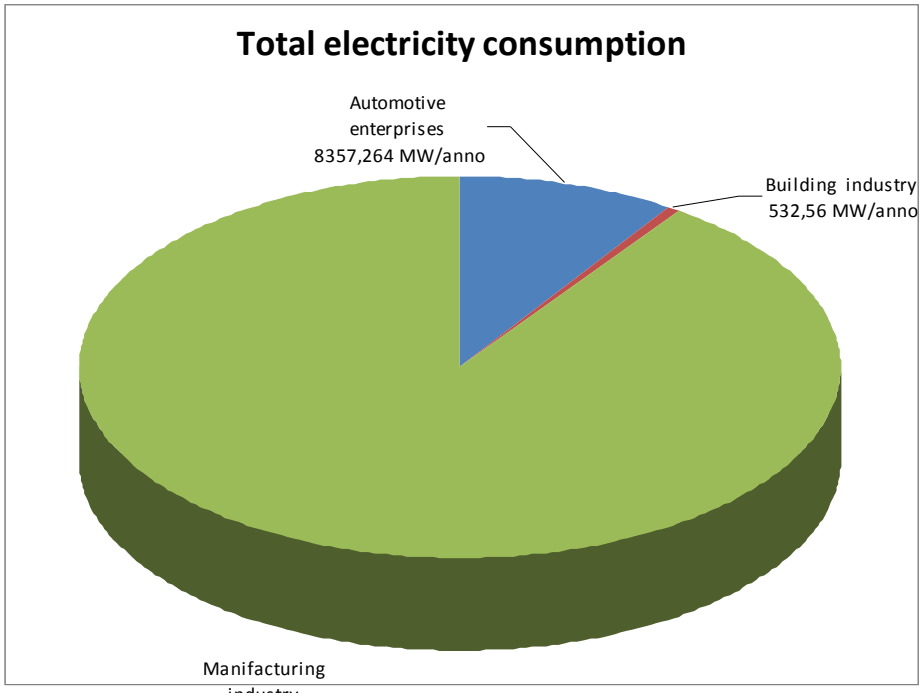
M. ZUNINO & c.	2168
NOVOZINC	5.400
RUGGER	100.000
COSTANTINO &C	5022,4
ALFACHIMICI S.p.a	31.000
ARRIGHI SRL	500.000
CELLINO SRL	2.062
CONRADO SPA	15.000
COOPERATIVA CASEIFICIO PUGLIESE S.p.a	21.600
DATA GB & C.	3.534
GUARTO SRL	400.000
ITT GALFER INDUSTRIE	13.030
LIRI INDUSTRIAL	166714
POGLIANO SRL	28.537
RASPINI	156871
SALUMIFICIO 3 VALLI	4484
SIGMA SAS	1000
SINOL SRL	4700
SOFFIERA BERTOLINI SPA	371.000
TECHNICAL 2 SRL	4
TGR	1460
BIG DIAM SRL	1278
Rotostatic	44000
totale	**2779378,4**

AUTOMOTIVE ENTERPRISES

Company name	electricity consumption (MWh/year)	thermal energy consumption (tep/year)	water consumption (m3/year)
1. AVL	106	24,6	1650
2.ENTECH	3,734	1,3448	118
3.GENERAL MOTORS	8247,53	281,59222	33435
total	**8.357,26**	**307,54**	**35203**

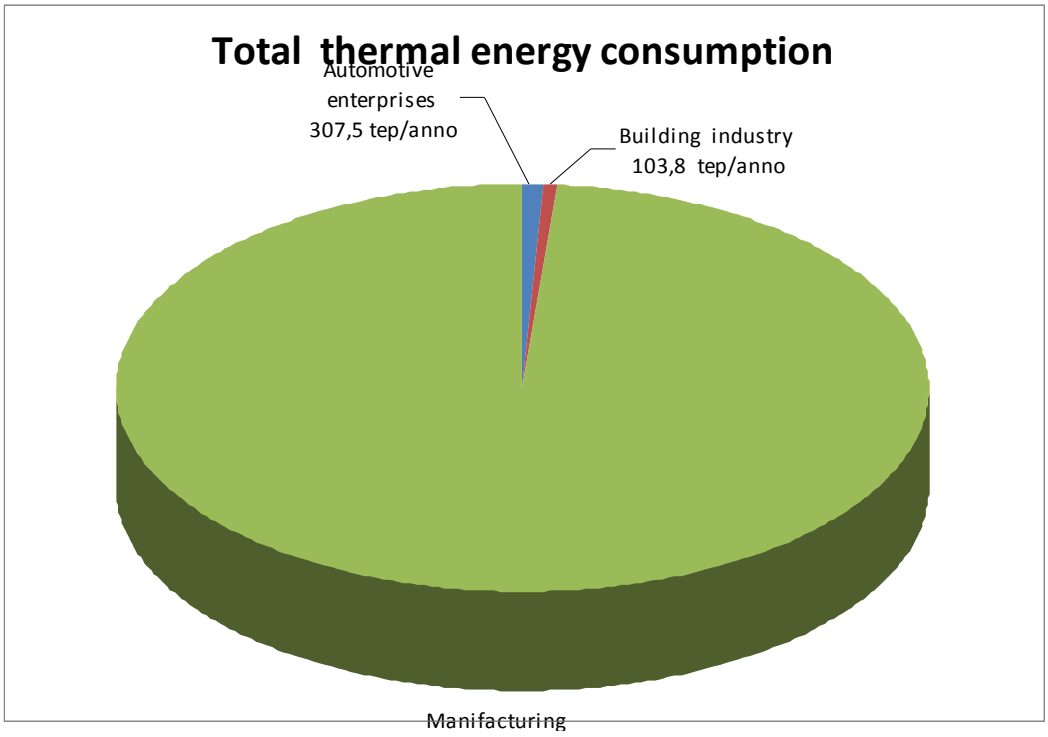
Total electricity consumption

Automotive enterprises	8357,264	MW/anno
Building industry	532,56	MW/anno
Manifacturing industry	82142,57	MW/anno



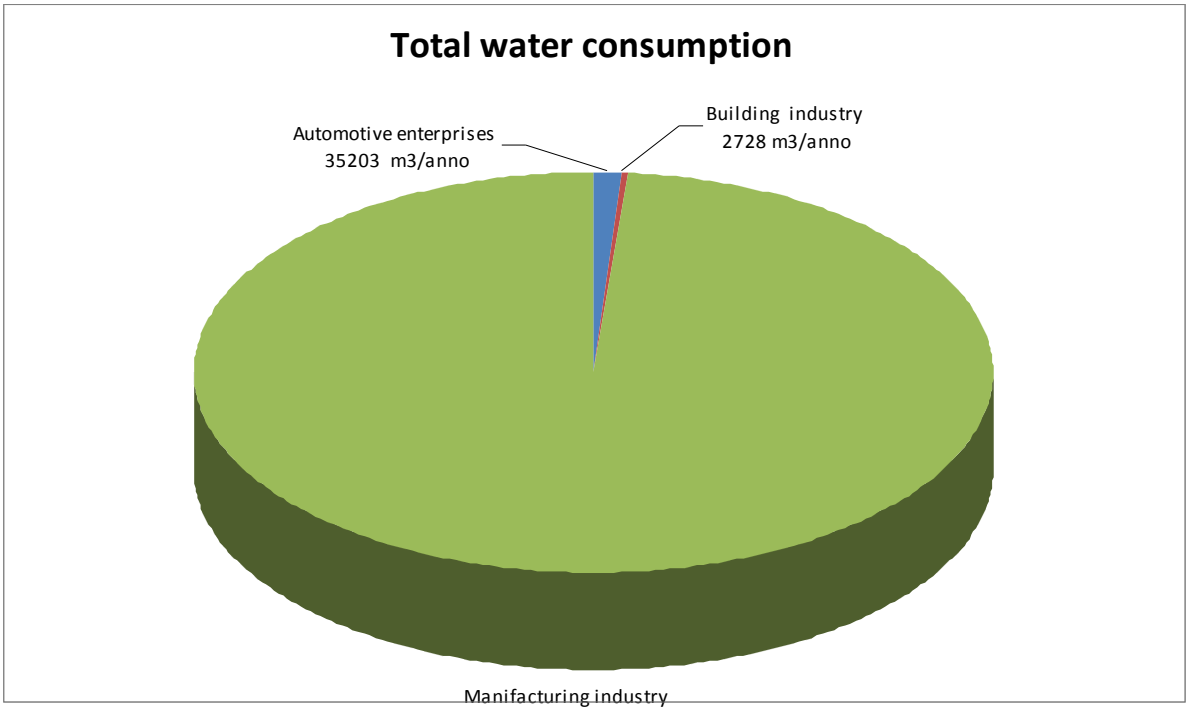
Total thermal energy consumption

Automotive enterprises	307,5	tep/anno
Building industry	103,8	tep/anno
Manifacturing industry	32050	tep/anno



Total water consumption

Automotive enterprises	35203	m3/anno
Building industry	2728	m3/anno
Manifacturing industry	2779378	m3/anno


Total water consumption
Automotive enterprises
35203 m3/anno
Building industry
2728 m3/anno
Manifacturing industry