

# **“Introduction of regional energy concepts”**

## **WP 3.1.3**

### **Regional energy demand report**

#### **PP12 Friuli Venezia Giulia Region**

**Silvia Stefanelli**

**Paola Zuodar**

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## **ENERGY DEMAND IN THE CONCEPT REGION "FRIULI VENEZIA GIULIA"**

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# Energy demand in the Friuli Venezia Giulia concept Region

## 1. Description of the concept region

### 1.1 Overview

The Friuli–Venezia Giulia region lies in the North- Eastern corner of Italy between the Alps and the Adriatic sea and its landscape includes coastal areas, mountain and lowlands. The Region borders further North with Carinthia (Austria) and further East with Slovenia, while to the South lies the Gulf of Trieste and to the West Veneto region. The distance of Slovenia from the capital city of Trieste is on average 5 km, while the same city is 140 km further South the border with Austria.

Friuli Venezia Giulia Region is one the 20 regions of Italy and one of the five autonomous regions of Italy with a special statute. Although it is part of federal Italy it operates with a higher degree of independence and it is responsible in large parte for its own administration, legislation and finance management.

The capital is Trieste and the region is crossed by the major transport routes between the East and west of southern Europe. It encompasses the historical-geographical region of Friuli and a small portion of the historical region of Venezia Giulia, each with its own distinct history, traditions and identity. The most significant mountains are the Julian mountains hence the Appendix Giulia in the Region's name.

The territory is divided in mountains (42,5), hills (19.3%) and plains (38.2%), whereas only 5,5 % of the population lives in mountain areas, 36% in the hills and the majority (58%) in the plains.

Figure 1. The concept region "Friuli Venezia Giulia" in the European and Italian context

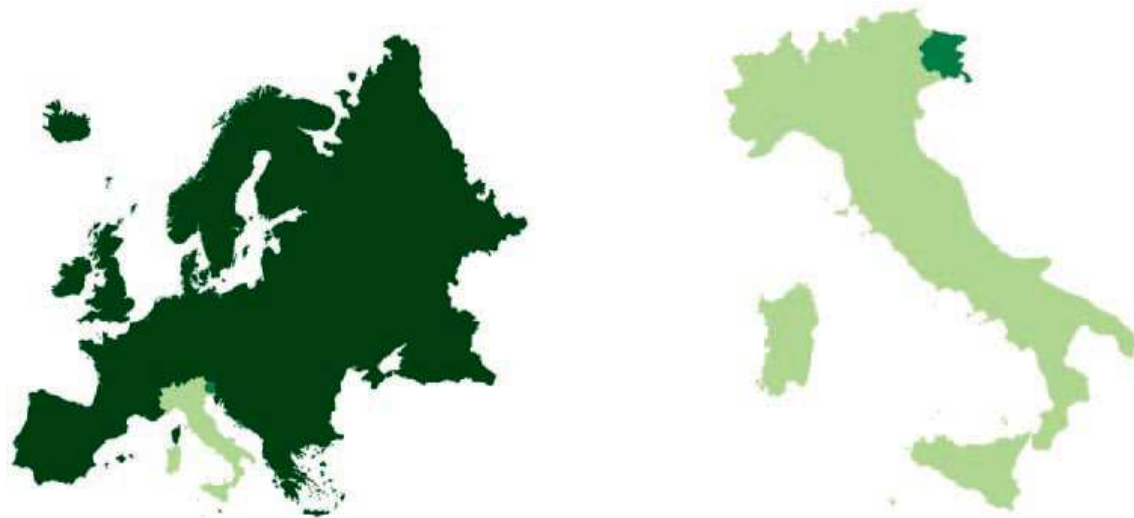


Table 1. Friuli Venezia Giulia region in a nutshell

Land surface	<b>7.858 km<sup>2</sup></b>
Position within the European Union division per NUTS	<b>NUTS 2</b>
Population profile – number of inhabitants	<b>1.235.808</b>
Active labour population	<b>785.973 or 63,6% of population between 15-64 years</b>

The Friuli Venezia Giulia is the fifth smallest region in Italy but its geographical location lies at the heart of the new enlarged Europe - 27 and it is deemed to be baricentric to the new Europe, bridging the Western to the Eastern groups of European countries.

Such strategic position represents an opportunity to strengthen economic relations between old and new European countries, which require new transport gateways, trade routes and goods distribution platforms. As a

result Friuli-Venezia Giulia lies in a strategic position for European international relations, trades and transport connections.

## **1.2 Natural environment**

The geographical position of the region influences its climate features, which include Mediterranean and Alpine climate elements and a wide range of different natural environments. The landscape includes different environmental features, from alpine and mountain habitat, lakes, rivers and sea wetlands.

Some of the most interesting environmental features are found in the mountains, hills and the plains. In the upper plains there are arid and permeable soils called "magredi", where rivers run underground and come up to the surface further down in the line of "karst springs".

Further East and bordering with Slovenia lies the "Karst or Carso" land, a rocky waterless limestone surface with underground limestone caves due to the chemical action of water on soluble stone. The area is featured with dolines, sinkholes and various other karst phenomena can be found. Underground, there are innumerable karst caves and abysses.

Down to the sea lie the lagoons of Marano and Grado, divided by the Adriatic sea by sandbars, an area that stretches out for 160 km<sup>2</sup> and an average width of 5 km. Although the lagoons are close to a heavily industrialized area with a multiplicity of environmental contamination sources, they represent a remarkable important ecological system, both for the habitats of several migratory birds. Most of the lagoon is covered by tidal flats and salt marshes and some areas are constantly submerged by tidal channels and subtidal zones.

The coastline includes sandy beaches further West while to the east the coastline becomes high and rocky, with little bays nearby Duino, Sistiana and Trieste.

Another relevant feature is the extension of forests that cover up as much as 300.000 hectares or 41% of the total regional area, 93% located in mountain areas. The forest area almost doubled since the 1960 in parallel with the population decrease in mountain areas where other traditional economic activities declined. Different climate and geological conditions, often overlapped in the same territory determine a diversification of forests into 20 categories and 105 forest types ranging from Alpine larch forest stands to sub – Mediterranean mixed oak forests along the coastal line.

The environment includes elements of a rather diversified Mediterranean and continental flora as well as fauna. In particular the fauna includes big mammals such as the lynx and the brown bear, the golden jackal, the wild cat and birds such as the the crown eagle and the griffon vulture.

The flora is highly diversified with 3388 different species out of 6000 on the overall Italian territory. To compare such figures with other European countries, the overall flora of Germany includes "only" 2000 floral species. Such diversification of species and ecosystems is due to particular geographic-geologic - climatic features as well and historic reasons.

Within the regional territory there are two Regional natural Parks: Parco delle Dolomiti Friulane and Parco delle Prealpi Giulie, 12 Natural Reserves and 30 biotopes. The Nature 2000 network of protected sites includes 116.450 ha ( 14,8%) of ZPS areas ( Specially Protected Sites) and 132.170 (16,8%) of Special Areas of Conservation ( SIC) .

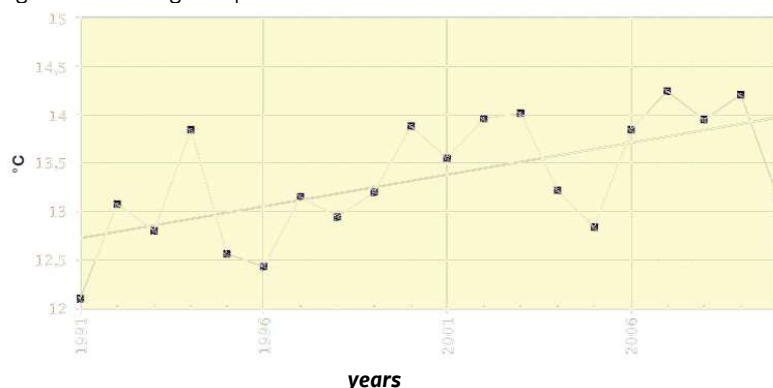
## **1.3 Climate and climate change in the Friuli Venezia Giulia Region**

Friuli Venezia Giulia has a humid, temperate climate which varies considerably from one area to another. The Alpine system protects it from the direct impact of severe northern winds, but the region is influenced by the general circulation of masses of air from the West to the East. Along this direction, the low pressure centres settle down bringing with them understorms and hailstorms, especially during the summer months, but also at times in the spring and autumn. Being open to the Adriatic Sea, the territory also receives scirocco winds, which bring with them heavy rainfall. With regard to wind features they depend on the characteristics of the territory. The chain of Alpine and Julian mountains that continues in the Carso territory are swept by winds as fast as on average 10 m/second whereas wind gusts that occasionally blow along the coast can reach 40 m/second (144 km/hour) and 3-5 m/second in the plains.

The annual average temperature is 12 degrees Celsius, while the annual average rainfall 1450 mm. Rainfalls vary significantly on the territory. The capital Trieste is relatively dry with roughly 1000 mm of rainfall per year, while

the area around the Julian Pre Alps is deemed to be one of the wettest spots in Europe with 3000 mm of annual rainfall. With regard to climate change according to recent data<sup>1</sup>, since 1990 the average annual temperature increased by roughly 1°C, as figure 2 shows. With regard to annual rainfalls, so far variations in terms of increase or decrease of total annual rainfalls are not significant or climate change related. However there is sufficient evidence to highlight monthly rainfall patterns variations in terms of frequency and intensity.

Fig.2 Annual average temperature trend from 1991 to 2010 in Friuli Venezia Giulia



Source: Osmer 1991-2010

With regard to climate change impacts, some of them concern the all Europe, others will specifically impact the Region. Table 2 shows an overview of impacts in a wide range of sectors from tourism to health and energy.

Table 2. Most likely impacts of climate change in Europe and in the Friuli Venezia Giulia Region

<b>Sector</b>	<b>Impact</b>
Water and soil management	Increase of risks of floods and landslides Water demand growth Decrease of water availability Water quality worsening
Coastlines management	Increase of floods Increase of coastal erosion Salinisation of rivers, coastal areas and groundwater
Health	Increase of casualties due to heatwaves, allergies and infections Decrease of casualties due to frostbites and cold related diseases
Pollution	Decrease of winter urban pollution Likely increase of summer ozone pollution
Agriculture	Decrease of crops yield in not irrigated lands Increase of crops yield in wetlands, irrigated lands and northern areas Increase of pest diseases Soil degradation in selected areas
Forests	Increase risk and frequency of summer wild fires Increase of wood growth in northern areas
Energy	Decrease of energy demand for heating in winter Increase of energy demand for cooling in summer Decrease of hydro - electricity production in some areas Increase of Solar PV electricity production
Biodiversity	Die out of some species Expansion of thermophile species
Transport	More frequent transport disruptions due to floods Decrease of snow and frost related disruptions
Tourism	Decrease of areas available for down hill skiing, ski resorts and snowline increase Shorter skiing season Longer summer season for green tourism in mountain areas Likely worsening of the quality of water for swimming

Source: adjusted from Arpa "Report on the environment in the Friuli Venezia Giulia region 2012"

<sup>1</sup> Agenzia per l'Ambiente della Slovenia 2010,2011; Rapporto sullo stato dell'ambiente 2012, ARPA

## 1.4 The economy

On average statistics on the scale of the economy show that GDP per capita amounted to € 29.500 in 2009. According to the EuroStat indicators systems, based on the assumptions of an European reference level of 100, regional GDP indicator is 117 above the Italian average of 104.

Economic activities in the Region cover a wide range of sectors from agriculture to manufacturing and building industries, commerce, tourism activities and other sectors. However the distribution of enterprises per sector in 2010 showed that commerce (23%), agriculture and farming (16,5%), building (16%) manufacturing (11%) and tourism (8%) industries are the sectors where more private enterprises are concentrated.

With regard to agriculture Friuli Venezia Giulia has a reputation of wine making region which substantially depends on a selected group of high quality wine makers and the Region is home to three DOCG and ten DOC.

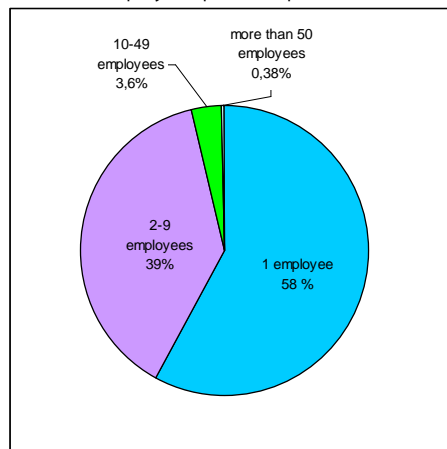
Also at the heart of the economy lies the "Chair district" a network of SMEs in the province of Udine specialised on chair manufacturing. The "Chair triangle" provides employment to around 14.000 people and more than 40 million chairs are manufactured each year, which represent 80% of the Italian production and respectively 50% and 33% of the European and world seating production. The main feature of the district is the emphasis placed on subdividing the production process. Specialised factories that are usually quite small carry out each single phase or process of the same phase. This system brings about a high degree of specialisation and an internationally recognised top quality product.

Beyond the chair district, other specialised districts play a major role in the regional economy: the districts of San Daniele del Friuli (cured ham), Maniago (knives) and Brugnera (furniture). Some of the regional based companies are world-leaders in their sectors, such as Fincantieri for the construction of the world's largest cruise ships, Zanussi-Electrolux in the production of electrical appliances and Assicurazioni Generali in Trieste, one of the worldwide leading insurance companies and Moroso, a world wide premium design furniture manufacturer.

In the services sector the city of Trieste plays a leading role with knock-on effects on the other provincial capitals. In Trieste the regional government as well as banking and insurance companies has their headquarters. With its commercial Free Port, Trieste also plays an essential role in the trade sector: special custom regulations ensure exclusive financial conditions to operators. The Port of Trieste is today one of the most important centre worldwide for the trade of coffee and plays a strategic key role in trade with northern and eastern Europe.

Another economic feature of the Region is the relevance of small to medium enterprises. Although the economy of the Region is based on a wide range of large ,medium and small enterprises, small companies are by and large the first type of business aggregation. In fact in 2008 in the industry sector out of 22.607 industries 45% of all enterprises had only one employee, followed by industries with 2-9 employees (41%) and 12% with 10-49 employees. Only 1,8 % of industries have more than 50 employees. Also the services sector reflects a similar distribution, where as much as 96% of enterprises have less than 10 employees, as figure 3 shows.

Fig 3. Number of employees per enterprise in the services sector



Source: ISTAT 2011

Another remarkable aspect of the economy is the link with research and development activities. Companies spending per capita in the Friuli Venezia Giulia on research and development amounts to € 216, much more above the Italian average, in 2008 of € 169.

The average monthly spending on energy and fuels per family amounts to € 131 or 5,9 % of the total monthly spending.

### 1.5 Transport and energy infrastructures

Transport infrastructures in Friuli Venezia Giulia offers a wide range of transport modes ranging from motorways to railways, ports, airports. More than 200 kilometres of motorway run from West to East, namely from Venice to Pordenone, Trieste and Gorizia crossing the Italian-Slovenian border, and from the South to the North, namely from Trieste to Udine, Tarvisio and the border with Austria. The rail network covers 500 kilometres of lines, with the two backbones twin-lines " Venice/Mestre – Trieste and Trieste – Udine – Tarvisio. The latter has a capacity of 220 trains per day and the possibility of carrying at 200 kilometres per hour. The motorway and railway networks connect the ports of Trieste, Monfalcone and Porto Nogaro.

Since 1719 the port of Trieste represented a strategic hub in the Adriatic sea and has the greatest capacity of covered storage in Italy: 500 thousand square metres of warehouses and a surface area of over 2.3 million square metres (of which The storage and trade of goods is guaranteed by the Cervignano Terminal, which operated since 1988 and stores up to 350.000 tonnes of goods per year.

Finally the regional airport "Ronchi dei Legionari" is directly connected to the motorway network: roughly twenty airlines operate within the airport, offering regular national and international flights which include destinations to the four European axis.

Looking to the future, the development of the Pan-European Transport "Corridor V" which will connect Venice/Trieste – Ljubljana – Budapest – Kiev will represent the new modern transport route that will guarantee a fast and sustainable means of transport for goods and people from Western to Eastern Europe.

Energy infrastructure and networks include pipeline, transmission networks, grid network as well as other energy facilities and their length and geographical distribution is shown in Table 3 and Figures 4,5 and 6.

Table 3. Main transport and energy networks in the Region

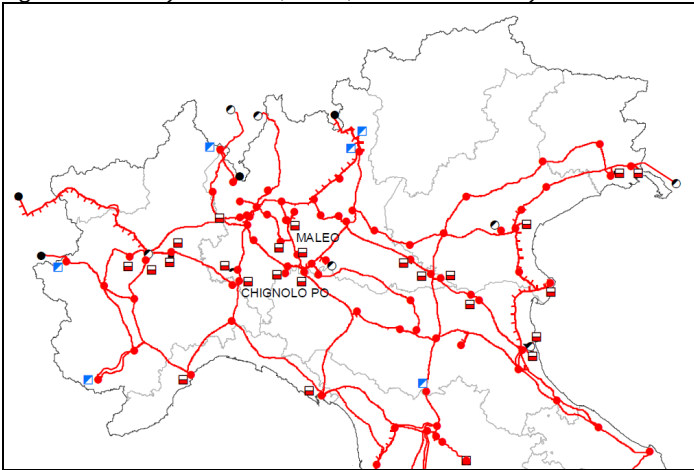
Network connections	Description
<b>Roads</b>	Length of roads: 3.593 km (total) Regional and provincial roads: 3.192 National roads: 191 km Motorways: 210 km
<b>Electricity National transmission networks at regional level<sup>2</sup></b>	<b>380 kV line:</b> 157 km. The line is divided in two directions: East-West and North-South <b>220 kV line:</b> 269 km <b>132 kV:</b> 1326 km Main industrial hubs are connected to dedicated 380kW and 220 kW grids.
<b>GAS pipelines<sup>3</sup></b>	<b>489 Km</b> National transport pipelines at regional level. The majority of the pipelines are owned by SNAM GAS Network and amount to <b>488,7 km</b> . Almost all the gas is imported from Russia.
<b>OIL pipelines<sup>4</sup></b>	<b>145 km</b> Trieste is the furthest North oil hub in the Adriatic sea where oil ships arrive from all around the world. Oil pipelines carry oil, gasoline and diesel to Austria, Germany and the Czech Republic.

<sup>2</sup> Sources: Atlante GRTN 2002, ARPA FVG 2005

<sup>3</sup> Sources: PER 2003

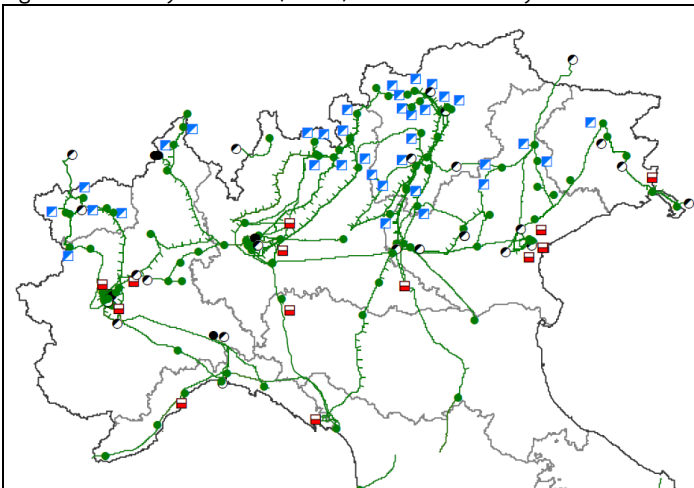
<sup>4</sup> Sources:PER 2003

Figure 4. Electricity network (380 kV) in the North of Italy in 2011



Source: Terna 2011

Figure 5. Electricity network (220kV) in the North of Italy in 2011



Source: Terna 2011

Figure 6. Gas pipelines network in the North of Italy in 2008



Source: International Energy Agency 2012



## 1.6 Society: demography and employment

Overall the population amounted to 1.235.808 inhabitants, whereas are made up to 9% are made up of foreign residents. As opposed to national population density of 202 inhabitants per km<sup>2</sup> the region has an average of 157-196 inhabitants per km<sup>2</sup>. However the mountain area that represents 42% of the territory has a density of 21 inhabitants/ km<sup>2</sup> whereas Trieste shows a highly densely populated spot with 1144 inhabitants/ km<sup>2</sup>.

The analysis of some of most relevant demographic indicators describe clearly how the population is evolving. The birth rate is one of the lowest in Italy and the population growth averages - 2.3 to 1.6 people per 1000 inhabitants. The demographic rate expressed as number of births and deaths per 1000 inhabitants shows a negative balance of - 3 inhabitants in the time frame of 2008-2010. However the population downturn trend has been counterbalanced by a net migration rate of 4 - 5 immigrants per 1000 inhabitants.

In addition to the fact that the percentage of inhabitants older than 65 years are up to 23,4%, second region in Italy after Liguria with the eldest percentage of population, the overall picture of the region shows a tendency of ageing of population.

Life expectancy at birth in 2010 was 79,1 years for men and 84,5 years for women. On average 83% of the population is satisfied of its health conditions.

The employment rate in 2010 was 64% with a gender gap between men (72%) and women (56 %) of 16% , well below the Italian average employment gender difference of 22% and but above the average difference in EU 27 countries of 12% and remarkably above certain EU countries like Denmark that shows a 70% women employment rate. One the positive side gender gap in the region is slightly decreasing from 19 % in 2008 to the current 16%, mainly as the result of the relative stability of women employment rate as opposed to a decrease of men employment rate and job losses.

In 2010 recruitment reached 109.350 people across the region, whereas 83% were Italian citizens, 5% were EU citizens, 6 % citizens from Central and Eastern European countries including not EU countries and 6% were citizens from other countries.

Overall during 2007-2011 time frame job losses amounted to 11.000 as a result of 16.000 men job losses, while women jobs increased by 4.000 jobs.

Table 4. Administrative and social framework

Sector	Description
Public sector infrastructure	Primary schools - 381 Secondary schools:114 Kindergartens: 438 Students ( private and public primary schools): 51145 Students (private and public secondary schools): 31326 Libraries: 369 Social houses: 29.091
Provinces	4 Provinces: Udine, Trieste, Gorizia, Pordenone
Administrative division of the region	Municipalities: 218 (see annexed list of municipalities)

## 2. Description of the methodological approach

### 2.1 Description of the methodology

Energy information have been collected adopting a top-down approach from national statistics data and from a survey carried out by CETA, Centre for Theoretical and Applied Ecology, a local research centre in energy and environmental issues from 2006 to 2011.

Data on energy demand from 2006 to 2008 has been mainly taken from Regional Energy Balance Reports carried out by ENEA, the Italian National Energy Research Agency. In these reports final energy consumption was measured at regional level in the following sectors: industry, agriculture, transport, services (including the public sector) and domestic or household sectors.

However the overall energy demand from 2009 to 2011, not yet available from ENEA, have been assessed by CETA which is carrying out studies on energy demand and supply at regional level. In particular the evaluation of the final energy demand for 2009, 2010 and 2011 in the Friuli Venezia Giulia Region was carried out by CETA on the analysis of annual trends in national energy demand for each sector, comparing the different weight and trend of each sectors into the regional system.

Data and information about energy production from RES –Electricity have been based on Regional Energy Balance Reports (ENEA) for 2006, 2007 and 2008 as well as on annual Statistics Reports carried out by Terna S.p.A., the National Electricity transmission Operator and by GSE, the National Managing Authority of Energetic Systems for 2009, 2010 and 2011.

### 2.2 Description of sources of information

The list of National and Regional sources of information which provide socio-economic and environmental data and information at regional level are provided in the table 5 reported below:

Table 5. List of sources on socio – economic and environmental data

Name		Website
National Statistical office	Istat	<a href="http://www.istat.it">www.istat.it</a>
Regional Statistical office	Servizio Statistica	<a href="http://www.regione.fvg.it">www.regione.fvg.it</a>
Meteorology, weather/climate Regional Agency	OSMER	<a href="http://www.osmer.fvg.it">www.osmer.fvg.it</a>
Environmental Regional Agency	ARPA	<a href="http://www.arpa.fvg.it">www.arpa.fvg.it</a>

The list of national sources of information on energy data and information at regional level are the following and detailed in Table 6:

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

Table 6. List of sources on energy data

Name		Website
National Electricity transmission Operator	TERNA S.p.A.	<a href="http://www.terna.it">www.terna.it</a>
National Managing Authority of Energy Systems	GSE	<a href="http://www.gse.it">www.gse.it</a>
National Energy Agency	ENEA	<a href="http://www.enea.it/it">www.enea.it/it</a>
Ministry of Economic Development	Statistical Energy Observatory	<a href="http://dgerm.sviluppoeconomico.gov.it/dgerm/">http://dgerm.sviluppoeconomico.gov.it/dgerm/</a>
Gas pipeline system operator/ Gas Provider	SNAM Rete Gas S.p.A.	<a href="http://www.snamretegas.it">www.snamretegas.it</a>

### 3. Understanding energy demand

#### 3.1 Energy outlook

Overall the main features of the energy sector at regional level reflect the national energy outlook with regard to energy dependence and market prices.

Energy dependence in terms of import of solid and petroleum fuels as well as natural gas is one of the highest in Europe and in 2010 amounted to 83,8 % as opposed to the average EU-27 of 52,7%. Although data for 2010 are not available at regional level, in 2003 energy import dependence reached 94,8% against the national level of 91,3 %. Presumably the rise of renewables has lowered energy imports at national level as well as at regional, although they still remain rather high as opposed other EU countries. According to the National Energy Strategy (SEN) energy dependence will decrease due to the implementation of energy efficiency measures that will lower primary energy demand and thus fossil fuels imports. The target set by the SEN of share of fossil fuels imports in primary energy consumption will decrease to 77% in 2020, in parallel with the rise of demand of primary energy from renewables from 11% in 2010 to 22-23% in 2020.

Energy prices at regional level also depend on national market prices. Gas prices to domestic consumers remain among the highest in the EU-27 and in 2011 reached € 24,32 /GJ, the fourth highest prices after Sweden ( € 32,37/GJ), Denmark ( € 30,14/GJ) and the Netherlands ( € 24,54/GJ), whereas the European average price in 2011 was € 8,16/GJ. However on the industry side the price of gas to industrial consumers in 2011 was € 10,84/GJ below the European average of € 12,54/GJ.

It is confirmed that the price of electricity either to domestic and to industrial consumers remained among the highest in Europe in the last 5 years (2007-2011). Electricity prices to domestic consumers reached € 208,4/MWh in 2011, the sixth highest price in Europe and 12% higher than average European price of € 183,6/MWh.

Such price difference is more significant with regard to electricity prices to industrial consumers where the price in 2011 was € 191,8/MWh, the third highest in Europe after Denmark and Cyprus and 29% higher than the average price at EU 27 level of € 136,90/MWh.

According to the last Italian Energy Strategy (SEN) the spread between Italian and European electricity prices will be reduced due to the reduced feed in tariffs burden on energy bills, gas market measures, increase of RES in the energy mix, phase out of green certificates and electricity grid bottlenecks and energy peak load demand decrease.

RES play a relevant role at regional level: hydropower is the first renewable energy source, followed by biomass and solar PV and finally geothermal sources. In parallel with the national RES share, also RES at regional level increased remarkably in the last years in particular solar PV supply and bioenergy consumption. As opposed to the national share of RES that include a wider range of RES sources, in the Region wind farms and geothermal electricity have not been developed due to a limited potential and other constraints. Looking at the future while hydropower will keep a dominant position in the RES-E mix however his future exploitation will be constrained by environmental factors. In the meantime other RES sources have gained market share such as Solar PV and bioenergy sources. Solid biomass from forest, agricultural and waste sources has a remarkable untapped potential that could be exploited if barriers that hinder their deployment will be overcome.

#### 3.2 Final energy demand

The breakdown of total final energy consumption at regional level shows that energy demand in 2008 was primarily driven by the industry sector (44%) followed by transport (21 %), household (18%) and finally services (17% commerce and public sectors) as Figure 8 shows. The energy consumption trend from 2006 to 2008 fell by 8%, where the decrease was primarily driven by the transport (-15%) and household (-23%) sectors as Figure 7 and Table 7 and 8 show. Such trend partially counterbalances the increase of final energy consumption by 33% occurred during the years from 1990 to 2004 followed by a decrease from 2004 onwards. As to energy sources and energy carriers natural gas (methane) was the main energy carrier in 2008, followed by electricity, liquid fuels namely oil, electricity, solid fuels and renewables as shown in Figure 9.

Natural gas is being used in the industry sector, in thermo-electrical installations and distributed into regional grids. An overview of main gas pipelines is provided by Figure 6.

Table 7. Final energy demand by sector in MWh from 2006 to 2008

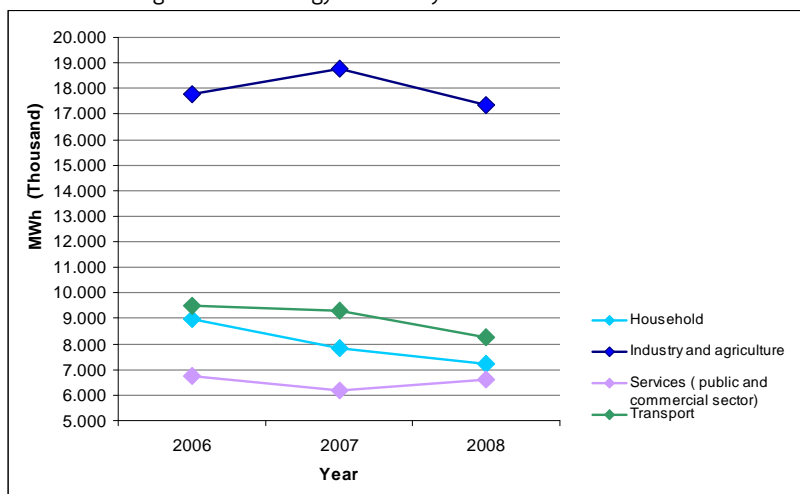
<b>Final energy demand per sector</b>	<b>2006 MWh</b>	<b>2007 MWh</b>	<b>2008 MWh</b>
<b>Household</b>	8.953.560	7.825.644	7.232.616
<b>Industry and agriculture</b>	17.755.956	18.755.964	17.360.604
<b>Services ( public and commercial sector)</b>	6.744.240	6.186.096	6.616.332
<b>Transport</b>	9.500.076	9.325.656	8.255.880
<b>Total</b>	<b>42.953.832</b>	<b>42.093.360</b>	<b>39.465.432</b>

Table 8. Final energy demand by sector in % from 2006 to 2008

<b>Final energy demand per sector</b>	<b>2006 MWh</b>	<b>2007 MWh</b>	<b>2008 MWh</b>
<b>Household</b>	8.953.560	7.825.644	7.232.616
<b>Industry and agriculture</b>	17.755.956	18.755.964	17.360.604
<b>Services ( public and commercial sector)</b>	6.744.240	6.186.096	6.616.332
<b>Transport</b>	9.500.076	9.325.656	8.255.880
<b>Total</b>	<b>42.953.832</b>	<b>42.093.360</b>	<b>39.465.432</b>

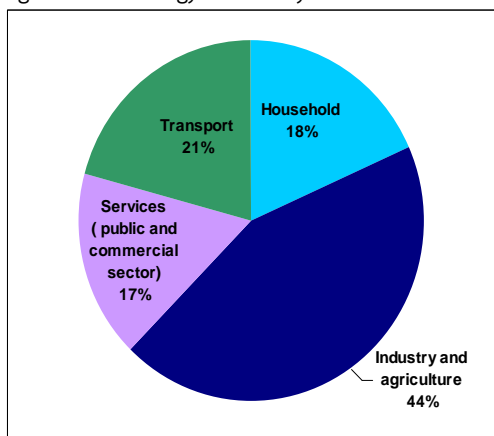
Source: ENEA 2008

Figure 7. Final energy demand by sector from 2006 to 2008



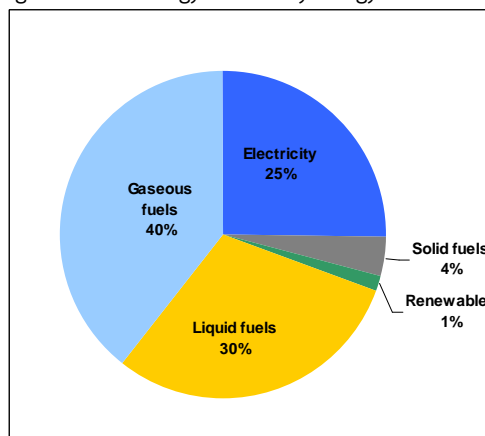
Source: ENEA 2008

Figure 8. Final energy demand by sector in 2008



Source: ENEA 2008

Figure 9: Final energy demand by energy carrier in 2008



## Household energy demand

in 2008 18 per cent of total regional final energy demand was consumed for household, showing a decrease of 3% from 2006, due presumably to the implementation of energy efficiency measures and demand slowdown. By and large household energy demand is being met by electricity sources by 19% and heat sources 81%. Within heat demand natural gas in 2008 was by far the main energy carrier in private households representing 62% of final energy demand and 76% of heat demand. Beyond the lion's share played by gas in household energy consumption, liquid and solid fossil fuels represented in 2008 14% of total energy demand and 18% of heat demand. RES consumption in households, mainly biomass – fire logs and pellets in domestic stoves - varied remarkably from 2006 to 2008 representing 20% of total household energy demand in 2006 going down to 4,8% in 2008 as shown in Table 9.

Table 9. Household energy demand

<b>Household energy demand</b>	<b>2006 MWh</b>	<b>2007 MWh</b>	<b>2008 MWh</b>
<b>Final energy demand</b>	<b>8.953.560</b>	<b>7.825.644</b>	<b>7.232.616</b>
<i>Electricity (including renewables)</i>	1.395.360	1.372.104	1.395.360
<i>Heat</i>	7.558.200	6.453.540	5.837.256
<b>Energy carriers demand for heat</b>			
<i>Solid fuels</i>	34.884	23.256	11.628
<i>Renewables</i>	1.848.852	1.244.196	348.840
<i>Liquid fuels total</i>	1.127.916	930.240	1.023.264
<i>Gaseous fuels</i>	4.546.548	4.255.848	4.453.524

Source: ENEA 2008

## Industry and agriculture energy demand

Industry energy demand plays by far the lion's share in the regional energy demand and it was up to 44% of total energy demand in 2008 as Figure 8 shows.

By and large energy demand of the two sectors are being met by electricity sources by 36% and heat by 64% (Table 10). Within heat demand natural gas in 2008 was by far the main primary energy carrier representing 43% of final energy demand, followed by oil sources (12%), coal (8,5%) and RES that represented in 2008 less than 1% of the overall industry and agriculture energy demand. More recent data might change energy demand breakdown in the industrial sector that up to 2008 was almost entirely based on conventional energy sources as Table 10 shows.

Table 10. Industry and agriculture energy demand

<b>Industry and agriculture energy demand</b>	<b>2006 MWh</b>	<b>2007 MWh</b>	<b>2008 MWh</b>
<b>Final energy demand</b>	<b>17.755.956</b>	<b>18.755.964</b>	<b>17.360.604</b>
<i>Electricity demand (including renewables)</i>	6.244.236	6.360.516	6.220.980
<i>Heat demand</i>	11.511.720	12.395.448	11.139.624
<b>Energy carriers demand</b>			
<i>Solid fuels</i>	1.441.872	1.093.032	1.488.384
<i>Renewables</i>	139.536	151.164	162.792
<i>Liquid fuels total</i>	1.174.428	1.813.968	2.069.784
<i>Gaseous fuels</i>	8.744.256	9.325.656	7.511.688

## Services energy demand - public and commercial sectors

Public and commercial sectors take up as much as 17% of final regional energy demand (17%), where in terms of secondary energy the demand is being met by electricity (34% including RES) and heat (66%) in 2008.

Table 11. Public and commercial services energy demand

<b>Services (public and commercial sector) energy demand</b>	<b>2006 MWh</b>	<b>2007 MWh</b>	<b>2008 MWh</b>
<b>Final energy demand</b>	<b>6.744.240</b>	<b>6.186.096</b>	<b>6.616.332</b>
Electricity demand (including renewables)	2.011.644	2.023.272	2.255.832
Heat demand	4.732.596	4.162.824	4.360.500
<b>Energy carriers demand for heat</b>			
Solid fuels	0	0	0
Renewables	11.628	11.628	11.628
Liquid fuels	1.000.008	674.424	790.704
Gaseous fuels	3.732.588	3.476.772	3.558.168

## Transport

Energy demand in the transport sector makes up a relevant share of consumption ( 21%) second only after industry and agriculture.

The demand is being met by petrol and diesel fuels that represent 97% of the overall demand. The role of electric vehicles seemed still rather marginal in the overall road fleet as Table 12 highlights, as electricity demand for cars represented only 2% of total demand. In the last years the introduction of national and regional incentives to electric vehicles combined with an improvement of electric cars efficiency and costs reduction have increased the fleet of electric cars, although still some barriers hinder their deployment.

Table 12. Transport energy demand

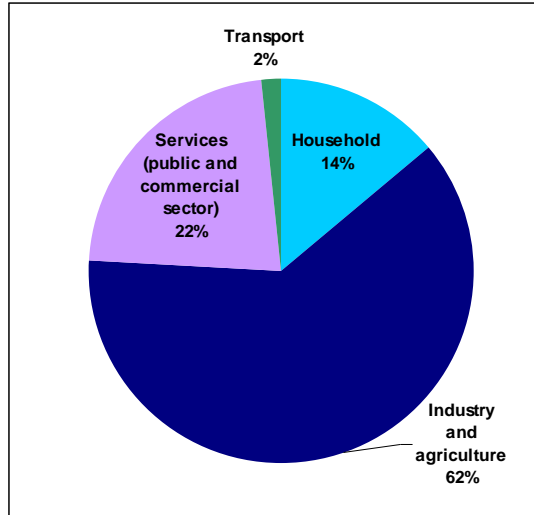
<b>Transport Energy demand</b>	<b>2006 MWh</b>	<b>2007 MWh</b>	<b>2008 MWh</b>
<b>Final energy demand</b>	<b>9.500.076</b>	<b>9.325.656</b>	<b>8.255.880</b>
Electricity demand	174.420	151.164	162.792
<b>Energy carriers demand</b>	<b>0</b>	<b>0</b>	<b>0</b>
Solid fuels	0	0	0
Renewables	0	0	0
Liquid fuels	9.290.772	9.127.980	8.046.576
Gaseous fuels	34.884	34.884	46.512

### 3.3 Final electricity demand

As opposed to data on final energy demand, statistics on electricity are provided by national energy authorities and electricity transmission companies, detailed by sector and are up to date. As a result the overall picture is rather detailed and allows considerations on the trend on electricity demand up to the end of 2011.

Total electricity consumption in 2011 amounted to 10.030 GWh and saw an increase of 3% in respect to 2010, mainly attributed to the industry (+4,7%) and the agricultural (+9%) sector whereas other sectors like services and household electricity consumption decreased. The lion's share of electricity demand is played by the Industry sector 61 % (industry 60%,+ agriculture 1%) followed by services (24%) and the household sector (15%) as detailed in Figure 10.

Figure 10. Final electricity consumption by sector in 2011



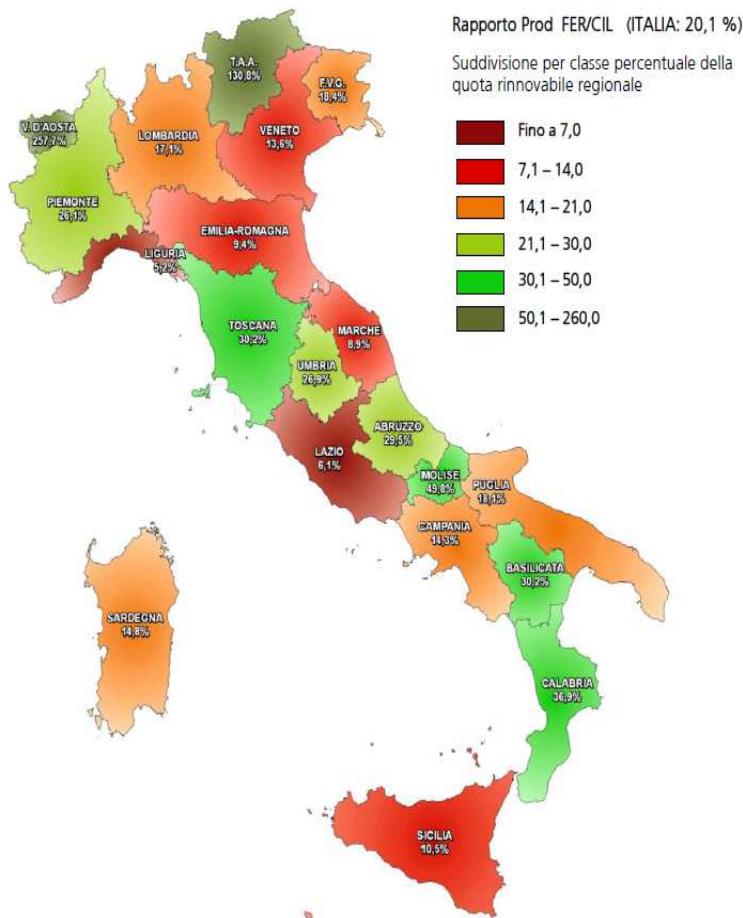
Source: Terna 2012

### 3.4 Renewable energy sources demand

The analysis provides an insight into renewables growth in the last four years with particular regard to RES-Electricity. Trends and estimates on RES-Heat are more uncertain due to the lack of harmonised data among RES – heating infrastructures, energy companies and distributors, public bodies and private entities. As a result data on RES-Heat produced are patchy and often fragmented. RES-E data are detailed and up to date as for conventional electricity are being provided by national energy and transmissions entities. The current analysis is based on the assumption that RES-E consumption equals RES-E production as RES-E is granted grid priority by National Energy Authorities thus being entirely dispatched into the grid.

The distribution of RES-Electricity as percentage of total gross energy consumption in the Region is detailed in Figure 11, showing that in 2010 the regional share of RES-E was just below the national average RES-E consumption of 20, 1%.

Figure 11. Distribution of RES-E as % of gross final energy consumption in Italy and in FVG



Source: GSE Renewable Energy Installations in 2010

The regional outlook of RES-Electricity reflects in part the national share of RES, where hydropower has been for a long time the main RES supplier of green electricity. Although hydropower remains the main renewable electricity source at regional level guaranteeing above 79% of RES – E as Figure 14 shows, however since 2009 other RES-E like Solar PV and biomass have come into the market gaining significant RES market share. Solar PV electricity has taken an increasing share of the electricity mix and from 2009 to 2011 Solar PV in FVG rose by 1325% as Table 14 highlights and in 2011 represented 10,6 % of the total RES-E share (Figure 14). Such regional impressive growth reflects also the leading role that Italy is playing on solar PV and installed capacity - 3478 MW installed capacity in 2010 - and in Europe where it represents the third European country after Germany and Spain either for solar PV capacity and solar electricity. In fact in terms of solar PV power output Italy in 2010 came third after only Germany and Spain with 1906 GWh.

The soaring growth of solar PV was mainly supported by a generous scheme of feed in tariffs (Conto Energia or Energy Bills) that granted up to € 49/MWh generated during the First Energy Bill 2005-2007. Other National Energy bills followed up to the last Vth Energy Bill with substantial changes. Now the Italian Government has introduced a sliding feed-in tariffs systems geared to the annual installation volume and the capacity of the installations. Therefore feed in tariffs vary depending on plants capacity, type of installation on building or ground level and other elements. Tariffs are still guaranteed for 20 years and are not indexed, as it was in the older Energy Bills and by and large the reduction of tariff levels for all sizes of plant in the range of -32% and -36% will bring them in line with other European member states.

Solid biomass (forest and agricultural biomass and waste) and biogas make up the second largest source of RES-E in the Region with a share of 11% in the RES mix, almost lined up with the national contribution of RES-E from biomass and biogas that was up to 9% of the national RES-E mix.



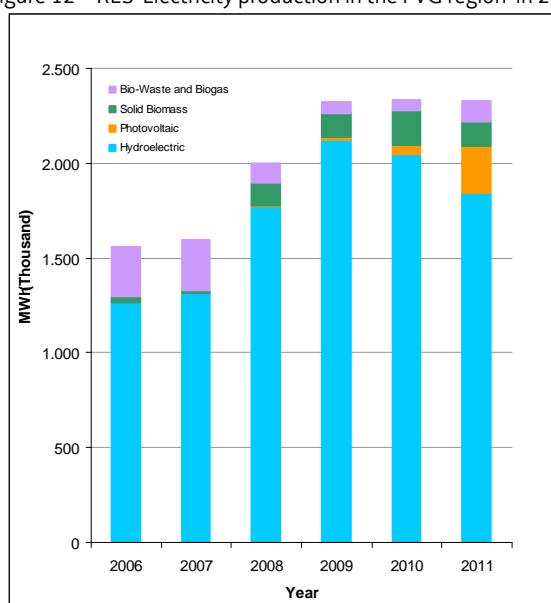
Table 13. RES – Electricity production in MWh from 2006 to 2011

<b>RES - E Production</b>	<b>2006 MWh</b>	<b>2007 MWh</b>	<b>2008 MWh</b>	<b>2009 MWh</b>	<b>2010 MWh</b>	<b>2011 MWh</b>
<b>Hydroelectric</b>	1.264.600	1.315.300	1.773.900	2.123.000	2.049.400	1.845.000
<b>Photovoltaic</b>	-	2.000	5.600	18.100	44.000	246.100
<b>Solid Biomass</b>	34.884	11.628	116.280	124.000	184.500	127.400
<b>Bio-Waste and Biogas</b>	255.816	267.444	104.652	57.000	56.700	107.100
<b>Total</b>	<b>1.555.300</b>	<b>1.596.372</b>	<b>2.000.432</b>	<b>2.322.100</b>	<b>2.334.600</b>	<b>2.325.600</b>

Table 14. RES- Electricity production in % from 2006 to 2011

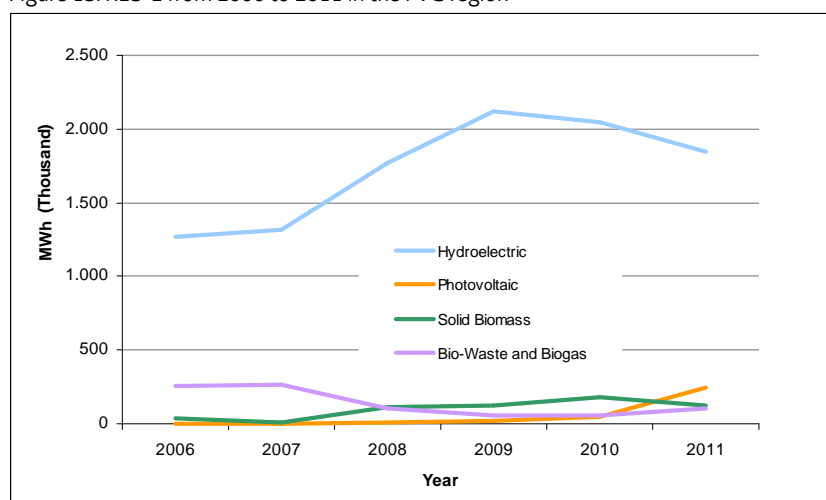
<b>RES - E Production %</b>	<b>2006 %</b>	<b>2007 %</b>	<b>2008 %</b>	<b>2009 %</b>	<b>2010 %</b>	<b>2011 %</b>
<b>Hydroelectric</b>	81,3%	82,4%	88,7%	91,4%	87,8%	79,3%
<b>Photovoltaic</b>	-	-	0,3%	0,8%	1,9%	10,6%
<b>Solid Biomass</b>	2,2%	0,7%	5,8%	5,3%	7,9%	5,5%
<b>Bio-Waste and Biogas</b>	16,4%	16,8%	5,2%	2,5%	2,4%	4,6%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

Figure 12 – RES-Electricity production in the FVG region in 2011



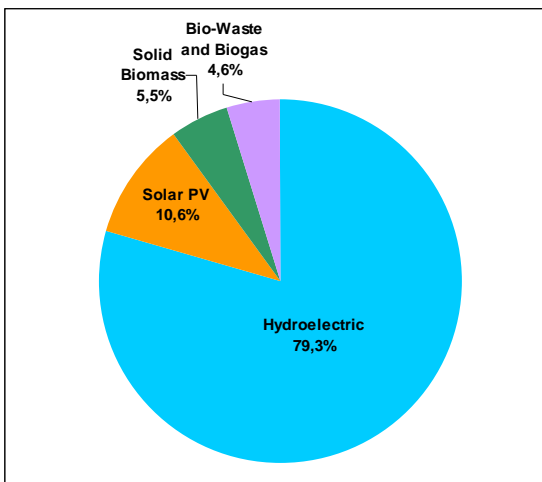
Source: TERNA and GSE 2012

Figure 13. RES-E from 2006 to 2011 in the FVG region



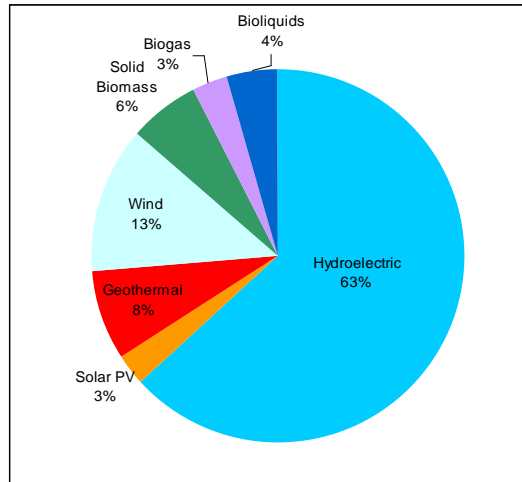
Source: TERNA and GSE 2012, ENEA2008

Figure 14 Share of RES-E in Friuli Venezia Giulia (2011)



Source: GSE and TERNA 2011

Figure 15. Share of RES- E in Italy ( December 2010)



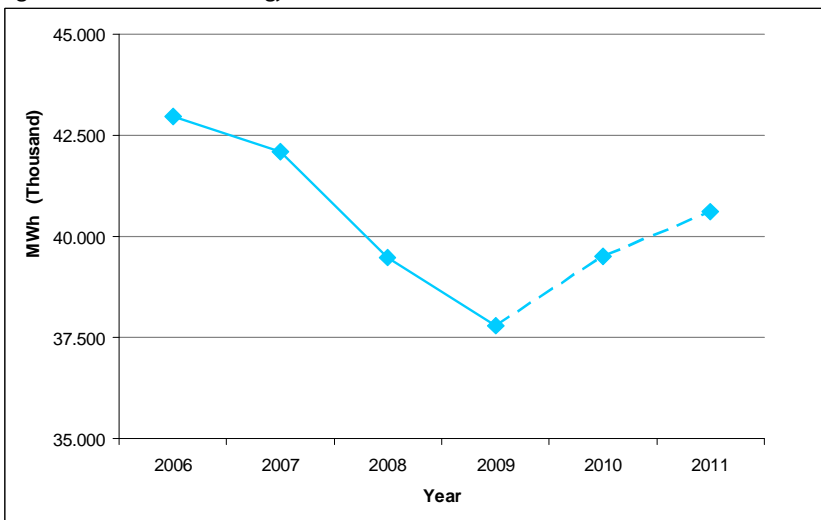
Source: 1<sup>st</sup> Italian Progress Report on Directive 2009/28/EC

### 3.5 Trend of final energy demand

According to recent studies, energy consumption from 2008 to 2009 continued the downturn trend with a 4% decrease. The overall energy consumption decrease is due to a combination of energy efficiency measures and slowdown of the demand also as the impact of the economic crisis. It should be noted that in 2009 final energy consumption was at its lowest level since 2000 mainly as a result of the downturn in the economy.

However after the partial recovery from the economic crisis a bouncing effect seems driving upwards the energy consumption almost as before the economic slowdown as Figure 16 shows.

Figure 16. Trend of final energy demand from 2006 to 2011



Source: ENEA 2006, internal sources

#### 4. Results from questionnaires

Questionnaires were sent out to twenty Municipalities and to ten companies representing different economic sectors.

**Municipalities** have been selected on the basis of different elements. They represent public entities that joined the Covenant of Major initiative, geographical outreach (mountains, hills and plains) and demographic levels including small, medium and big towns. Questionnaires were sent out at the beginning of 2013 by certified email.

**Private companies** have been selected on the basis of representation of different economic sectors: food and steel industries, manufacturing companies, pharmaceutical companies, paper and pulp industries.

Among the surveyed municipalities only 15 % replied providing either the filled in questionnaires and energy plans that include some of requested data. None of the surveyed companies replied. As a result of poor interest on the survey and the lack of sufficient data to elaborate energy statistics on the surveyed sectors, data have not been reported in the current analysis.

Table 15. List of surveyed municipalities and companies

<i>Friuli Venezia Giulia Region</i>	<b>Description</b>	<i>Number of respondents</i>	<i>Respondents</i>
<i>Addressed municipalities</i>	<b>20 Municipalities</b> Udine Pordenone Trieste Forni di Sopra Tavagnacco Cividale del Friuli Sacile Cervignano Ampezzo Lauco Spilimbergo Codroipo Duino Aurisina Mereto di Tomba Amaro Verzegnis Cavazzo Carnico Tolmezzo Lestizza	3	Gorizia, Tolmezzo, Ampezzo
<i>Addressed companies</i>	<b>10 companies</b> Fantoni, Pittini, Danieli, Calligaris, Pasta Zara, Burgo, Latterie Friulane, Di Farma, Azienda Agricola Eros Canelutti, Zuccolo Enrico	0	0

#### 5. Analysis of barriers and constraints on key outcomes of the report

The main stumbling blocks faced during the lay out of the report concerned data collection, the lack of harmonised data as well as poor feedback on questionnaires.

Data collection on final energy demand went back to the years 2006-2008 in order to provide reliable data provided by the national energy research agency at regional level (ENEA). As a result an up to date picture of final energy consumption in the most recent years (2011-2012) is missing, although an assessment on energy consumption has been provided for the latest years.

In addition to that, data on heat consumption either for conventional and for renewable energy demand relies on statistics on energy carriers but very few data were available. For all the sectors covered by the report heat consumption was measured by subtracting final energy demand and electricity demand.

Finally the lack of responsiveness of the surveyed municipalities and companies results to a certain extent undermines the effort to capture although for a small fraction of entities energy consumption from the bottom.

Table 16. Barriers in the lay out of the report

<b>Type of obstacles</b>	
<i>Lack of willingness for data collection</i>	YES- questionnaires
<i>Lack of sufficient data</i>	Yes – heat
<i>Lack of responsiveness</i>	Yes - questionnaires
<i>Use of different reference years or combined methodologies/ results accrued into harmonised data/values</i>	Yes
<i>The regional/local data necessary to convert National data to Local level was not always available</i>	
<i>Accurate local data from energy suppliers was not available due to confidentiality issues</i>	No
<i>Statistics are not always reliable and the method of collecting national statistics changed, so it is difficult to compare energy balances over the years.</i>	YES
<i>In some cases, data was not up to date to obtain an accurate evaluation</i>	Yes

## 6. Recommendations and dissemination

The report could be improved by gathering more up to date data either from national statistics when they will be made public and adopting a bottom up approach, namely collecting data at regional level.

With regard to dissemination the report will be turned into a brochure and it will become part of a series of reports called “Regional energy factsheets” that will include reports on energy demand, on energy supply and on RES. They will be disseminated during project events, conferences on energy and other events.

## 7. References

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Annex 1 - List of EU energy projects with partners from the FVG region from 2009

Programme	Priorità/Priority	Subject	Progetto/Project	Year	Partners in FVG Concept Region	Website
Interreg Italy-Slovenia	Priorità 1 - Ambiente, trasporti e integrazione territoriale sostenibile Priority 1 - Environment, Transport and sustainable environmental integration	Renewables	MODEF - Creazione e sperimentazione congiunta di Modelli per l'ottimizzazione dell'utilizzo di energia fotovoltaica/ MODEF - Creation and joined experimentation of models for maximisation of PV energy capacity	2012-2014	Elettra - Sincrotrone Trieste S.C.p.A. Pordenone Energia Scpa	-
		Energy efficiency	Futurelights	2011-2014	Provincia di Gorizia Comune di Doberdò del Lago - Doberdo APE - Agenzia per l'Energia del Friuli Venezia Giulia	-
		Energy efficiency renewables	EnergyViLLab - Network di Living Lab virtuosi nel risparmio energetico e nello sviluppo di fonti di energia rinnovabili/ EnergyViLLab - Network of virtuous Living Labs in energy saving and development of renewable sources	2011-2014	IAL - Innovazione Apprendimento Lavoro Friuli Venezia Giulia	<a href="http://www.energyvillab.eu">www.energyvillab.eu</a>
Central Europe	Priority 3.3 Environment	Energy efficiency	GovernEE- Enrolling the Green Carpet to good governance in energy efficiency	2011-2013	CETA Centre of theoretical and applied ecology	<a href="http://www.governeeproject.eu/">http://www.governeeproject.eu/</a>
	Priority 3.3 Environment	Energy efficiency/climate change	EnerCity- Reducing energy consumption and CO2 emissions in cities across Central Europe	2010-2013	NATIONAL INSTITUTE OF OCEANOGRAPHY AND EXPERIMENTAL GEOPHYSICS - OGS (FVG)	<a href="http://www.energycity2013.eu/">http://www.energycity2013.eu/</a>
	Priority 3.3 Environment	Energy efficiency renewables	CEC 5- Demonstrating energy efficiency and utilisation of renewable energy sources through public buildings	2011-2014	Municipality of Udine	<a href="http://www.projectcec5.eu/">http://www.projectcec5.eu/</a>
	Priority 3.4 Supporting Environmentally Friendly Technologies and Activities	Green tech	Central Environmental and Energy Management as a kit for survival	2012-2014	Friuli Innovazione, Research and Technology Transfer Centre (Friuli-Venezia-Giulia)	

Programme	Priorità/Priority	Theme	Progetto/Project	Year	Partners in FVG Concept Region	Website
Interreg Italy-Austria	Priorità 1 - Relazioni economiche e competitività/ Priority 1 - Economic relationship and competitiveness	Energy efficiency	EXPLORE - EXploit the Potential fOr Research and innovation in Eco-building	2009	P3 Camera di Commercio di Pordenone	
		Renewables	Smart Energy – Network of Excellence	2009	P1 C.E.T.A. Centro di Ecologia Teorica ed Applicata P2 Università degli studi di Udine	
		Energy efficiency	Alpine – ECO – Companies and Building	2011-2014	P2 APE - Agenzia per l'Energia del Friuli Venezia Giulia	
	Priorità 2 - Territorio e Sostenibilità/ Priority 2 - Environment and Sustainability	Renewables	Autonomia energetica da fonti rinnovabili/ Energy independence from renewable sources	2010	LP Comunità montana Torre, Natisone e Collio P1 7 comuni della val del Gail P2 Comunità montana Friuli Occidentale P3 Comunità montana della Carnia P4 Comunità montana Gemonese, Canal del Ferro e Valcanale P5 Dipartimento di Scienze Agrarie e Alimentari - Università degli studi di Udine	
		Energy efficiency	COME La via per l'efficienza energetica nei Comuni/ The way for energy efficiency in Municipalities	2010	LP Provincia di Udine P1 APE - Agenzia per l'Energia del Friuli Venezia Giulia	
IPA Adriatico	Priority 2.3 Energy saving and renewable energy sources	Energy efficiency Renewables	Alterenergy - Energy sustainability for adriatic small communities	2011-2015	Energy division, Friuli Venezia Giulia Region	<a href="http://www.alter-energy.eu/">http://www.alter-energy.eu/</a>
Intelligent Energy Europe	ALTENER	Renewables	PATRES - Supporting the Public administration for the introduction of RES systems in private and public buildings	2010-2013	AREA Science Park	<a href="http://www.patres.net/eng/homepage-english.aspx">http://www.patres.net/eng/homepage-english.aspx</a>
	ALTENER	Renewables	Sweethanol - Sustainable ethanol for EU	2010-2012	CETA Centre of theoretical and applied ecology	<a href="http://www.sweethanol.eu/">http://www.sweethanol.eu/</a>
Life+	Environment Policy and Governance	Climate change	CarboMark - Improvement of policies toward local voluntary carbon markets for climate change mitigation	2009-2011	Forest management division, Friuli Venezia Giulia Region	<a href="http://www.carbomark.org/">http://www.carbomark.org/</a>

## Annex 2 - List of municipalities in the Friuli Venezia Giulia Region

### Municipalities of the Province of Gorizia

Municipality	Inhabitants	Population density/		N° Families
			km2	
1 <u>Gorizia</u>	35.798		870,8	17.225
2 <u>Monfalcone</u>	27.877	1.358,50		13.014
3 <u>Ronchi dei Legionari</u>	12.130		714,4	5.566
4 <u>Grado</u>	8.611		75,5	4.408
5 <u>Cormons</u>	7.698		222,6	3.376
6 <u>Staranzano</u>	7.257		387,9	3.124
7 <u>Gradisca d'Isonzo</u>	6.617		612,7	3.059
8 <u>San Canzian d'Isonzo</u>	6.383		190,1	2.817
9 <u>Romans d'Isonzo</u>	3.732		242,8	1.644
10 <u>Fogliano Redipuglia</u>	3.071		395,2	1.400
11 <u>Turriaco</u>	2.756		522	1.260
12 <u>Sagrado</u>	2.267		160,3	1.036
13 <u>San Pier d'Isonzo</u>	2.017		221,9	863
14 <u>Farra d'Isonzo</u>	1.754		173,1	772
15 <u>Capriva del Friuli</u>	1.747		280,9	723
16 <u>Savogna d'Isonzo</u>	1.739		106	706
17 <u>Villesse</u>	1.729		147,1	751
18 <u>Mossa</u>	1.674		274,9	705
19 <u>Mariano del Friuli</u>	1.592		190,4	727
20 <u>San Lorenzo Isontino</u>	1.558		357,3	678
21 <u>Doberdò del Lago</u>	1.462		54,5	592
22 <u>Medea</u>	979		134,1	451
23 <u>San Floriano del Collio</u>	811		76,7	319
24 <u>Moraro</u>	761		217,4	332
25 <u>Dolegna del Collio</u>	387		31	159
<b>Total</b>	<b>142.407</b>			<b>65.707</b>

## Municipalities of the Province of Pordenone

	<b>Municipality</b>	<b>Inhabitants</b>	<b>Population density/km2</b>	<b>N° of families</b>
1	<u>Pordenone</u>	51.723	1.352,90	23.308
2	<u>Sacile</u>	20.227	620,1	8.381
3	<u>Cordenons</u>	18.470	325,3	7.379
4	<u>Azzano Decimo</u>	15.601	303,5	6.127
5	<u>Porcia</u>	15.443	523,7	6.400
	<u>San Vito al</u>			
6	<u>Tagliamento</u>	15.015	247,3	6.137
7	<u>Spilimbergo</u>	12.220	168,6	5.268
8	<u>Maniago</u>	11.968	173,2	4.946
9	<u>Fontanafredda</u>	11.686	252,2	4.789
10	<u>Fiume Veneto</u>	11.494	321,4	4.634
11	<u>Brugnera</u>	9.300	318,1	3.495
12	<u>Aviano</u>	9.270	81,7	4.068
	<u>Casarsa della</u>			
13	<u>Delizia</u>	8.585	420,6	3.461
	<u>Prata di</u>			
14	<u>Pordenone</u>	8.569	374	3.198
15	<u>Zoppola</u>	8.565	188,8	3.306
	<u>Pasiano di</u>			
16	<u>Pordenone</u>	7.901	173,6	2.891
17	<u>Caneva</u>	6.541	155,9	2.629
	<u>Sesto al Reghena</u>			
18	<u>Roveredo in</u>	6.296	155,3	2.514
	<u>Piano</u>			
19	<u>Piano</u>	5.746	360,9	2.381
20	<u>Chions</u>	5.260	157,2	1.946
	<u>San Giorgio della</u>			
21	<u>Richinvelda</u>	4.758	99,3	1.831
	<u>Montereale</u>			
22	<u>Valcellina</u>	4.570	67,4	1.963
23	<u>San Quirino</u>	4.310	84,2	1.711
24	<u>Pravidomini</u>	3.532	218,8	1.342
25	<u>Polcenigo</u>	3.237	65,8	1.453
	<u>Morsano al</u>			
26	<u>Tagliamento</u>	2.887	89,8	1.130
27	<u>Cordovado</u>	2.759	227,6	1.125
28	<u>Budoia</u>	2.573	68,3	1.199
29	<u>Sequals</u>	2.258	80,8	975
30	<u>Valvasone</u>	2.232	125	950
31	<u>Travesio</u>	1.861	64,6	791
32	<u>Arzene</u>	1.808	149,9	742
33	<u>Vajont</u>	1.785	1.129,70	759
34	<u>Meduno</u>	1.701	54,4	736
35	<u>Cavasso Nuovo</u>	1.637	156,5	669
	<u>Pinzano al</u>			
36	<u>Tagliamento</u>	1.613	74,1	714
37	<u>Fanna</u>	1.572	155,2	700
	<u>San Martino al</u>			
38	<u>Tagliamento</u>	1.556	87,3	585
39	<u>Vivaro</u>	1.388	36,9	561
40	<u>Arba</u>	1.336	90,5	551
41	<u>Claut</u>	1.027	6,2	505
	<u>Castelnovo del</u>			
42	<u>Friuli</u>	942	41,7	458
43	<u>Vito d'Asio</u>	843	15,7	439
44	<u>Frisanco</u>	683	11,2	364
45	<u>Cimolais</u>	431	4,3	204
	<u>Tramonti di Sotto</u>			
46	<u>Tramonti di Sotto</u>	423	5	236
47	<u>Clauzetto</u>	402	14,4	235
48	<u>Erto e Casso</u>	389	7,4	185
	<u>Tramonti di</u>			
49	<u>Sopra</u>	385	3,1	218
50	<u>Andreis</u>	289	10,7	176
51	<u>Barcis</u>	256	2,5	156
	<b>Total</b>	<b>315.323</b>		<b>130.921</b>



## Municipalities of the Province of Udine

	Inhabitants	Population density/ km2	N° of families
1	Udine	1.758,60	49.081
2	Codroipo	215,7	6.770
3	Tavagnacco	938,9	6.664
4	Latisana	329,9	6.045
5	Cervignano del Friuli	477,3	6.135
6	Cividale del Friuli	230	5.116
7	Gemona del Friuli	200	4.853
8	Tolmezzo	162,2	4.720
9	Fasian di Prato	586,7	4.083
10	Tarcento	260,9	4.051
11	San Daniele del Friuli	236,7	3.627
12	Campoformido	353,4	3.221
13	San Giorgio di Nogaro	304,2	3.300
14	Tricesimo	441,5	3.388
15	Pozzuolo del Friuli	201,3	2.903
16	Lignano Sabbiadoro	420,3	3.500
17	Buia	242,4	3.008
18	Martignacco	252,6	2.914
19	Manzano	217,9	2.948
20	Fagagna	171,9	2.740
21	San Giovanni al Natisone	259	2.558
22	Majano	216,4	2.619
23	Remanzacco	198,5	2.518
24	Pavia di Udine	165,9	2.374
25	Povoletto	143,3	2.333
26	Palmanova	409,4	2.428
27	Basiliano	126,1	2.145
28	Mortegliano	169,8	2.173
29	Fiumicello	221	2.187
30	Reana del Rojale	250,1	2.189
31	Pagnacco	339	2.132
32	Gonars	241,7	1.988
33	Tarvisio	22,8	2.234
34	Rivignano	145,9	1.884
35	Premariacco	106,3	1.682
36	Talmassons	96,9	1.687
37	Buttrio	233,2	1.776
38	Lestizza	115,2	1.586
39	Sedegliano	77,8	1.641
40	Castions di Strada	118,9	1.552
41	Bagnaria Arsa	188,7	1.494
42	Pradamano	218,5	1.552
43	Aquileia	94,8	1.597
44	Corno di Rosazzo	263,6	1.329
45	Palazzo dello Stella	88,4	1.257
46	Faedis	65,2	1.332
47	Osoppo	136,9	1.282
48	Torviscosa	62,8	1.306
49	Ruda	159,7	1.266
50	Ragogna	133,1	1.371
51	Cassacco	251,6	1.266
52	Artegna	259,8	1.266
53	Terzo d'Aquileia	102,7	1.219
54	Varmo	78	1.173
55	Carlino	92,4	1.085
56	Nimis	82,3	1.215
57	Paularo	33	1.191
58	Mereto di Tomba	100	1.134
59	Porpetto	136	1.058
60	Muzzana del Turgnano	109,6	1.077
61	Pocenia	109,4	1.011
62	Bertiolo	98,4	1.064
63	Rive D'Arcano	110,9	1.050
64	Santa Maria La Longa	124,9	949
65	Dignano	89,4	999
66	Paluzza	34,3	1.043
67	Magnano in Riviera	281,2	1.017
68	Moruzzo	132,3	981
69	Trasaghis	30,1	1.032
70	Arta Terme	43,1	990
71	Torreano	65	1.017
72	Coseano	94,8	929
73	Aiello del Friuli	173,4	955
74	Colloredo di Monte Albano	104	958
75	Venezzone	40,7	956
76	Villa Santina	171	967
77	San Pietro al Natisone	91,8	975
78	Ronchis	112,3	828
79	Ovaro	35,7	960
80	Teor	117,9	791
81	Marano Lagunare	21,8	889
82	Bicinicco	121,3	738
83	Attimis	56,8	875
84	Forgaria nel Friuli	63,5	868
85	Moggio Udinese	12,8	872
86	Treppo Grande	156,1	782
87	Trivignano Udinese	92,9	685
88	San Vito di Fagagna	198,1	707
89	Camino al Tagliamento	74,3	651
90	Moimacco	138,4	667
91	Pontebba	15,7	768
92	Prencisacco	55,7	632
93	Villa Vicentina	258,7	570
94	Sutrio	65,3	602
95	San Vito al Torre	117,3	544
96	Enemonzo	57,2	605
97	Campolongo Tapogliano	126	506
98	San Leonardo	44,8	546
99	Flaibano	70,1	519
100	Cavazzo Carnico	28,5	495
101	Resia	9,2	555
102	Forni di Sopra	13,2	593
103	Ampezzo	14,4	542
104	Pulfero	21,9	526

105	<u>Malborghetto Valbruna</u>	965	8	448
106	<u>Prato Carnico</u>	958	11,8	477
107	<u>Socchieve</u>	938	14,2	449
108	<u>Verzegnis</u>	929	23,9	437
109	<u>Prepotto</u>	829	24,9	347
110	<u>Amaro</u>	820	24,7	372
111	<u>Bordano</u>	810	53,3	370
112	<u>Lauco</u>	805	23,3	425
113	<u>Visco</u>	786	223,3	327
114	<u>Lusevera</u>	711	13,5	383
115	<u>Chiusaforte</u>	705	7	354
116	<u>Cercivento</u>	705	45,9	335
117	<u>Taibana</u>	699	10,7	381
118	<u>Forni di Sotto</u>	660	7,1	348
119	<u>Treppo Carnico</u>	659	35,2	299
120	<u>Forni Avoltri</u>	653	8,1	314
121	<u>Chiopris-Viscone</u>	649	71,9	284
122	<u>Zuglio</u>	607	73	274
123	<u>Ravaschetto</u>	569	21,6	290
124	<u>Montenars</u>	558	27,1	269
125	<u>Comeglians</u>	540	27,7	274
126	<u>Rigolato</u>	513	16,8	271
127	<u>Raveo</u>	506	39,8	215
128	<u>Savogna</u>	506	22,9	248
129	<u>Sauris</u>	429	10,3	223
130	<u>Stregna</u>	413	20,9	214
131	<u>Grimacco</u>	395	24,1	185
132	<u>Resiutta</u>	320	16	172
133	<u>Preone</u>	279	12,4	142
134	<u>Dogna</u>	200	2,9	110
135	<u>Ligosullo</u>	180	10,7	73
136	<u>Drenchia</u>	141	10,6	96
	<b>Total</b>	541.522		240.838

### Municipalities of the Province of Trieste

Municipality	Inhabitants	Population density	
		km <sup>2</sup>	N° of families
1 <u>Trieste</u>	205.535	2.432,70	107.305
2 <u>Muggia</u>	13.410	981,7	6.288
3 <u>Duino-Aurisina</u>	8.717	193	3.944
4 <u>San Dorligo della Valle - Dolina</u>	5.913	241,2	2.580
5 <u>Sgonico</u>	2.091	66,8	857
6 <u>Monrupino</u>	890	70,2	346
<b>Total</b>	236.556		121.320