NORTH SEA
SUSTAINABLE
ENERGY
PLANNING

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The Interreg IVB North Sea Region Programme
Investing in the future by working together for a sustainable and competitive region

European Community
European Regional Development Fund

Table of contents

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NORTH SEA SUSTAINABLE ENERGY PLANNING

1 Energy infrastructure

The Kortrijk region covers 8,4% of the Flemish green power production capacity. Compared to the region's surface (about 3% of Flanders) and the population (approximately 5% of Flanders), this is a rather above average proportion.

The local, decentral, and green power production increases. There is no large scale power generation in the region besides the mid-scale peak power plant of Harelbeke (80MW). The power plant previously was fueled by fossiles, but is currently fed by biofuels. This makes it the largest green energy production unit of the region.

The small-scale, decentralized energy production is growing rapidly. The number of small-scale plants is booming: households, businesses and governments take initiatives to invest in small and medium-sized energy production installations. Together, they represent a capacity of 53.6 MW:

- The four wind turbines at the Evolis business park (8MW) are the most iconic representatives of green energy in the region.

- The installation of solar panels grew exponentially since 2009. They now have become a familiar sight on rooftops of homes and businesses. Together they account for a capacity of 40.6 MW. Especially the SME's of the region are front runners.

- Several installations generate electricity from biomass: by waste incineration (Imog) or by the use of landfill gas and sewage gas. This accounted for 5 MW.

But still, in the Kortrijk region the power supply cannot yet meet the demand. As a consequence the region uses "green" and "gray" power from the national grid, which is still mainly fed by large power plants (nuclear and fossil fuels). In Belgium, more than 95% of the energy needs to be imported, because there are few resources. renewables have the largest potential but cannot cover the demand.

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BOX: what is renewable energy?

Bioenergy can be produced from a variety of biomass feedstock, including forest, agricultural and livestock residues; short-rotation forest plantations; energy crops; the organic component of municipal solid waste; and other organic waste streams. Through a variety of processes, these feedstock can be directly used to produce electricity or heat, or can be used to create gaseous, liquid, or solid fuels. Bioenergy technologies have applications in centralized and decentralized settings, with the traditional use of biomass in developing countries being the most widespread current application. Bioenergy typically offers constant or controllable output. Bioenergy projects usually depend on local and regional fuel supply availability, but recent developments show that solid biomass and liquid biofuels are increasingly traded internationally.

Direct solar energy technologies harness the energy of solar irradiance to produce electricity using photovoltaic (PV) and concentrating solar power (CSP), to produce thermal energy (heating or cooling, either through passive or active means), to meet direct lighting needs and, potentially, to produce fuels that might be used for transport and other purposes. The technology maturity of solar applications ranges from R&D (e.g., fuels produced from solar energy), to relatively mature (e.g., CSP), to mature (e.g. passive and active solar heating, and wafer-based silicon PV). Many but not all of the technologies are modular in nature, allowing their use in both centralized and decentralized energy systems. Solar energy is variable and, to some degree, unpredictable, though the temporal profile of solar energy output in some circumstances correlates relatively well with energy demands. Thermal energy storage offers the option to improve output control for some technologies such as CSP and direct solar heating.

Geothermal energy utilizes the accessible thermal energy from the Earth's interior. Heat is extracted from geothermal reservoirs using wells or other means. Reservoirs that are naturally sufficiently hot and permeable are called hydrothermal reservoirs, whereas reservoirs that are sufficiently hot but that are improved with hydraulic stimulation are called enhanced geothermal systems (EGS). Once at the surface, fluids of various temperatures can be used to generate electricity or can be used more directly for applications that require thermal energy, including district heating or the use of lower-temperature heat from shallow wells for geothermal heat pumps used in heating or cooling applications.

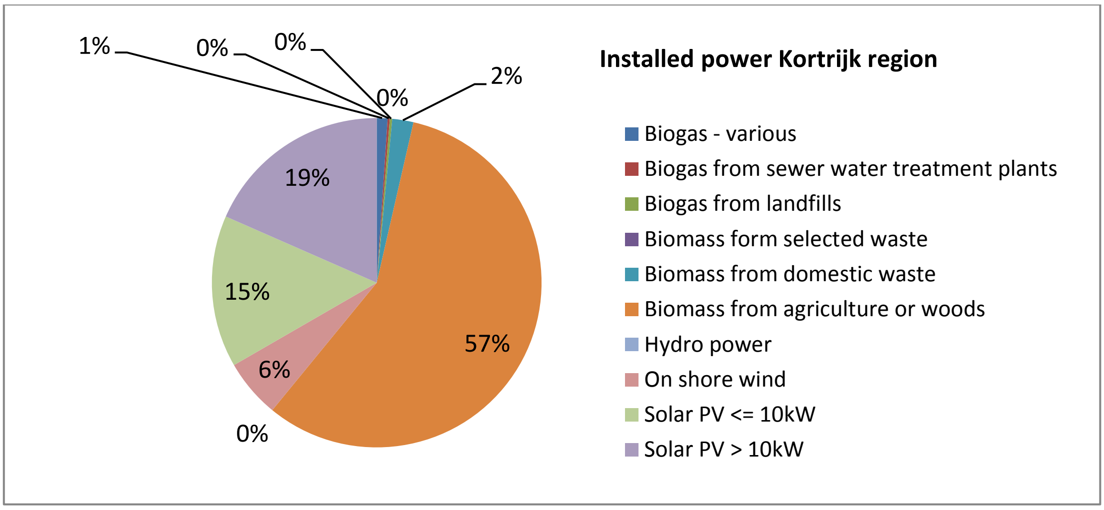
Hydropower harnesses the energy of water moving from higher to lower elevations, primarily to generate electricity. Hydropower projects encompass dam projects with reservoirs, run-of-river and in-stream projects and cover a continuum in project scale. This variety gives hydropower the ability to meet large centralized urban needs as well as decentralized rural needs.

Ocean energy derives from the potential, kinetic, thermal and chemical energy of seawater, which can be transformed to provide electricity, thermal energy, or potable water. A wide range of technologies are possible, such as barrages for tidal range, submarine turbines for tidal and ocean currents, heat exchangers for ocean thermal energy conversion, and a variety of devices to harness the energy of waves and salinity gradients. Ocean technologies, with the exception of tidal barrages, are at the demonstration and pilot project phases and many require additional R&D.

Wind energy harnesses the kinetic energy of moving air. The primary application of relevance to climate change mitigation is to produce electricity from large wind turbines located on land (onshore) or in sea- or freshwater (offshore). Onshore wind energy technologies are already being manufactured and deployed on a large scale. Offshore wind energy technologies have greater potential for continued technical advancement. Wind electricity is both variable and, to some degree, unpredictable, but experience and detailed studies from many regions have shown that the integration of wind energy generally poses no insurmountable technical barriers.

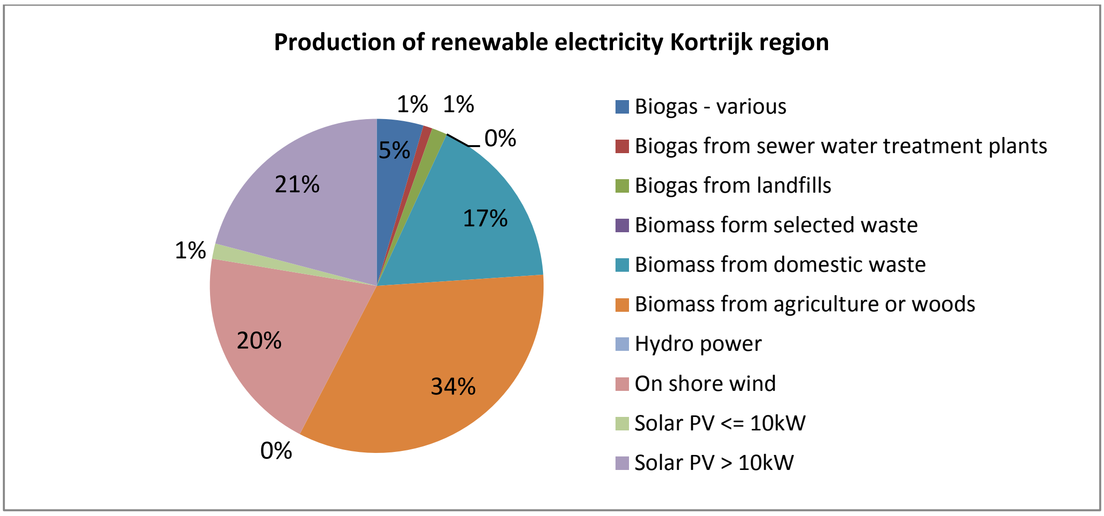
1.1 The current renewable energy production in the Kortrijk region

The VREG, The Flemish regulation organisation for energy, presented figures about renewable energy in Flanders in 2010. These new figures, available on the level of municipalities, for the first time, make a specific research possible for the region of Kortrijk.



- In the region of Kortrijk (South-West-Flanders) the biggest part of renewable energy is located in the municipality of Harelbeke: de power plant of SPE and Imog account for 50 % of the renewable energy in the region.
  But, it needs to be noticed that the power plant of SPE is not working at full capacity on biomass (only a limited part). It is a former diesel-power plant, sometimes running on palm oil. The power plant delivers only the double of renewable energy of Imog (waste incinerator), but has an installed capacity to produce renewable energy that is 27 times bigger than that of Imog.

- The Daltons (the four wind turbines along the motorway E17) cover 20 % of the renewables in the region.
- 20 % of the renewables are covered by large scale solar power plants.



- The region covers 10 % of the large scale solar plants of Flanders, installed on industrial halls.

- The region produces more energy out of domestic waste than average in Flanders.

- The amount of domestic solar panels in the region is on the average of Flanders (about 5% of the houses have solar panels)

- There are some remarkable numbers about the solar plants on small scale. The ratio installed capacity / green power certificates is totally different than with the solar plants on big scale. A possible explanation is that a lot of new installations appeared in 2010, but these installation receive only in 2011 green power certificates. So a lot of installations are already in the statistics but they don’t have green power certificates yet. Because of this it seems that 97 % of the installations generates only 1,5 % oft he renewable energy.

Kortrijk region	Biogas - various	Biogass from sewer water treatment plants	Biogass from landfills	Biomass form selected waste	Biomass from domestic waste	Biomass from agriculture or woods	Hydro power	On shore wind	Solar PV <= 10 kW	Solar PV > 10 kW	Total
Number of installations	3	1	1	0	1	1	0	4	5202	155	**5368**
Installed power (kW)	1474	298	332	0	2900	80000	0	8016	20825	25693	**139539**
Production of renewable electricity (MWh)	3662	715	1205	0	13802	27294	0	16183	1200	16940	**81001**

There is more power used than produced in the region of Kortrijk. We import a lot of power, as well as *green* power as *grey* power. This goes by the national power grid, that mainly is feeded by the big power plants as Ruien (fossiles) or Doel (nuclear). Nevertheless, the local power production is rising especially because of the many small-scale production sites.This trend is stimulated by the system of green power certificates.

In the region there is one big energy plant: the 80 MW power plant of Harelbeke. But on Belgian level this is still a modest installation. Mostly this plant is running on fossile fuels (diesel), but sometimes the engines are fueled by imported biofuels. Doing so, it becomes the biggest green power supllier in the region.

Small scaled, decentral energy production is growing very fast. The number of small-scale installations has increased seriously: households, companies and governements have taken initiatives to place these installations. Together they have a capacity which is less than the power plant in Harelbeke.

The four wind turbines of Evolis (in Kortrijk – Harelbeke, along the motorway E17) are the biggest eye-catcher in the region. Together they have a capacity of 8 MW.

The installation of solar panels increased exponential grow since 2009. Nowadays they are a well-known sight on the roofs of houses and companies.

Beside this there are a lot of different installations that produce elektricity from waste already for a long time: by incinerating domestic waste (Imog, Harelbeke),by use of landfill gas (Lendelede) and by biogass from a sewer water treatment plant (Harelbeke).

In the region there is a production capacity for 8,4 % oft he total renewable energy. This is a big part in comparison with the surface oft he region (3 % of Flanders) and with the amount of citizens (5 % of Flanders). The impact of the power plant in Harelbeke on this figures is very high.

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1.2 CHP in Kortrijk region

Combined Heat and Power (CHP) combines the production of power and usefull heat. In this way the use of fuels is more efficient and the loss of heat is less than in traditional power plants. A qualitative CHP saves sufficient primary energy compared to the separate generation of the same amount of elektricity and heat in a power plant and kettle. Flanders supports this by CHP-certificates.

	Number of installations		Installed electrical power MWe)		
	Region of Kortrijk	Flanders	Region of Kortrijk	Flanders	Share
CCGT	0	3	0	551,9	0%
Internal combustion engine	4	237	5,1	460,1	1,1%
Gasturbine with heatrecovery	0	7	0	332,7	0%
Back pressure steam turbine	0	8	0	127,8	0%
Other	0	4	0	27,7	0%
TOTAL CHP	4	259	5,1	1.500,0	0,3%

Overview of qualitative CHP-installations in Flanders and the Kortrijk region (VREG, january 2011)

In the region of Kortijk there are 4 qualitative CHP-installations, accounting for an capacity of 5,1 MWel. This is a small share (0,3 %) in comparison with the total capacity of Flanders (1500 MW).

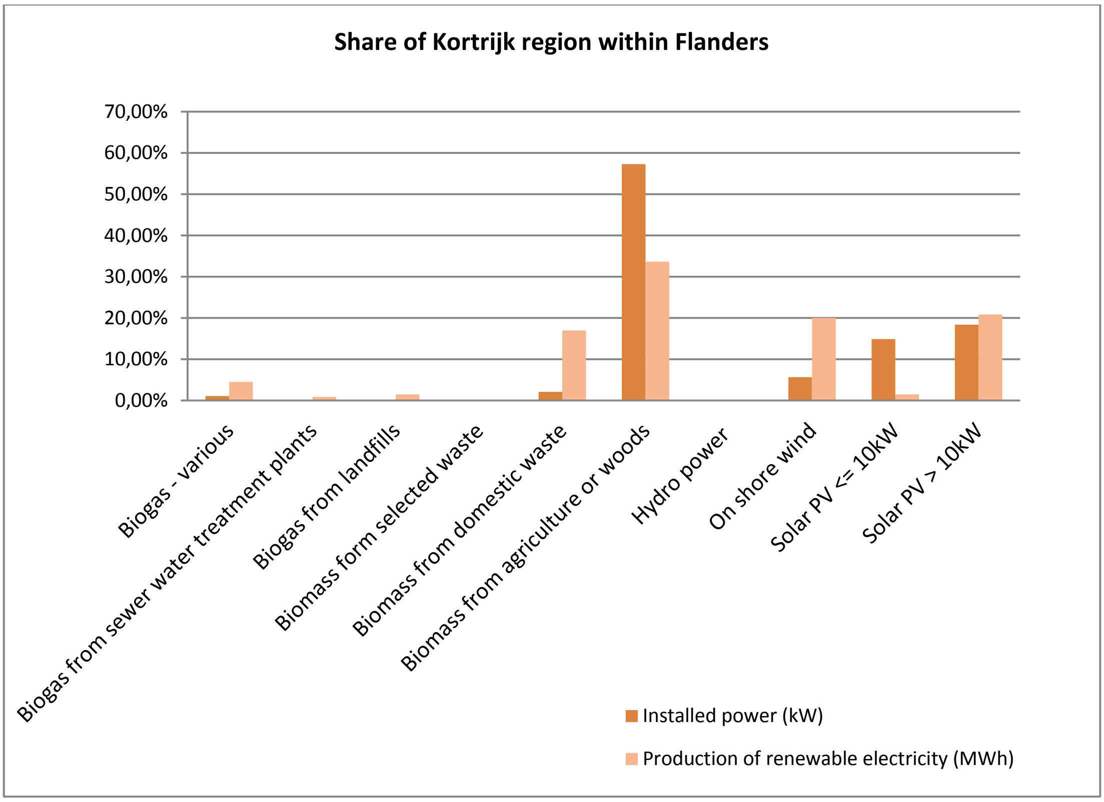
The biggest part of these 1500 MW are generated by very big CHP-installations like CCGT's or gasturbines in harbour areas. In the region of Kortrijk there are none of these installations. The 4 CHP-installations are the type of internal combustion engine, the most frequent type. But also here the region of Kortrijk is underrepresented (1,1 %)

1.3 Renewable energy in Flanders

Renewable energy is used for the production of heat and elektricity, but also for transport (biofuels). In Flanders the amount of green heat is as much as the amount of green elektricity, but less biofuels (see graphics). The tree fractions have an obvious growth. Flanders aims for 13% of renewable energy by 2020.

Green power accounts for 4,7 % of the power use, green heat for 2,3 % of the total heat production. Since July 2009 there is the obligation to mix 4% biofuels with fossile diesel and gasoline. The production of green heat doesn't grow as fast as the production of green power or biofuels. Green power is strongly supported by the governement, green heat is less supported.

Share of Kortrijk region within Flanders	Biogas - various	Biogass from sewer water	Biogass from landfills	Biomass form selected	Biomass from domestic	Biomass from agriculture	Hydro power	On shore wind	Solar PV <= 10 kW	Solar PV > 10 kW	Total
Number of installations	6,0%	6,7%	7,7%	0,0%	11,1%	2,7%	0,0%	5,6%	5,5%	9,9%	**5,5%**
Installed power (kW)	2,1%	7,0%	1,8%	0,0%	8,0%	32,9%	0,0%	3,2%	5,0%	8,7%	**8,5%**
Production of renewable electricity (MWh)	1,1%	10,1%	1,9%	0,0%	6,6%	4,1%	0,0%	4,1%	4,9%	9,1%	**2,9%**



Kortrijk region covers about 3% of the surface of flanders, and 5% of the inhabitants.

1.4 The future of renewable electricity and the consequences fort he Kortrijk region.

Currently half of the produced green power is generated with the incineration of biomass. There’s also production of green power by the incineration of the renewable part of waste. Wind turbines and photovoltaic systems have a share of 20 % of green powerproduction, despite the strong grow recently.

So there is still a long way to go to reach the goal of 13 % of renewable energy by 2020.

A future scenario 2020 with a pro-active Flemisch policy suggests a potential over 20% renewable elektricity. This future scenario shows also that a mix sources will be necessarily.

What are the possible consequences fort he region of Kortrijk?

- More windturbines on land. The regional vision want to increase the number up to 20 turbines (for the moment there are four).

- Possible new medium-sized installations: biomassplant(s), CHP steamturbines, CHP engines / or CHP ORC.

- Further growth of photovoltaic panels on roofs.
- Offshore windenergy, co-insineration of biomass, waterpower,… probably will have no impact in the region. Also big installations will be planned outeside the region in big industrial regions (like harbours).

- More import of biomass and the better use of biomass from wast in bio-CHP's (waste wood, used oils and fats, lignocellulose, pellets,…)

1.5 The future for renewable heath and the consequences fort he Kortrijk region.

About 2% of the total heat in Flanders is green heat. There are no figures on renewable heat production in the region of Kortrijk. The biggest part of the renewable heat is from biomass (from traditional incineration installations like pelletheaters which only produce heat and from bio-CHP's). Heatpumps, heatpumpboilers and solar boilers which extract heat from the soil, the air or solar radiation only account for 4 % of the renewable heat.

Currently there are no goals or aims for renewable heat, nor on European, Belgian, or Flemisch level.

With the current policy there will be little increase of renewable heat. A future scenario 2020 with a pro-active Flemisch policy suggests seven times more renewable heat/cold than now. In Flanders about 75% of the renewable heat could be covered by biomass. In addition, underground energy storage could cover 20% and with solar heat 6%.

What are the possible consequences fort he region of Kortrijk?

- Increase of small and medium-sized installations for incineration of biomass (whether or not bio-CHP), with a big potential in the residential sector, agricultural sector and industry.

- The tertiary sector (trade and services) have a big potential for underground energy storage. And besides also installations in new building.

- Increase of renewable heat from solar, especially in the residential sector.
- Recuperation of residual heat from industrial processes.
- In the region of Kortrijk there is no forestry, so biomass will be mainly imported or recoverd from waste (industrial and domestic).

The future scenario doesn't take acoount with the possibilities of recuperation of residual heat from existing installations. Actually, there are a lot of residual heat that could be recuperated form the traditional power plant, big cooling installations, from industry,…

1.6 The future for renewable energy for transport and the consequences fort he Kortrijk region.

In Flanders biofuels are the main source of renewable energy for transport, because it's the fastest way to CO2-reduction. This is also the intention of Europe and Flanders and happens by adding biofuels to fossile fuels. In the future elektrical cars and hydrogen cars can play a significant role if they make use of renewable energy to charge or produce hydrogen. The EU foresees the use of at least 10 % of renewable energy – biofuels, renewable energy and hydrogen frem renewable energysources – for all transport modes by 2020.

In Flanders only a fraction of the biofuels used in Flanders are grown, so there is mainly import. For biodiesel (rapeseed) theoreticaly it's possible to reach the 2010 target by proper production. For bio-ethanol (sugar beet and wheat) it's theoreticaly possible, but pricesettings determine if these crops will be used for biofuels are not. Besides, Flanders will need new installations for the processing of these energy-crops. Some of them are already are founded in the the large harbours (based on the premium locations for import).

The switch to renewables for transport will probably have less consequences for the region of Kortrijk. If the prices increase significant, the growth of energycrops could become attractive. The region doesn't seem to be an appopiate location for production installations for biofuels because of the lack of resources.

1.7 The potential of renewable energy for the Kortrijk region

Before raising the questions which potential there is in the region, we first have to determine which kind of potential we are talking about. We can distinguish:

- Thereoretical potential: the offer of all natural energy in all kinds: wind, sun, water,… This is the absolute upper limit. e.g. all wind energy.

- Technological potential: this is the amount of usefull energy out of natural energy with help of the current technology (already proven and ready for the market). e.g. wind energy that turbines can convert into electrical power.

- Social-Economic potential: this is what can be realised within the current social norms, thus what is socially acceptable. E.g. wind turbines at a reasonable distance from houses.

- Economical potential: this is the amount of energy that can be produced within the current market conditions (whether or not with corrective measures like subsidies). E.g. is it economical profitable to invest in windturbines?

To estimate the potential of renewable energy is difficult. There are few numbers. We can only set a number of lines for the technologies that will play an important role according to the future scenario's.

Solar energy can grow, as well as for solar power as for solar heat. Roofs are excellent production locations. Also sites where the future destination is limited (e.g. landfill) are potential sites. In our dense region there is still a big potential of roofs. Probably about 45 % of the roofsurface is suitable (good orientation), but only few are used. There is a big potential for big and small installations (industry and households).

Bio-energy can grow, but this will likely be based more on the import of biomass and biofuels than on local crops. Besides this there are possibilities to adjust waste for energyproduction in better ways.

- Biofuels and biomass from agriculture and forestry. These sources aren't available on large scale and it's not opportune to produce biomass on large scale. Small-scale initiatives can be an alternative.

- Selective waste (from wood, oils and fats,…). Currently there ar now such installations for this type of waste in the region. Wood waste is now exported outside the region as biomass. Also the grass form verges are trees can be used as source for energy production.

- The domestic waste is already used as energy source, as well as landfill gas and gas from sewage water.

- The potential of industrial waste is unknown.

- Waste from agriculture. Manure of the current livestock can be used for biogass, but the potential is rather limited.

Windenergy can grow further. The regional vision on wind energy plans 40 MW by 2020. This is an increase of 32 MW. But the growth of windturbines is inhibited by some difficult debates about location. Medium-scaled windturbines can be a possible alternative for a better implementation into the landscape. Very small wind turbines produce to small amounts of energy to have substantial impact.

Because of the kind of geological underground there is no potential for geothermic. The heat oft he earth closer tot he surface gives some possibilities for heatpumps. This is especially interesting for energy-efficient houses, so for green heat in a good insulated (new) houses.

In this flat region there are now potential for waterpower.

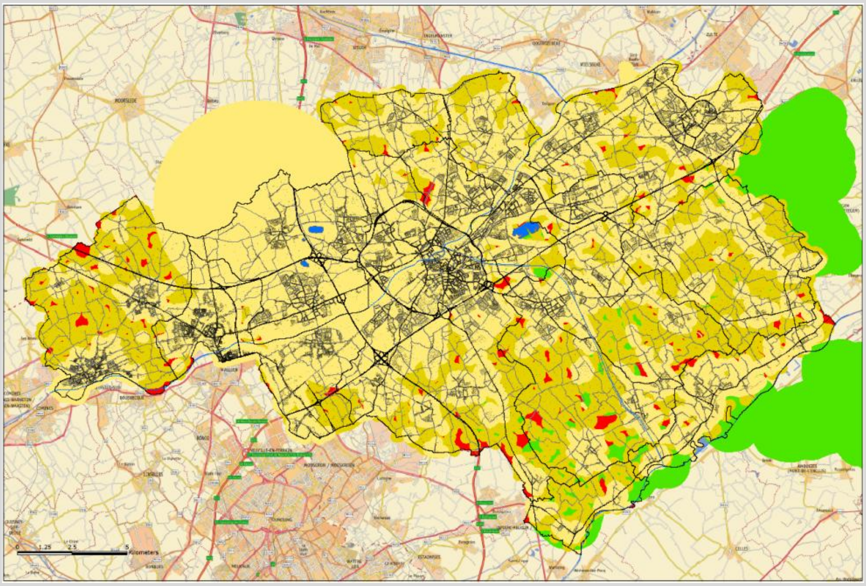
A further grow of CHP is expected. There are already a lot of installations on micro-, meso- and macrolevel (households, companies, energy powerplants,…). Most oft he time micro and meso-installations are connected with buildings: producing the energy on the same place where it‘s used. It is best not to transport heat for long distances. Maybe the distribution of heat on district level will play a more important role.

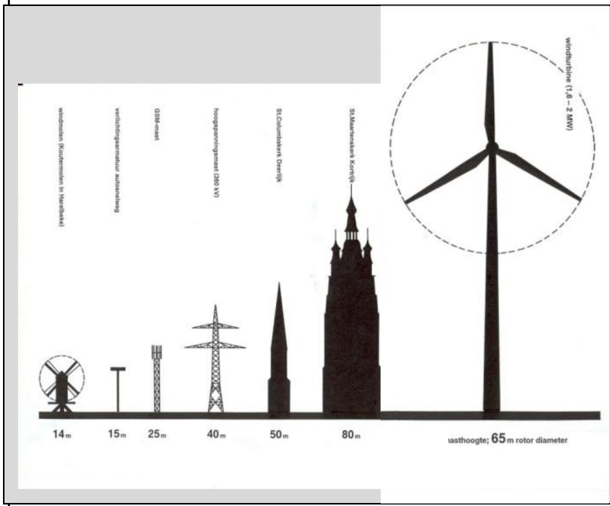
Besides, existing heat losses could be recovered, e.g. from industrial installations. This residual heat can be distributed in the surronding area of the installations (e.g. to heat buildings). We don't expect a large potential because of the low number of energy-entensive companies in the region.

BOX: vision on wind energy in the region

In 2009, Leiedal analysed the potential on wind energy in the Kortrijk region, and developed a vision on the spatial integration of wind turbines. Because of the dense urbanization, the airport and other limiting factors, the possibilities are quite limited. The vision proposed to develop 40 MW on wind energy by 2020, mainly along the highways (E17) and in business parks.

The wind turbines are considered as determiniang infrastructure in the landscape. It is advised to group wind turbines (at least 3), and to create geometrical composition, preferably in line.





Wind turbines are the largest new objects to integrate into the landscape. They are way larger than the objects previously determining the landscape, suct as cathedrals, old windmills or power lines.

1.8 Conclusions

Currently there is little energy production in the region of Kortrijk, but this can increase in the form of renewable energy production in small, decentral installations for the production of renewable power and renewable heat.

For the moment we depend already of imported energy in the form of fossile energy. This amount can decrease by:

- producing more local, renewable energy from wind, sun and waste
- importing renewable energy, e.g. biomass or windenergy from the North Sea

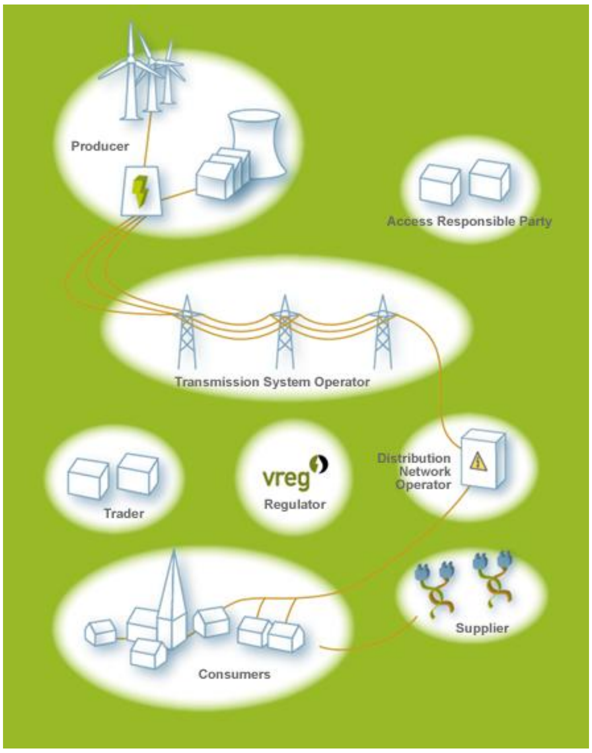
In the future the region of Kortrijk will depend on energy-import, as well as fossile as renewable energy. The switch to sustainable transport will depend on this. Local natural energy resources are limited. The flat land gives no potential for waterpower. The agriculture isn't suitable to produce large amounts of biomass and biofuels which will cover the energy demand. Solar energy and wind energy will play an important role, together with the use of waste for energy. The dense buildings give a potential for solar energy, but is a disadvantage for windenergy.

Finally we notice that some elements will have an influence on the effective realisation of this potential, such as:

- Price developments of installations (e.g. solar energy)
- Mechanisms for subsidies (green power certificates, CHP-certificates,…)
- social developments (e.g. social support for development of windturbines)
- Policy descissions (e.g. license policy)

2 Organisations and markets

2.1 Overview: new types of players since the liberalisation of the energy market



Production
The major electricity producers in Belgium are Electrabel and SPE. No natural gas is generated in Belgium. All natural gas is imported from abroad.

Balance
There must be a permanent balance between the electricity production and the consumption of electricity. This is the responsibility of the Access Responsible Party. Lack of balance can even result in power outages. The transmission operator is the Access Responsible Party's counterpart for natural gas.

Transmission
Transmission system operators transmit energy to the distribution network. Elia is the transmission system operator for electricity, Fluxys is the transport company for natural gas.

Trading
Energy suppliers who are not producers are to buy their energy from a producer or from energy exchange markets.

Monitoring
Regulators monitor and regulate the liberalised energy market. There is one federal regulator, the CREG in addition to three regional regulators. The VREG (Flemish Regulator of the Electricity and Gas Market) is the regulator in Flanders.

Distribution network operator
The network operators manage, develop and maintain the electricity and/or natural gas distribution network for a specific territory and transmit, at the supplier's request, the energy to the end users. They provide new connections to the network and are responsible for reading your electricity and/or natural gas meter.

Energy supply
The energy suppliers ensure that you receive energy and sell electricity and/or natural gas and invoice your energy use.

2.2 Tendencies on the Belgian energy markets, since the liberalization of the early 2000's: electricity

Consumers start to produce energy
The electricity companies produce or buy on the international market. But even other companies than energy suppliers also produce electricity, wholly or partly intended for own use. Consumers also called prosumers produce energy, a fusion of the words producer and consumer. There were also created and independent producers, companies whose main activity, such as waste incineration, immediately produce electricity to sell them to third parties.

Producer Market: Still one large company and a range of smaller ones
Until a few years, the total power production by or in cooperation with Electrabel was 72,723.6 GWh (2006 figures) or even 91.9% of the total Belgian production. Other producers in Belgium are a.o. Essent International / Belgium, Nuon, RWE, Aspiravi, Ecopower, Wase Wind and Beau Vent.

Challengers go „alternative“
The challengers of Electrabel quickly went alternative. E.g., Essent owned in 2010 already wind farms, biomass plants, hydro and solar power and a CHP. Nuon also has a wind farm. RWE operated through a joint venture with Electrabel a CCGT operating on an important site in the port of Antwerp. This is a steam-gas power station with two turbines and produces electricity. Aspiravi focuses primarily on wind turbines, biogas plants, biomass, small hydro and cogeneration plants.

Foreign power needed!
Our power grid also makes use of electricity from neighboring countries France, Netherlands and Luxembourg. Once, the major producers exchanged power through contracts and cross-shareholdings. Thus they could, with limited resources, guarantee the supply of energy to avoid shortages or blackouts. Today there are other players such as suppliers and traders, involved in these transactions, and cross border trade bacomes an essential element in a single European market. The exchange of electricity in Belgium last year showes a net import balance increased from 2004 to 2006 annually. According to Synergrid, the Federation of the grid owners of electricity and natural gas in Belgium, Belgium needed to import almost one quarter of the energy. In 2007, reduced the balance of imports is slightly, but rose again in 2008.

Grid management and energy sypply: a clear separation
Grid management includes transportation, also called transmission and distribution of electricity. Before liberalization, it was assumed that transmission through high and medium voltage power lines was exceeding 30 kV (kilovolts), while the distribution were all under 30 kV. According to the Federal Electricity Law, the regions (e.g. Flanders) are now responsible for local distribution and transmission

over networks with a maximum voltage of 70 kV. The Flemish Region consideres this as distribution grids.

Elia linking production with distributors.
The transmission system operator is responsible for the transport of electricity on the grid, so from the power plants to the distribution network or to the end customers directly connected to the transmission grid. The federal government indicated in 2002 Elia as transmission system operator with a monopoly on all transport of electricity above 70 kV in Belgium. The network consists of overhead lines, underground cables and high voltage substations and the equipment components that enable the transmission of electricity such as transformers.

Distribution as usual for the intermunicipal ernergy companies
Elia is also appointed in Flanders to run transmission systems of 30 to 70 kV. There are several distribution companies for further distribution from the transmission network to final customers, but also here there is no free choice. The distribution companies for systems below 30 kV are the existing intermunicipal energy companies as they existed before the liberalization of the energy market, and were the historical energy suppliers. Their activities are tied to a region.

End Customer is free to choose their supplier
Electricity suppliers are themselves producers or they sell the electricity they buy from other producers. They provide service to the end customer who, in the liberalized market, can choose ist own energy supplier. This applies to individuals in Flanders since 2003 and throughout the European Union since 2007.

2.3 Tendencies on the Belgian energy markets, since the liberalization of the early 2000's: natural gas

Energy sources and imports: near-monopoly erodes very slowly
Because Belgium has no natural gas reserves, natural gas is imported by specific companies. The biggest importer is Distrigas, which is responsible for purchasing, sales and trading ‚on the spot markets', as for sales of international transit capacity. Distrigas also trades liquefied natural gas (LNG) and arranges transport by ship. In 2005, Distrigas imported 86% of Belgian gas, Gaz de France 10% and Wingas 4%. The latter is a joint venture between the company BASF and Russian gas producer Gazprom. Since early 2007 Wingas also supplies gas to three major gas users in the port of Antwerp: BASF, Air Liquide and Zandvliet Power, accounted for about 9% of total gas consumption in Belgium. A new pipeline conects BASF Antwerp to the Dutch gas network.

The distribution network: a national and many local monopolies
Fluxys has a legal monopoly on the transportation of natural gas under high pressure from the borders of the receiving stations of the distribution system operators (DSOs) and the end customers directly connected to its transmission. Fluxys also manages the storage facilities in Belgium, in particular underground natural gas storage in Loenhout and a plant in Zeebrugge (Dudzele) for aboveground storage of liquefied natural gas (LNG) tanks, the peaks in the gas fluctuations. The DSB, which are responsible for the distribution network from the transmission of Fluxys up to the

final customers, are almost all the existing intermunicipal energy companies before the liberalization of the energy markets. They are legally bound to their public service delivery in their area and have to connect in residential and residential development areas by 2015 at least 95% of the residents and at least 99% in 2020. There is an exception for rural residential areas.

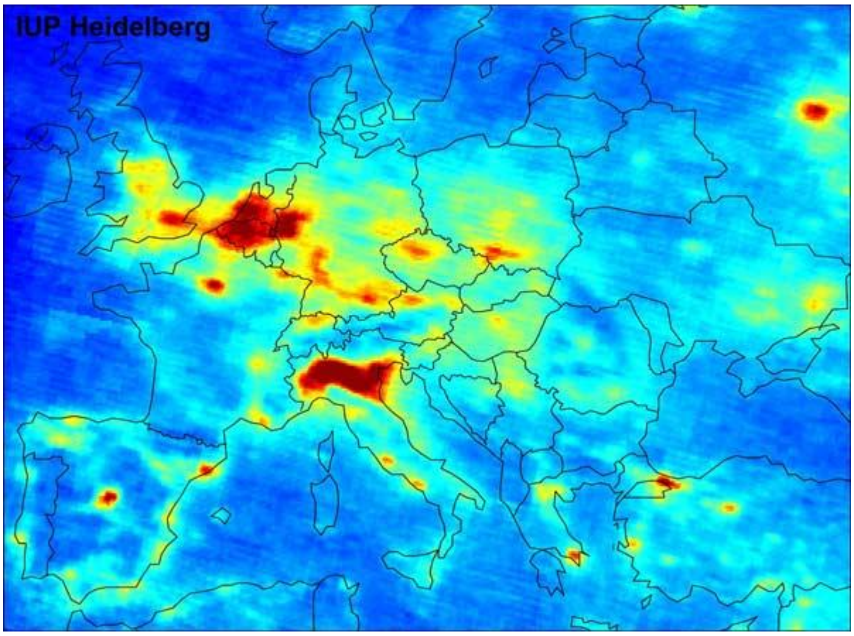
Wide range of gas suppliers
Energy suppliers are the people who effectively supply the gas. They buy the gas at the importer and sell it to the final customer. They provide the service tot he customer. The consumer is free to choose its supplier. The gas suppliers in Flanders are Distrigas, Dong Energy Sales, EDF Belgium, ENECO Energy International, E. ON Belgium, E. ON Ruhrgas, Essent Belgium, Gaz de France, Lampiris, Nuon Belgium, Netherlands RWE Energy, SPE, Thenergo and Wingas.

3 Built environment

The region is situated in the West of Flanders, it counts almost 300.000 inhabitants on its 446 square kilometres (667 inh/km²) so it is very densely populated.

Its wealth is owned to a large number of SME's (namely 8.000, on a total of 44.000 businesses), and offering jobs to 104.000 employees making the region to have one of the lowest unemployment rates of Belgium. It is the result of a post World-War II policy focussed on economic growth offering space for businesses and industry.

As a result of this policy, the environmental quality is poor, the energy intensity is high as well as the level of air pollution. This is due to the intensive traffic and the fuel combustion in the region and surrounding regions.

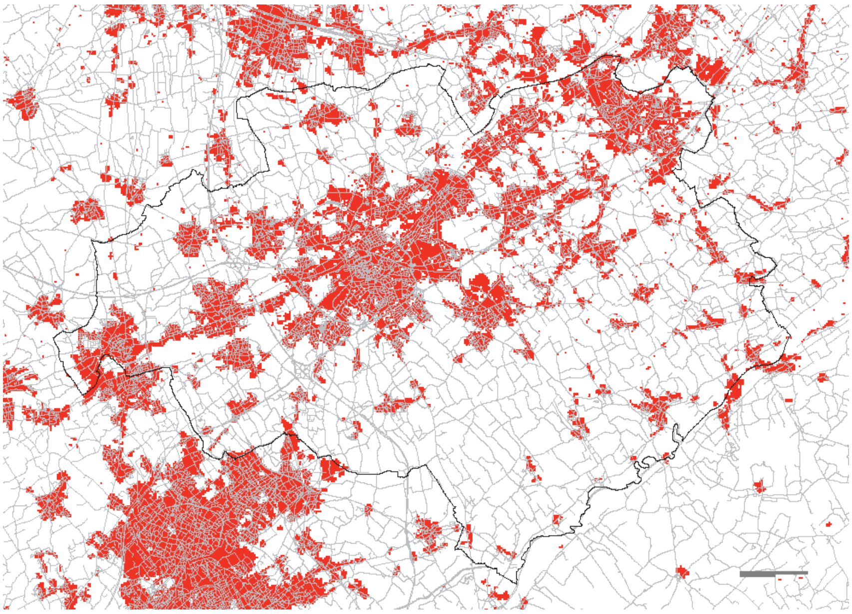


NO2-pollution shows the emmisions and is linked with the use of energy

3.1 Urban sprawl

We have to put this against the background of the widespread urban sprawl in the region. Urban sprawl is a term commonly used to describe physically expanding urban areas. According to the definition of European Environment Agency it is a physical pattern of low density expansion of large urban areas under market conditions, into surrounding agricultural areas.

Urban sprawl is the opposite of the compact city (one of the crucial elements in sustainable urban districts such as Vauban in Freiburg), it is characterized by inefficient land use through development. The Kortrijk sprawl is part of the larger urban sprawl zone extending from northern France (around Lille and Nord-Pas-de-Calais), over Flanders and the northern part of Wallonia (Borinage to Liege), Randstad Holland, and the German Ruhr-area.



Urban sprawl in the Kortrijk region: red is built-up area.

The drivers for this energy intensity are the expanding industrial complex, spreading urban patterns and high mobility. On a marco-economic level the economic growth within each of the 13 communities is crucial (tax revenues of local municipalities depend for a large part on this), on micro economic level the rising living standards, the cheap agricultural land, and the competition between communities is important, further the drivers are the democraphic growth of the number of households; the facilitation of easy mobility (large private ownership, availability of roads, poor public transport); and finally a weak regulatory framework concerning the land use planning and lack of horizontal and vertical coordination between levels of government.

There is a triangular relationship between

(1) urban sprawl,
(2) the economic growth policy and
(3) the energy intensity of the region.

In the historic (and current) economic growth policy Flanders and the region opted to promote cheap land to built upon, for a competitive industry, and for cheap housing

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as stimulating forces for welfare and competitiveness of the region. This has negative impacts on land-use, landscape, agriculture, mobility, energy consumption and the quality of the living environment (messy, unhealthy: smog, dust, unsafe mobility, air pollution, light pollution…)

3.2 Energy use in buildings

A *residential survey*, carried out in 2005 by the Flemisch governement, has given input on aspects of heating, insulation, renewable energy (savings, raising efficiency en renewable goods,…). For the heating of the houses there is a strong increase in the use of natural gas.

A negative evolution is the increase of the use of elektricity. Since 2000 the new houses aren’t heated anymore with elektricity in comparison with houses from 1971 until 2000, what is a positive evolution.

The use of renewable energy is still limited. Renewable energy is uses by 3,8 % of the households in Flanders, which increased significant since 2001. Solar, bio or wind energy is used by 2,4 % of the Flemisch households, which increased significant since 2001.

An important step in a energy-efficient house is the use of thermal insulation. 66 % of the houses in Flanders have double glazing, 62 % of the houses have roof insulation. The use of insulation have increased since 2001. If we make a comparison in time (2001) we can say that the evolution of energy saving and sustainable measurements are is positive. This because of the increasing attention for the environment and the subsidies.

But this positive evolution is especially noticable with the stronger socio-economic groups (households with a higher income, higher education) and much less with the weaker socio-economic groups (elderly people werklozen, lower incomes, lower education, one-parent families, sick people and unemployed people). Nevertheless the differences are rather small.

Sprawl in Kortrijk region

4 Government and governance instruments

RES POLICY Targets differ between the three regions of the country (Flanders, Wallonia, and Brussels) and energy policies are implemented separately, leading to differing supporting conditions and separate regional markets for green certificates.

RES TARGETS Mandatory targets set by the Directive on the Promotion of the use of energy from renewable sources
13% share of RES on the final consumption of energy in 20206.
At least 10% share of renewable energy in final consumption of energy in transport by 2020.

Indicative Target set by the RES- electricity European Directive from 2001
6 % Share of RES on gross electricity consumption by 2010

Indicative Target set by the European Biofuels Directive from 2003
Biofuels consumption of 5.75% of petrol and diesel use for transport in 2010.

National commitments
The target for renewable electricity is 8% by 20109in the Walloon region, 6% by 2010 (and 13% by 2020) in Flanders10 and 2.5% by 2006 in Brussels. Wallonia and Flanders are on track to meets their targets. Wallonia is expected to overtake its target from 2009/2010.

There is no national target/commitment for heating and cooling.

Technology Roadmap
The Walloon Region aims at reaching a production of 4,100GWh heat from wood and vegetal by-products by 2010.

The Walloon region aims at reaching a production of electricity from wind of 370GWh (approximately 150 windmills) by 2010).

Flanders region aims at a production capacity of electricity from wind of about 1,000GWh by 2010. A memorandum of the Flemish government has been published in May 2006 aiming to reach this objective through accelerating measures. PV sector is also growing: from the 553 kW installed in 2005, it passed to 2035 kW in 2006, to 15,658 kW in 2007 and 40,000 kW in 2008.

Progress towards the targets
With an RES-E share of 2.98% in 2006 the national target of 6% is still far away. Wallonia and Flanders are on track to meet their targets set at national level. Wallonia is expected to overtake this target from 2009/2010.

3 sets of measures are key to the Belgian approach to RES-e:

Quota obligations
Quotas have been set (obligation for all electricity suppliers to supply a specific proportion of RES-e) and guaranteed minimum prices or 'fall back prices' have been

foreseen. In all three regions, a separate market for green certificates has been created. In order to guarantee the authenticity of certificates, the certificates are registered in a data bank managed by the respective regulative authorities in charge (for instance Art. 13 arrêté royal du 16. juillet 2002, Art. 21 arrêté du gouvernement wallon du 30 novembre 2006 , *besluit van de Vlaamse Regering van 5 maart 2004*.) In the Walloon Region, the price of the green certificates depends on the quotas which are going to appear quickly too low to sell the green certificates at a competitive price. The Walloon region should increase its quotas at the time of the future regional government.

Green certificates Price
In the Flanders Region, around 1 million of certificates were traded for the quota period 1 April 2007 – 31 march 2008, with an average price of 109 euro/MWh. The price is very stable since 2004. The price of quota certificates with or without guarantee of origin does not indicate a significant value for the guarantees of origin. CWaPE (Commission Wallonne pour l'Energie), energy regulator in the Walloon region of Belgium, has recently published the green certificates market prices and volumes for the fourth quarter of 2007 - covering the months from October to December. The volume of green certificates traded was 154,087. The third quarter of 2007 ended with the highest volume traded since 2004, reaching 227,009. The average price for the fourth quarter was 88.16 Euro/MWh. The price of certificates traded in the previous quarter, from July to September, was 91.46 Euro/MWh

Fiscal Incentives
PV benefits from Tax Credits for both private and companies: the former have a tax reduction of 40% of investment, max 3440 €/ residence (2008), whereas the latter have a 13.5 % of installation cost deductable from profit tax . RES-e technologies benefit from a tax deduction

Support for RES Heating and Cooling
Renewables for heating and cooling are mainly supported by investment subsidies and fiscal incentives in Belgium.

Support for Biofuels
Quota Obligations
For the production of bio ethanol, a yearly quota of 250 million litres has been allocated on October 2006 and until 2013, to 3 companies. For the production of bio diesel, the Belgian Government decided to allocate production quotas with reduced excise duties to three Flemish and one Walloon companies. These four producers must be ready to deliver adequate bio diesel supply to the Belgian market from September 1st, 2007

Tax exemption
The Act of 10 June 2006 concerning biofuels reduces the excise duties on diesel oil containing at least 3.37 % biodiesel and on gasoline containing at least 7 % ethanol of non-chemical nature. Furthermore, this Act allows the regional public transport companies to use a higher exempted percentage of biofuels. The Royal Decree of 10 March 2006) fixes the general conditions for the exemption of excise duties for pure rapeseed.

Some focusses in the policy:

European policy:

- The EU aims for a constant and safe supply of energy. Sustainable energy doesn't lead to the reduction of greenhouse gasses only, but also to a less dependence of imported fossile fuels.
- To reach the goals of 20 % energy from renewable energy, the EU want's to double the efforts in the sectors of elektricity, heating, cooling and biofuels.
- The EU sets up programs to stimulate research, investements and developments of renewable energytechniques and safe nuclear power (f.e. het SET-plan fort he development of carbonneutral technologies, the 7th framework programme, action plans around energy technologies and ecotechnologies, ICT for carbonneutral economy and energyefficiency,…

Federal policy:

- The goals of 20/20/20 are translated to the goal of 13 % renewable energy by 2020.
- By green power certificates, CHP-certificates and other measurements decentral and renewable powerproduction will stimulated.
- The obliged addition of biofuels contributes tot he switch to sustainable mobility.
- Subsidies for companies to invest in renewable energy installations.
- Decentral steamproduction and renewable energyproduction stimulating by adaption of policy
- Development of Flemisch Energycompany to invest in renewable energy production, decentral production of elektricity and qualitative CHP.

Sprawl regions and low-density urban developments are characterized by high energy consumption: post World War II single houses are little insulated, and have large surfaces to lose their heat. It requires a lot of raw materials to build (more roads and other infrastructure needed, more energy for street lighting), the maintain mobility there is inefficient car use, and it creates energy-intensive urban lifestyles. The remaining space is scarce, and the pressure on biodiversity, natural sites and agriculture is high, as well as a poor air quality.

The energy strategy will have to formulate an answer on how to deal with this urbanized region through new interventions, and energy- optimisation of the existing urban fabric. The new interventions concern decentralized energy production or new urban developments.

Considering the different techniques for renewable energy production, the Kortrijk region has no large 'geographic' or natural advantage: no large woods or other natural resources to produce biomass (only 1,0% is covered with woods), no advantageous geothermal potential, no large heights to generate hydro-electric power (flat land)… Even more, because of the dense population the pressure on the land and natural system already is very high: 25% of the land is built-up, most of the rest of the land is used for agriculture (cropland and grassland, 59,5%). Because of the vicinity of the North Sea, there is more wind energy potential than the rest of Belgium.

The state-of-the-art windmills have a size of 150 meter and a capacity of 2MW, thus in relation with the existing and dominant high landscape elements (some with historical relevance like old windmills or churches, other infrastructural like electricity lines) they are noticeable higher. New and very visible energy infrastructure affects the urban landscape so there are new societal burdens. There is a constant threat of the rejection of windmills by public opinion and individual citizens. By a discerning approach the burdens can be minimized: negligible noise and shadow effects, alignment and integration with the landscape. Simultaneously windmills generate new prophets, mainly financial. Currently they are often shared with the owner of the land and the owner of the windmill. A reorganisation of the benefits also could enhance the public acceptance: if the residents living around the windmill can become shareholder through a cooperative structure for example, they are assured of electricity at a (and lower) price not depending on oil-prices. It is proven that the residents conceive those windmills as 'theirs'.

In the exercise of Leiedal only the spatial component was taken into account, using an 'elimination' technique: according to current legislation windmills must remain at a certain distance from housing areas (250m), houses (250m, in Flanders not all houses lay in housing areas but are also dispersed into the landscape, sometimes illegally), green nature areas like woods, parks and nature (250m), mall airports (3,7 km), highroads, electricity lines, military zones and radars (15km)… After this exercise through GIS-buffering, only few possible locations remained.
But if we want to come to a vision, not only excluding elements should be taken into account, but also normative elements such as the aims to remain from a reasonable distance from historic sites and the few remaining valuable landscapes, and a geometrical emplacement and lay-out of the windmill parks. For example, a windmill park should count at least 3 identical windmills, orderly placed along a pre-existing main landscape element (e.g. canal, highroad), and at regular distance. Finally seven locations in the region were determined, where we visualised the possible future situation (Photoshop-simulations), for 20 windmills in total. Currently there are 4 windmills in the region, on the Evolis Business Park.

The regional windmill plan 2009 was the second edition after the initial 2004 version. It was necessary to update the plan due to changing context: the technical evolution lead to larger and more powerful windmills, legislation changed, the market changed… And even in December 2009 some elements need to be updated again because of an initiative of the Province of West Flanders. Thus, a regional approach is a valuable instrument on short term, fitting within the mid-term goals and targets of regional energy production. It is a dynamic instrument that needs frequent updating but offers a framework to deal with implantation of new windmills through an integrated vision. Also the updates must fit within the mid-long and long-term vision, and also must be consistent with the previous versions. In our approach, the windmill plan can grow from something carefully and perhaps hesitating, to a more and more ambitious plan that perhaps itself can change the context: from a plan that carefully keeps distance from illegal housing, housing, infrastructure… to a plan that proposes integrated solutions (e.g. changing of function of the house) so goals for regional wind energy production can be achieved. So a shift from an "elimination-exercise" towards a pro-active approach. But this will depend on the direction of future societal, technical and socio-economic tendencies.