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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
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1 Introduction

This baseline study is the result of activity 1 in workpackage 3. The document is based on an inventory template developed by Edinburgh University ISSTI (Institute for the Study of Science, Technology and Innovation). This template contained a list of questions to examine the contexts in which sub-national energy initiatives (SNIEs) take place.

1.1 General aspects of the context for SNIEs

The context shapes the design and operation of SNIEs, determines their appropriateness, provides the opportunities, challenges and problems they face, and influences their success or failure. Judging which models and experience might be transferred from one partner region or country to others will require an understanding of differences in the conditions in which SNIEs have been created and operated. Relevant aspects include

- the physical infrastructure and technologies of energy provision, and the delivered energy forms available
- the structure of organisations and markets in the energy sector – for the supply of equipment and energy
- the pattern of settlement and the built environment, and the industries supporting it
- the organisation of national, regional and local government
- national, regional and local governance in energy, industry and the natural and built environments: legislation, policies, strategies, regulation, self-regulation, management
- financial and fiscal frameworks and climate
- industry capacity and expertise; skills and training; research and innovation systems
- key issues and debates in energy and the natural and built environments.

These aspects are mostly relevant to SNIEs in general and improving the conditions for them.

1.2 Content

This document has the following structure.
Part A: General aspects of the energysupply in The Netherlands:
Chapter 2: Dutch energyinfrastructure in global terms
Chapter 3: Structure of the Dutch energy market
Chapter 4: Decentralised energy initiatives
Chapter 5: The built environment;
Chapter 6: Energy issues and debate

Part B: Specific local context for the SNEI in Tynaarlo
Chapter 7: Short description of SNEI „Energyproductive housing development De Bronnen Tynaarlo“
Chapter 8: Regional and local energypolicy
Chapter 11: Energydemand
Chapter 12: Saving options for the housing development
Chapter 13: Options for generating electricity
Chapter 14: Conclusions and further research

2 Dutch energysupply in global terms

2.1 Governmental levels in the Netherlands

There are three relevant levels of government: national, provincial and municipality. They play different roles related to sustainable energy.

2.1.1 National level

On the national level the framework and goals for the reduction of CO2 are defined. The Netherlands follow the European guideline of a reduction of 20% CO2 emission reduction in 2020. The European directives were translated in the Building Regulations, in the regulations on environmental permits and in national, regional en local policies. Buildings and enterprises are controlled by law enforcements officers.

2.1.2 Provincial level

Provinces play an intermediary role. In Chapter 9 the provincial policy of Drenthe is described.Drenthe has a strong objective in gas and oil, biomass, sustainable transport (100.000 vehicles plan), housing (100.000 houses plan) and soil energy. The Northern part of the Netherlands has a Climate and Energy agreement with the national and local authorities and the waterboards. An actual discussion is being pursued about a provincial sustainable energy company (public ownership).

2.1.3 Municipal level

In the Netherlands, regional and local governments play an important role concerning decentral sustainable energy initiatives. Since recent years, (after the start of the effective BANS-agreements in 2003) the local and later regional government became important driving forces in the implementation of energy-initiatives.

Municipalities can easily connect to stakeholders. For example a lot of environmental organizations are funded by local governments and they aim to work cohesive, towards their own objectives and targetgroups. A problem is that the national government is dualistic in it's approach towards sustainable energy on the one side and the traditional oil and gasindustry at the other side. National policies and funding keep changing all the time. That is a big problem for projects on the long term and upscaling towards a substantial transition to sustainable energy.

Since 2002, the national government started a program of socalled Climate agreements with the municipalities, as part of the decentralisation of tasks to municipalities.

In a Climate Agreement (BANS), Dutch municipalities can compose a "menu" of climate actions and for this effort they are subsidized. The subsidy is meant for

the wages of an energycoordinator. This way a basis is formed for future initiatives. The Climate agreements show a significant growth of climate-officers in the municipalities and the province. Each municipality can set their own ambition. As a consequence a lot of municipalities run for "first climate-neutral municipality". A positive sideeffect is the growing awareness of the need for cooperation with stakeholders on a regional level.

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2.2 Energy infrastructure

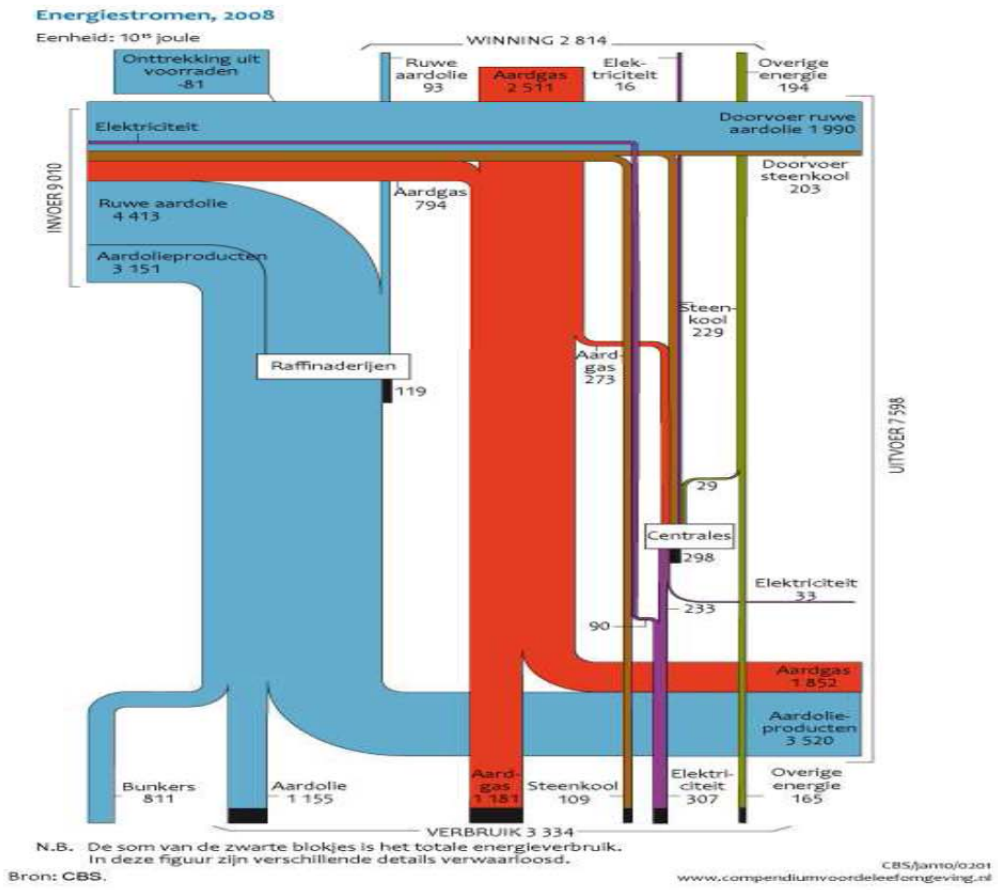
The Netherlands have large gassupplies and also oilreserves. Untill the 20th century coal was an important source too. In 1959 the Slochteren gasfield was discovered. It is 2800 billion km3 large, one of the largest known in the world. In 1963, the Slochteren gasfield started to deliver to households.

The discovery of the gas has had large impact on the energysupply. In 1965, the government decided to close all of the coalmines.

At present, almost all households are connected to the very extended gasgrid.Decentralised heating and electricity also occurs but on a small scale.

Figure 1

National Energymix Netherlands 2008 (import, export, internal production) (source CBS, 2008)



2.3 Renewable energy

The share of sustainable energy in the inland energyuse in 2008 was 3,4 percent. Almost two thirds comes from biomass and almost onethird from windenergy. The next table is a split of the electricityproduction . The overall percentage of sustainable electricity is 9 % (2009).

Table 1: Sustainable electricity in the Netherlands (CBS, 2008)

	1990	1998	2008
	% of total electricity use		
Internal production (Netherlands)			
Total energysources	0,92	2,05	7,49
Hydropower	0,11	0,11	0,09
Windenergy Total	0,07	0,64	3,56
Windenergy on land	0,07	0,64	3,06
Windenergy on sea	-	-	0,50
Solar electricity Total	0	0	0,03
Biomass total	0,74	1,29	3,81
Inceneration	0,59	0,92	3,23
Biogas, Total	0,11	0,25	0,58
Biogas from dump	0,02	0,15	0,09
Biogas from sewagewater	0,08	0,09	0,12
Biogas farmers			0,28
Biogas, other	0,01	0,01	0,08
Import and export			
Import (Certificates)	.	.	15,81
Export (Certificates)	.	.	1,23

Bron: CBS (2010).

Referentiecode: CBS/CLO/feb10/0517
Indicatorcode: i-nl-0517
Indicatorversie: 12

Import of certificates is an important source for green energy. A growing amount of renewable energy is produced and supplied on a local scale. Table 2 “Use of sustainable energy” shows a significant growth of biofuels and “environmental energy”: energy from the surroundings provided by heatpumps or heatstorage in the underground.

Table 2: Use of sustainable energy in the Netherlands, 1990-2008				
	1990	**2000**	**2005**	**2008**
	TJ avoided use of primary fossile energy			
Total	**18.096**	**35.577**	**80.538**	**112.689**
Hydropower	752	1.179	733	840
Windenergy total	495	6.861	17.222	35.094
on land	495	6.861	17.222	30.184
at see	-	-	-	4.910
Solar energy total	76	487	1.047	1.189
Solar electricity	3	66	295	330
Solar heat	73	421	752	859
Environmental energy	-	809	2.328	5.443
heatpumps	-	589	1.830	4.622
heat/cold storage	3	220	498	821
Biomass total	16.770	28.242	59.208	70.124
incineration	6.093	11.417	11.874	13.051
co-firing		1.755	30.522	19.692
stoves at firms	1.308	1.806	1.914	2.508
stoves at households	6.231	5.701	5.464	5.464
Reminder biomassincineration	440	2.317	4.397	9.125
Biogas total	2.698	5.246	4.936	8.234
biogas from landfills	336	1.934	1.580	1.387
Biogas from wastewatertreatments	1.866	2.299	2.127	2.262
biogas from agrifirms	-	-	78	2.927
reminder biogas	497	1.013	1.151	1.658
Biofuels for traffic total	-	-	101	12.048
biogasoline	-	-	-	4.524
biodiesel	-	-	101	7.524
	as % of total energyuse			
Total sustainable energy	**0,67**	**1,23**	**2,44**	**3,39**
CBS (2009a) CBS/CLO/dec09/0385				

3 Structure of the Dutch energy market

3.1 Electricity

The Electricity Law (1998) and the GasLaw (2000) regulate the administration of gas and electricity nets. Since 2004, transport and retail activities are splitted into regulated net-companies and commercial retail organisations. The regional netadministrators are installed by the minister of Economic Affairs and registererd by the Energychamber. The Energychamber sets the tarives for the netcompanies (for connection to the grid and transport of electricity) yearly. The retail organisations are commercial and operate on a free market.

3.1.1 Regulated Net-adminisatrators

National level: Tennet is the Transmission System Operator and administrator of the 110 kV-, 150 kV-, 220 kV- en 380 kV-transportnet.

Regional level: regional electricitynet-administrators are responsible for the connection of consumers. The regional net-administrators take care of transporting electricity lower than 110 kV. The regional net-administrators also take care of maintenance, construction and governance of the transport and distributionnets. They are an important link between the consumer and the energysuppliers. The regional net-administrators are independent to ensure a fair admittance for third parties. There are 9 regional electricitynet-administrators each for a different geographical area.

The regional electricitynet administrator is legally obliged to connect each consumer who demands for a connection to the grid and to transport electricity to that consumer. Unlike the electricitynet-adiministrator, the administrator for the gasnet does not have a legal obligation to transport or connect.

3.1.2 Commercial Electricity-traders

Traders in electricity try to buy and sell with the highest amount of profit. Some suppliers and producers have their own tradefloor, others outsource this activity. The traders buy their electricity directly from producers through the suppliers or on the APX.

3.1.3 Program-responsibility-holders//producers

Each electricity producer with one or more connections to the grid, is responsible for an energyprogram. The program-responsibility holders are registerd at the Energychamber. Daily, each electricity producer sends Tennet an Energyprogram based on the expected production of that day. The day after, Tennet measures the real amount and when an imbalance occurs, the producer can get a fine.

Suppliers

Suppliers of electricity to consumers and small businesses need a licence and are registered at the Energychamber. At this moment there are 27 licenceholders.

Metering

Each connected consumer can choose a party responsible for metering the energyuse.

3.2 Gas

Also for gas there the transport and supply are splitted. There are 13 regional net-administrators. The suppliers need a licence to supply households and small businesses and are registered at the Energychameber, at this moment 22 gas-suppliers have a licence.

3.3 Heat

The Heatlaw (2009) regulates the yearly maximum tarives for the supply of heat. Heatsuppliers that deliver heat to more than 10 persons will need a licence in the future. At this moment the energychamber has a list of 56 heatnets.

4 Sub-national energy initiatives (SNEIs)

4.1 Intoduction

Both large international companies and small specialised companies provide decentralised energy equipment etc. The Gasunion cooperates with large retail and installer companies in the introduction of the HRe (combined heat and power). Large scale wind energy is planned on a national and provincial level and is most of the times developed by large companies specialised in windenergy or by large overall energycompanies. But also smaller initiatives on a particular level take place. Larger national companies often have a homeservice company for maintenance, advise and retail associated under a different trademark.

Besides the mainstream development from energyretail to selling service, the amount of smaller and innovative companies is growing. Also on a local level there is knowledge and business. This is really a very diverse market. For example in the municipality Tynaarlo there is a large manure-fermantation installation at a farm that produces electricity for 12.500 households. The larger building companies tend to start divisions specialised in low-energy building concepts. And there are smaller building companies that specialise into zero-emission buildings who are also operating on the local market. In general, the installationcompanies are a bit more conservative. As a side effect we see the beginning of an innovative industry. For example in Tynaarlo there is a company developing smart meters, a company for geothermical techniques, a company offering electric cars and a building company building with recycled glass-walls.

4.2 Intermediaries involved in energy and equipment markets

There are a lot of intermediaries involved in the market. For example industry associations, professional associations, energy advisers and auditors, architects and designers, specifiers, wholesalers and distributors, energy services companies, social housing agencies, community groups and charities, campaigning groups, estate agencies, landlords, etc.

All of the intermediairies mentioned play a role. Social housing agencies and or local governments tend to play a role as pioneers. Not very active are the estate agencies, they tend to be more conservative. An important intermediair are the energy adivisors (EPA-adviseurs). They offer a subsidised energysavingsadvise about the energyeffectiveness of an existing house and the measures that can be taken to make it more energyeffective. Also architects with a special interest for energy are important intermediairies.

4.3 Community-led energy initiatives

Spread over the Netherlands there's a lot of community-led energy initiatives. Wellknown examples are:

- the community led-sustainable neighbourhood of EVA Lanxmeer in Culemborg. Since april 1st 2009, the local residents own their own

heatstation. The company is called Thermo Bello. The municipality of Culemborg guarantees the next 10 years for the amount of 150.0000 euro. The heatstation was part of the drinkwaterpumpstation of Vitens. The heat is distracted from the drinkwaterreserves and is submitted to the lowtemperature heating for 180 houses in the neighbourhood. Two gasunits are used for extra heating at cold days and in case the heatpump falls out. Check at www.eva-lanxmeer.nl

- Cooperative windmillassociations such ass the Windvogel, Waterland, and Pakdewind. The members are all individual co-owners of a windmill and the sustainable energy that is produced. The Windvogel also developed a model for self-supply which is tested now and will make it independant of subsidies.
- Ecoteams and transition town-intiatives
- In the 90ties, there has been some interest for neighbourhoudteams to educate themselves in environmently friendly living, energysaving etc. The Ecoteam foundation offered an information and workmap to those teams who paid a small amount of contribution. Then, in a period of a year, the teams came together and improved their energyconsiousness on a deliberate base.

4.3.1 Examples in the northern part of the Netherlands

- Waterland, a housing area of about 150 houses in a suburb of Groningen. In the early nineties a group of residents asked the municipality if they wanted to participate in a sustainale housing area. This led to the development of one of the first sustainable housing areas in the Netherlands with an emphasis on solar oriented building;
- Biomass installation Beesterzwaag; an initiative of the Agrarian NatureAssociation De Alde Delte, who exploits the biomass installation. The project is a combination of landscape maintenance, heatsupply for a carecentre—and special school. DLG, a subdivision of the ministry of Agriculture, carried out the projectmanagement. Triodos Bank, a sustainable bank, did the financing.
- The former Foundation Biobuurtkracht in Groningen was a particular initiative to stimulate pv-cells in the neighbourhood. They worked independant but the municipality facilitated and payed for an instruction video on the instalation of pv-cells and a brochures about how to get subsidies and choose a pv-system. Also the municipality organized a funding for the (high)preinvestment that had to be paid prior to getting the subsidy back.
- Swimmingpool De Peppel in Beilen

  A swimmingpool and school are heated by heat from dairycompany Friesland Coberco Dairy Foods
- Sustainable street in Balinge

  Residents of the street find each other in their enthousiasm to spare energy together.
- Frederiksoord:

  In Frederiksoord/Wilhelminaoord the Society of humanitarianism started the first agriculture colonies, where people where housed and trained for work and so they created employment. The environment, beautiful cultural

heritage rural area of 1300 hectare (with lots of monumental properties), faces challenges to sustainable redevelopment. The society of humanitairianism also wants sustainable renovate some old agriculture colonies.

- Municipality of Meppel:Development of sustainable housing development Nieuwveenselande. The municipality wants to make the houses energy generating.
- Swimmingpool Noord Sleen
- Residents have (in cooperation with Unica Tecnical Installation), placed a Mobil central heating that Works on wood chips from the adjacent natural areas. In wintertime the installation heats a nearby located service station.
- Assen; leader in Led lighting in public places. With “smart” lighting, the municipality saves 30% energy. There is at the moment a try out for green Led lighting in Assen.
- Farmer Emmens in Zeyen. Sensortechnology may well be applied in the agriculture. Every day the farmers are getiing advice about working on his land. This brings savings in fertilization, pesticides and water.
- Staying a sustainable farmer in Assen. There are approximately 100 milkfarmers who has been followed. With the target to reach as many as possible Dutch milkfarmers to tempt them to produce sustainable.

4.4 Aspects of decentral production

Decentral production of sustainable energy is difficult to realise. A few problems that occur are:

The current electricity-net gets unbalanced when huge amounts of localley produced renewable energy are returned in to the net;

Often there is an unbalance between consumption and availability of local sources.

Often the scale of a development is two small to set up a feasible local sustainable energyinitiative.

Consumer and investors confidence are affected by the reliability of the (national) government, continuity in the subsidary system, examples of local municipalities, examples of so called ”opinion leaders”.

Commercial developpers claim a level playing field, they get tired of having to submit to different ambitions in each different municipality

Some features of the cost structure of energy efficiency or renewables installations are disadvantageous. The fact that in the Netherlands prices for heat are linked to the price of gas makes it difficult for local initiatives to concur.

4.5 Aspects of the supply chain

Particular end users (consumers) buy their energy from licenced energysuppliers. Some of the companies that used to be part of a regional netowners, also offer advise and servicecontracts. They often offer internetservices also energysavingprograms and internet provides

comparison. There is quite a lot of commercial activities and aggressive marketing from the side of the energysupplier. Some websites offer comparisions between energycompanies and prices.

For commercial end users with a high consumption, getting the cheapest contracts has become a specific target since the free market was introduced. They get advise from specialized consultants that operate on the energymarket and have a daily update of the prices.

4.6 Active market segments among energy users

Important market segments in the built environment in the Netherlands are the social housing companies, schools and municipalities. Retrofitting is a growing industry and a lot of smaller schools tend to merge in multifunctional public buildings. Those developments are vehicles for sustainable energy initiatives. Regional energy initiatives are a niche market, since local initiatives are often too small and could use a regional scale. In the North Netherlands, the governments, companies and knowledgeinstitutes work together in Energy Valley. Based on what we've seen in Gussing, one could say that innovative projects on a regional scale with a R&D component, are an important focuspoint too.

5 The built environment

5.1 Pattern of settlement in the Netherlands and Drenthe

In the Netherlands, 6% of the land is occupied by livingareas. Within the Netherlands there are big differences. In general we distinguish 6 different types of livingareas (Bosatlas):

- Centrum-urbanised: a lot of very different functions and facilities, very well connected
- Sub-central: close to city centre, above average density, well connected
- Green-urbanised: lower than average density, for example housingareas
- Centre-village: low to middle density, average level of facilities;
- Rural: low density, below average facilities
- Working areas

In Drenthe only 3,7% of the land is occupied by livingareas. Drenthe is mostly characterised as rural, exept for the cities and the areas at the border of the province.

5.2 Density

The Netherlands are the most dense country in Europe and belongs to the top nine of most dense countries in the world. The Netherlands as a whole have 483 inhabitants per square km. Important for the energy-policy and adaptation strategies is the low position. The Netherlands is positioned in a delta of three big rivers: the Rijn, Maas and Schelde. This has been an advantage for the development of the economy for both the connection to Germany as the worldharbour of Rotterdam (and before that Amsterdam).

In Drenthe the density is much lower than the national average: only 50-100 inhabitants per km2. Except for the two larger cities in the region: Groningen and Assen with a density of more than 1100 (Groningen) respectively 500-1100 (Assen).

5.3 Drenthe's fysical landscape related to energy

Drenthe is characterized by its fysical landscape and hydrology: the uprisen Drents Plateau, from where different natural waterways start, and the ridges, formed by gletchers in the latest iceperiod. In the eastern lower parts, large peatfields developed. Until the 17th century not much happened in this hardly accescible land, but after the rise of the cities in the west, the peatcolonies became an important producer for western energyneeds. They were exploited by the cities. Unfortunately, the exploitation led to a lot of poverty in the peatcolonies.
This leads to an important culturally rooted distinquishment in Drenthe between the peat- and the sandarea's. On the higher sandparts, a small scale agricultural landscape developed, where for a long time, landscape, watermanagement, agriculture and inhabitation, went hand in hand in

harmony. In 20th century, upscaling of agriculture and inhabitation lead to a more formal organized landscape. Recently there is a tendency to restore old landscape values, also for reasons of reaching an outstanding quality of living. (s*ource: Wikipedia.nl and The Bosatlas voor Nederland, 2009)*

5.4 Dutch housing types and ownership

Number of houses: 6,900.000 (2007)
Particular ownership: 56% (property for sale)
Rental: 44% (most is social housing, the % of particular rent is less than 10%)
On average 2,4 people per household.

There is a significant renovation-task in the older cities. Each year 12.000 till 13.000 houses disappear from the market due to demolishment or agregation for example 2 row houses aggregated to one bigger house.

5.5 Spatial regulations

A Zoningplan, developed by the municipality, is the juridical description of what functions can be developed where. A zoningplan runs an extended procedure with a lot of possibilities for civic participation. A zoningplan is the formal base for a building permit.

The motive for a zoningplan for new areas is often a municipal masterplan that points out future development locations. Very often, large development companies have bought strategic locations. This means the commercial developers play an important role in negotiations about the spatial plan and design that forms the base for the juridical zoningplan. A zoningplan needs to be accompanied by an exploitationplan. In this so called GREX, the costs and benefits of the location are summed up and also the costs are devided between the participants in the development.

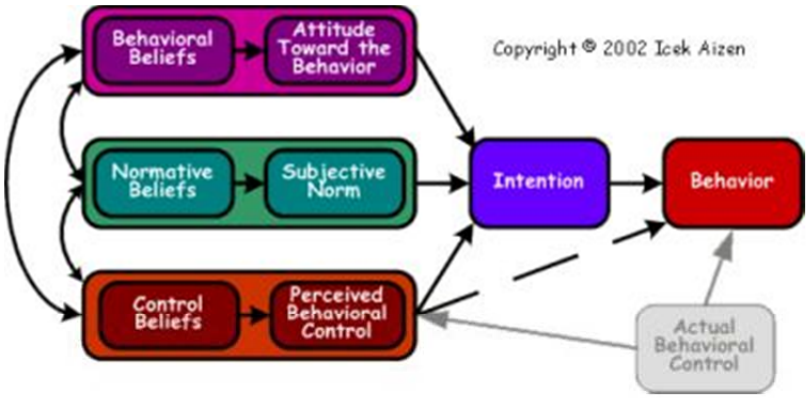
6 Energy issues and debate

6.1 Attempts to influence behaviour

In the Netherlands the national government typically attempt to influence energy users' behaviour. For example by the TV-spots of Postbus 51 "more with less"about energysaving (http://www.youtube.com/watch?v=H5xvqdAzb0A). And also by way of subsidies for double glazing, PVC's etc.
But nowadays it's not just up to othe national government to show best practice. Most of the energy supply companies offer awarenessprogramms on their websites.

6.2 Level of environmental awareness

A survey performed by Bouwfonds (2009) shows that a majority of 68% of the respondents (homeowners) do concern about the environment. But also, 43% thinks the discussion about the environment is somewhat excessive. 80% of the respondents thinks all newly build residences should be energyefficient and 60% thinks energyefficient houses will earn more on the longer term. But no more than 1/3 of the respondents is willing to pay extra for energymeasures. An important conclusion of the survey is: consumers who are well informed about the expected price of gas and electricity and the possibilities to save on energy, do have interest in innovative energysystems. It's more important to focus on convincing evidence that energymeasures bear priceadvantages than focusing on environmental awareness.



6.3 Actual discussions: CO_2 storage and wind on land

Actual discussions with a broad social impact are the storage of CO_2 in emty gasfields and large windparks. The debate generates a lot of attention from regional media. In the debate a diversity of groups is involved. Generally, in the discussion of windparks an interesting local dynamic has started in reaction to a policychange of the national government. The national government raised the goals and opened more possibilities for the development of parks. This has certainly raised the amount of requests for windparks in the province of Drenthe by large investors as wel as local initiatives with farmers. In this discussion the province tries to regulate the locations to avoid damage on the visual quality of the landscape in Drenthe.

We see that on a local level there's a somewhat equal spread of opponents and patrons. But in the discussion about CO_2, we see the locals and regional government are more likely to join an alliance against the National plans for storage CO_2 in emty gasfields. Here the discussion is much more a political isssue, where the discussion on windparks is much more about shorter term concrete plans with investors.

For insiders in the buildingsector, an actual discussion is about the norm for energyeffective buildings. Untill 2010, the regional governments of the 3 northern provinces had an intentional agreement with the municipalities, the building sector and national government. The idea was to speed up the decrease of the Energy Performance Norm in the northernpart of the Netherlands. This would mean a level playing field for all northern municipalities. Unfortunately this was temporized and at last rejected by the national government and building sector argumenting the economical crisis would not validate investing in a lower (better) EnergyPerformance Norm for houses. This discussion was covered less intensive by the media than the storage of CO_2 and the windpark issue.

Locally, the municipal initiative of building a very sustainable residential area opened the discussion on the costs of sustainability rather than the benefits. This is a merely local political debate. The local parties tend to have more interest in strictly local issues such as the location of a school and traffic. There is a lot of awareness, but little interest.

6.4 *Organisations involved in education and debate on energy issues*

As an example, the municipality of Tynaarlo has a communication officer who is partly responsible for communication and education about environment and energyissues. Also, in Groningen there is the centre for Sustainable Building, supported by companies and governments. Further, there is lack of independent organisations stimulating education and debate on energy issues on a local level.

Nationally, there is a tendency of commercial consultants and energy suppliers organizing (semi)public debates. Larger energycompanies have websites with energysaving games and models. A while ago there was an organisation called "ecoteams" were small groups of neighbours were supported to raise their knowledge on energyissues. This organisation was supported by municipalities running energycampaigns. At the moment there is a growth of bottumup initiatives around the international Transition Town movement.

6.5 *Aspects of communication*

Sometimes, sustainability merits of different technologies are not clear. It's difficult to compare different measures. This can cause disagreement about design features and best practice in products, installation and use. It affects consumer confidence.

There is a lot of discussion between energyexperts. For example the one advisor is fond of biomass, where another disputes the economical and environmental benefits and gives the advise to start a solarpark. The disagreement is usually not about the techniques or the design, but different opinions about the strategy for the energytransition. The real discussion that lays underneath pro- and contra biomass, solar, wind is about the argumentation (why), and effects (where, when, who). I'ts difficult to say how it affects consumer confidence, but I't surely will have an effect. Not in the last place because the consumer is not part in those discussions and is not given the opportunity to make a choise on arguments.

6.6 Level of consultation

The level of consultation depends on the subject and the initiators and the public interest. Often, the consultation ends up with a negative effect on proposed projects. There's many examples of fe proposals for windparks that did not make it to realisation.

6.7 Providers of advice on energy issues

Energy companies offer advice to households on how to reduce energy-use.

Energyconsultancies and engineeringcompanies offer commercial advise to municipalities and builders.

Also non-commercial advise is available through environmental organisations that are mostly financed by public funding.

A regional example is the Information Point for Sustainable Building in Groningen. A particular initiative, partly funded by municipalities and the province. They offer a helpdesk and an exposition, workshops, lectures for policymakers as well as consumers.

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7 SNEI De Bronnen in the municipality of Tynaarlo

7.1 Introduction

Energy is, socially speaking, a hot item. The pressure on municipalities to pay more attention to saving energy and sustainable energy is increasing as well. However, energy is not important to municipalities simply because of social interest. With energy prices rising steeply, the energy standard in housing (whether privately owned or rented) is of strategic interest. Municipalities would be wise to integrate energy in their strategic supply policy. One of the ways to achieve this is to include the generation of sustainable energy in the planning of new residential areas, as Tynaarlo is doing during the development of Vries de Bronnen.

In view of the rising demand for and the shortage of sustainable energy, residential areas are more often involved in local energy projects.

In De Bronnen (formerly named Vries Nieuwe Stukken), an area east of the village Vries in the municipality of Tynaarlo, approximately 350-550 new houses and a multifunctional building are to be built. The houses are intended for people from the region around the cities of Groningen and Assen who wish to live in a more suburban area. The houses will be built for different price classes and are aimed at different target groups. Both new housing projects (for the elderly or groups) and traditional detached or semi-detached houses with gardens are needed.

7.2 Ambitions

The Municipality of Tynaarlo has high ambitions for this new residential area. De Bronnen must distinguish itself in both environment and sustainability. The natural landscape forms the basis for the design. This environment must continue to function without any interference. The landscape and living area should form a synergy regarding energy production, water purification, natural water management and social aspects such as recreation, experience of living quality and value development. In this way productive mutual relationships between the various functions can be created.

The municipality of Tynaarlo is looking for energy solutions for the residential area Vries de Bronnen that match the ambition of becoming one of the most innovative and sustainable residential areas of the Netherlands. For the energy in Vries De Bronnen this means ‘an energy producing area’. Energy producing means that there is more sustainable energy generated than necessary for the houses and street lights.

What makes De Bronnen unique is the ambition to innovate the system on the whole area level and the desire to stimulate a more sustainable approach to development on a regional scale at the same time. For example, by ensuring a cleaner water supply to the regional brook system, by growing biomass products, but also by involving entrepreneurs and local inhabitants during the development phase and by delivering energy for the already existing area.

This requires a different approach to planning. Central to this approach is creating more room for innovation, knowledge exchange, co-operation with partners and re-drafting. The municipality has the director's role concerning development. In intense work sessions ideas are developed and then checked and improved together with external experts. The plan formulation phase is focussed on:

1. The development of a neighbourhood system producing energy and clean water - without waste.
2. The development of a socially conscious community that is also connected to the existing village.
3. The development of an integrated spatial design based on the existing landscape.
4. Increasing knowledge and sharing this as well as implementing it.
5. Making use of and organizing the involvement and commitment of partners.

This results in:
Designs for urban development, buildings and utilities;
A Business Model for the development and growth of the area.

Impression of the location of de Bronnen in Vries, Drenthe

8 Regional and local energypolicy

8.1 Drenthe's approach to climate

The Province of Drenthe is aiming for a 30% reduction of CO_2 emissions in 2020 (based on the situation in 1990). Drenthe has also signed the Northern Energy Agreement which aims for 40-50 PJ renewable energy and 4-5 Mt CO2 reduction of emissions. Drenthe has a 25% share in this and the Province hopes to achieve these goals by:

- Mitigation: emission reduction through source-oriented approach and energy saving.
- Adaptation: spatial planning with consideration for climate change.
- Participation: increased shared responsibility focussing the approach on the various actors.

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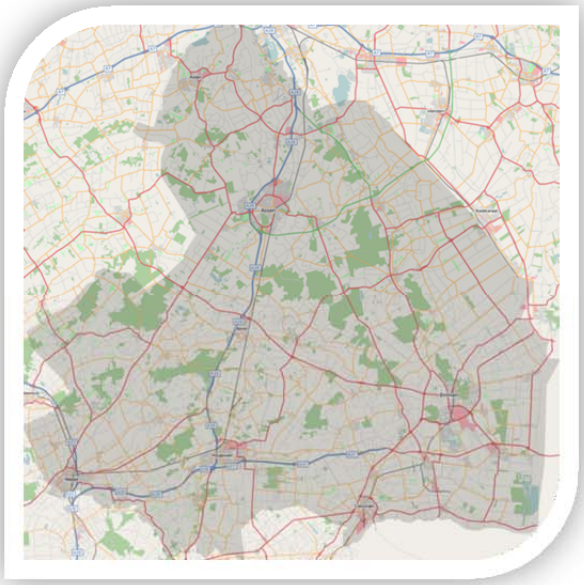
Concrete projects show that climate policy is strongly anchored in the Province's policy making:

- Setting up a uniform CO2 monitoring system in all 12 municipalities;
- The Energy Transition Park at Wijster;
- Establishing the Drents Energy and Climate deliberative body with all 12 municipalities;
- Initiating the SEBB whereby inhabitants of Drenthe can recieve a 20% subsidy when purchasing enegy-saving or energy-producing measures.

Province of Drenthe
2626,4 km2, 12 municipalities
490.870 inhabitants (per 31-12-2009).
Lowest density of all Dutch provinces



The Provincial long term energy strategy stretches 7 „changefields":

- Urban area
- Rural area
- Mobility
- Water
- Production processes

- Energyproduction
- Participation

Example of regional energyplanning in Drenthe: Energytransitionpark Wijster

At november 30 2009 Attero, de Federation for Environment Drenthe and the province of Drenthe signed the 'Agreement of Wijster'. This agreement is about changing the existing businessparklocation next to the location of the wastetreatment company Attero in Wijster into an energytransitionpark. Sustainable energy, heatsupply and cascading and also recycling of waste are central issues (Source: Atttero).

The province of Drenthe facilitates municipalities with the realisation of their climatepolicy. The cooperation between the province and the municipality is exemplary. At the start of the housingdevelopment of De Bronnen, the province offered a two day workshop on sustainable planning and design. Based on the results, the two partners decided to cooperate in the Interreg Ivb project North Sea Sustainable Energyplanning and De Bronnen was asigned as a pilot project within the province. Together, the province and municipality work on a model for the development of housingareas with a high energyperformance.

8.2 Energy and climate policy of the municipality of Tynaarlo

The municipality of Tynaarlo is rural in its character. It forms the tranquil 'green lung' of the urban region Groningen-Assen. In 2008 the municipal council signed the Northern Energy Agreement and, in 2010, made a Climate Contract with the Province of Drenthe. The municipality has a great deal of

experience with sustainable building. For example, housing with a low Energy Performance Norm were built in the development plan of Ter Borch. The town hall has been built with every consideration for sustainability.
Tynaarlo considers local energy projects to be important. The plan to make the new housing development 'De Bronnen' (meaning The Sources') energy producing by 2020 is extremely ambitious. The municipality is also involved in a regional study into the possibilities for using bio-mass to produce renewable energy and it supports the European project Green Sustainable Airports (GSA), another Interreg IVB project. The latest plans of the Municipal Council are for an Energy Transition Park at Vriezerbrug, closely located to 'De Bronnen'. In this way Tynaarlo stimulates businesses, environmentalists, farmers, local inhabitants and water boards to work on sustainable energy solutions.

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

European Community
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9 Local energydemand

9.1 Introduction

The municipality of Tynaarlo has requested several consultants to perform energy studies. Central question in this is what is the energydemand and what kind of mix of energy sources would best match the basic principles of De Bronnen. The next chapters give a summarized overview of the results that form the baseline for Tynaarlo's roadmap and energymodel for De Bronnen. The studies that form the basis for this are:

- Ten Kroode & Van Zee, study dated october 11th 2010, rapportnr. 117.001
- Deerns, combineded study with Wiertsma & Partners rapport uitgebracht op 24 maart 2011, rapportnr. 160-11-03584-03

9.2 Method

The study of the energy model is an elaboration of the Innovative Agenda from the Globaal Ontwikkelkader Vries Nieuwe Stukken , published in June 2009, (outline development framework Vries Nieuwe Stukken). The results are recorded in the Stedenbouwkundig Programma van Eisen de Bronnen, published in january 2011, (urban development plan of demands of de Bronnen).

9.2.1 Entire residential area

This study is focused on the entire area, both with regards to saving as well as generating energy. Firstly, the possibilities for energy-saving in the housing, the MFA and on street lighting are explored, based on the legal energy performance norm. Subsequently, the possibilities for generating energy are explored, both for the individual buildings as well as the central possibilities for the entire area. The combined options for saving and generating lead to a preferred scenario regarding the energy supply of de Bronnen. In order to be able to compare all the different measures and variations, all data is converted to kWh.

9.2.2 Work group

The goal of the Innovative agenda was drawn up in 2009, in cooperation with a group of experts. Ten Kroode & Van Zee organisation consultants were requested in 2010 to explore the possibilities of an energy producing area. Ten Kroode & Van Zee, Deerns and Wiersma and Partners presented several times and conferred with the Energy study work group of Vries de Bronnen. In between they fine-tuned the municipality's vision and the research that had been done so far for Vries de Bronnen. The following people are members of the municipality of Tynaarlo's work group:

- Sebastiaan Berends, Water Consultant
- Derk Jan de Boer, Energy and Climate Consultant
- Ria de Boer, North Sea Sustainable Energy Planning Project Leader
- Jan Elzinga, Civil Technology Engineer
- Andrea Hut-Wagenaar, MFA Vries Project leader
- Wildrik van Reeken, Architect – Spatial Designer

• Rob Schreibers, Urban Architect
• Amanda Roubos, Vries de Bronnen Project Leader
• Femke Adriaens, ROiD, SustainableAarea Development Consultant

9.3 Planned program De Bronnen

The aim is to make Vries de Bronnen an energy producing area by 2020. This means that on balance more renewable energy should be generated than is necessary for the housing, the MFA and the street lighting.

The environmental planning for the residential area is as follows:

- 35 ha gross living area
- 20.2 ha to be issued (collective and private)
- 14.8 ha for roads, communal green and water
- 550 residences, in various segments and densities (one third expensive, one third average, one third low-cost segment)
- 20 ha landscape, water storage, water treatment, recreational area
- the location and opening up of one multifunctional accommodation (MFA)

The residential area will be developed in phases:

- 60 residences in 2013
- 40 residences every year from 2014 through 2021
- 170 residences to be developed after 2022
- The decision on the exact residential programme will be made based on existing demand, actual market research or specific requests from initiators. The building of the MFA will start in mid-2012.

The area will be developed within a ‘scenic’ framework. The landscape values are important in the design and form the basis of the sustainable water system and the scenic environment. Opportunities arise within this given framework to achieve sophisticated housing in a varied residential programme. De Bronnen accommodates for varied age groups, housingtypologies and price classes.

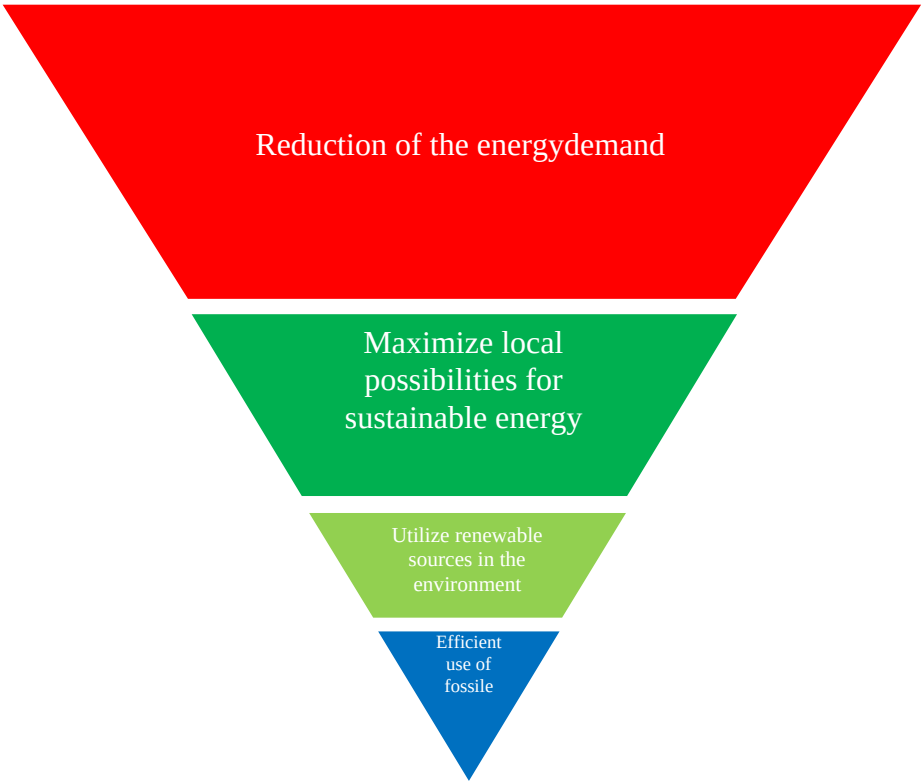
Scenic framework De Bronnen

9.4 Baseline

9.4.1 Principle of trias energetica local

To create an energy producing area a combination of several measures is necessary. On the one hand, there should be a focus on limiting the energy use of the houses. On the other hand, there has to be an investment in generating energy from sustainable sources. This involves generating renewable energy and producing heat or biogas. By considering sophisticated design, the relations within the entire residential area and by utilising all opportunities optimally decentralized local options become more apparent. Such options as generating energy when processing waste water, biomass from green maintenance and generating from sun and wind will be considered.

Bearing in mind the energy vision that the municipality has drafted, several scenarios have been studied and assessed.



Trias energetica locus (ROiD, based on the trias energetica (Senternovem))

9.4.2 Building Energy Requirements

The energy consumption and energy needs of a building consist of the energy needed for heating, hot tap water and electricity. The energy need for tap water and electricity mainly depends on the consumption. The energy consumption for heating depends heavily on the structure of the building. Especially insulation and the climate system (ventilation for instance) should be considered here.

The planned increase of the energy performance coefficient (EPC) in the coming years was considered when determining the energy need of Vries de Bronnen, Currently (2010), the EPC is 0.8. In 2011 this will change to 0.6 and the expectation for 2015 is 0.4. The increase of the ECP norm in 2011 is affirmed in a letter (sb2010013797) from the minister of VROM (Dutch Ministry of Infrastructure and the Environment, former Ministry of Housing, Spatial Planning and the Environment). The procedure for the intended increase in 2015 has yet to be started.

9.4.3 Reference

According to Ten Kroode and van Zee, assuming a traditional construction of the residences and an MFA with a HR boiler, the consumption of the residential area (550 residences, MFA and LED street lighting) will be 7,005,907 kWh annually during the complete period.

10 Saving options for the housing development

10.1 Studied heating concepts

Several concepts have been considered concerning the heating of the residences:
Heating and hot tap water by HR boiler with a gas connection and electricity from the national grid
Heating and hot tap water by HR boiler with a solar boiler on the gas connection and electricity from the national grid
Heating and hot tap water by heat pump and electricity from the national grid
Heating and hot tap water for a Passiv Haus (very high level of insulation and air-tightness) with an HR boiler and a solar boiler on the gas connection and electricity from the national grid.

For the MFA the following has been considered:
Heating and hot tap water by HR boiler on the gas connection and electricity from the national grid
Heating and hot tap water by heat pump on electricity and electricity from the national grid

10.2 Electricity Street Lighting

The best option to save energy in public spaces is to have street lighting using LED.

10.3 Domestic Electricity

Saving energy for domestic consumption has not been considered in this study. This is outside of the control of the municipality when developing the area.

10.4 Conclusion

The analysis shows that equipping the residences and the MFA with a heat pump yields the most favourable effect on decreasing the total energy consumption of the area.
When applying a heat pump combined with heat and cold storage, the remaining energy need in a residence at an EPC of 0.6 is circa 6,400 kWh (see table 0.1). For the MFA it is desirable to combine this with a HR boiler to guarantee continuation of service. Should this be chosen, then the remaining energy needs for the MFA is approximately 131,000 kWh annually (compared to 417,557 when the HR boiler for heating is chosen).

	With Hr-boiler EPC 0.6	With Heat pump EPC 0.6	With Heat pump EPC 0.4
Energy consumption heating rooms	5,150	1,030	618
Energy consumption water	4,635	1,854	1,854
Energy consumption electricity	3,500	3,500	3,500
Total Energy consumption per residence	13,285	6,384	5,972

Table 0.1 Comparison of savings in kWh at a traditional residence and the preferred option with heat pump, assuming an EPC 0.6 (legislation from January 2011) and EPC 0.4 (proposed change after 2015)

10.4.1 Explanation of the Advantage of the Heat Pump

The heat pump utilises the heat and cold that is naturally available in the soil to heat the residence in winter and cool it a few degrees in summer. A residence with a heat pump draws four fifths of its energy from the soil. That leaves only one fifth of the energy still needed in electricity. The residence with a heat pump does not use gas. When choosing this concept it is possible to decide on an infrastructure without gas.

10.4.2 Comparing the Options Based on Finances

A residence with a heat pump (without a gas connection) is now more expensive than a residence with a HR boiler, with or without solar boiler. As time passes, the residence with the heat pump becomes financially ever more attractive compared with the residence with the HR boiler. This is due to the fact that the Netherlands only has enough own natural gas left for the next thirty years maximum. After that it most likely will be bought from Russia (for instance) for a higher price. According to Ten Kroode and van Zee, we will already notice the increase in price over the next few years. The Passiv Haus concept only needs a very limited amount of natural gas to heat rooms (app. 150 m3), but the construction costs are considerably higher (app. €25,.000) because of the higher insulation level and higher air-tightness. For the MFA, the heat pump concept is also the most efficient.. Further investigation will show whether the subsoil is fit for applying WKO (without the various heat and cold sources mixing).

PV cells on the roofs, source Deerns

11 Options for generating energy

11.1 Starting point

The amount of energy that needs to be generated for the residential area depends on the concept that is chosen for heating.

Starting from the preferred option for saving (heat pumps and LED), the residential area should generate app. 530,000 kWh of electricity in the first year. When the residential area is complete, the necessary amount would be app. 3,686,000 kWh in order to remain energy neutral for the energy needs of 550 residences, the MFA and the LED street lighting.

11.2 Sources in the residential area itself

Several options for generating energy have been laid out. The first research established what the area itself can produce. Options include collecting and utilising the biomass made available: sewage from the residences, kitchen waste (vegetables and fruit) and wood from woodcutting/pruning in the surrounding environment. Calculations show that the possible energy generation from biomass coming from the residential area (green waste) and biogas from sewage are marginal, see table 0.2.

Table 0.2 Remaining extra energy needs for residences with heat pumps at the completion (2022 and onwards)

	Required kWh when complete
Annual consumption of the area for 550 residences and the MFA with heat pumps, LED Street lighting (end of duration)	3,533,735
Yield biogas from sewage and Green (kitchen) waste	46,982
Yield gasifying woodcuttings	318,310 -
Remaining energy need	3,168,443

11.2.1 Aspects Utilising Biomass for the Energy Supply

Utilising woodcuttings can be a realistic option, depending on how it is collected.. In that case it should be implemented directly at the beginning of the project regarding the infrastructure. The heat can be supplied to the MFA; the electricity can go to the national grid. It is not possible to supply the residences with this heat; there is simply not enough of it.

Since it is impossible to generate enough energy from biomass in the residential area for the entire area, a biomass station would need to run, using mainly biomass, from outside the area itself. That is not compliant with the basic principles for Vries de Bronnen. The basic principle is that the residential area supplies energy to other areas and not the other way round. A biomass station has to be realised and financed at the same time and Vries de Bronnen is developed in phases. On top of that, the main product of a biomass station, apart from electricity, is heat, while new residences, due to the increase of the EPC, have a continually lower energy need. The need for electricity and cooling is increasing. And a lot is lost by using (long) cables to reach the residences.

This means that it is necessary to get most of the energy need to be generated in a different manner, such as wind and solar energy.

11.3 Large-scale and Small-scale Wind Energy

As far as wind energy is concerned, the current provincial policies prohibit the use of large and medium windmills in Vries de Bronnen. It is possible that this option opens up in the future. While developing the plans for Vries de Bronnen, a close eye is kept on the developments for wind energy, to see if new possibilities arise and if Vries de Bronnen can take advantage of them. Small-scale windmills might be an option in theory, but only in a very limited manner in Vries de Bronnen. Reason for this is the limited financial return.

11.4 Photovoltaic Cells

If the choice is for solar power, the entire energy need of 3,533,868 kWh can be generated by app. 23,000 solar panels (if the heat pumps are used). About 44 % of these can be placed on buildings (residences and the MFA). The MFA plays a major part in this; the MFA can generate more than necessary. If the maximum of solar panels is placed on a residence, approximately one third of the energy need of that residence can be generated, if the heat pumps are used. Should the choice be for the HR boiler, less than one fourth can be generated by the solar panels. In reality, the percentage will be even smaller because of the special placements and because the whole roof surface is not available (skylights and dormers).

	At residences	*At the MFA*	*Option with heat pumps*	*Option with Hrboiler*
Potential m2 PV per residence	*20*	*2.500*		
Potential PV cells per residence (number off cells)	*15*	*1.814*		
Potential kWh PV per residence	*2.340*	*283.060*		
Total potential PV at 550 residences and MFA (kWh)	*1.287.000*	*283.060*	*1.570.060*	*1.570.060*
Energy need for 550 residences and MFA (kWh)			*3.533.735*	*7.005.907*
PV-yield potential as percentage of the total energy need			*44%*	*22%*

Table 0.4
Potential yield of PV systems on buildings in de Bronnen.

11.5 Solar Park

This means that an additional large-scale form of generating sustainable energy is necessary. This is possible with a solar park, with the advantage that the concept of generating energy with solar panels situated in a solar park can be achieved in phases and the system is expandable. The development of the solar park can take place in the same time-frame as that of the residential area. It would also be possible to develop the solar park at the opposite side of the Noord-Willemskanaal. That would comply with the aim of the municipal executives stated in the municipal manifesto (namely, developing an energy transition park) and offers good possibilities for growth of large-scale utilisation of a solar park.

11.6 Aspects Energy Supply New Residential Areas

Particularly, the need for charging electrical vehicles will offer new options for the national grid. The short distance to both Groningen and Assen can make the new occupants prefer electrical transportation. In the evening those vehicles can be in re-charged Vries. The charging stations be already be considered at an early stage in the development of Vries de Bronnen. The same goes for the exchange of renewable energy inside the residential area and the surrounding areas. It might be necessary to install smart grids in a residential area that generates a lot of renewable energy. A smart grid is a new generation electricity network with software. The software manages the balance between supply and demand of renewable energy in the area, which mainly means financial benefits. The benefits increase as the residential area has more electrical devices (cars, heat pumps), power stations (miniature) that can be switched on and off and sources that supply variable amounts of energy (sun, wind). More research has to be done to find out whether smart grids are interesting and applicable in De Bronnen. The municipality of Tynaarlo participates in the smart grids pilot of Energy Valley.

11.7 Timeline

During development, the demand for energy will be increasing constantly. For some options it is no problem to implement in phases, such as with the solar park. Other options, however, need to be decided upon before the start. The following tables give an idea of the timeline.

Table x: Increase of energy consumption in kWh during the development (for the entire area based on heat pumps and LED)

	2013	2021	Completion
550 residences with heat pumps	383,040	2,343,520	3,358,760
MFA with heat pump	131,175	131,175	131,175
LED street lighting	8,760	43,800	43,800
Total	522,975	2,518,495	3,533,735

Table 0.5: Timeline central generation options in kWh

	2013		2021		Completion	
Total need for heat pumps in residences and LED street lighting (excl MFA)	522,975		2,600,895		3,686,175	
Yield biogas of sewage and green waste (for MFA)	Electrical -4,032	Thermal -6,672	Electrical -46,982	Thermal -62,272	Electrical -46,982	Thermal - 62,272
Yield gasifying prunings (for MFA)	-318,310	-418,946	-318,310	-418,946	-318,310	-418,946
Necessary PV yield in order to be energy producing	> 200,633		> 2,235,603		> 3,320,883	
Of which maximum PV on buildings	< 140,400 (60 residences) < 283,060 (MFA)		<1,078,660 (340 residences + MFA)		< 1,570,060 (550 residences + MFA)	
Wind 0	Pm		Pm		pm	
Balance	0+		0+		0+	

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12 Conclusion and further research

12.1 An Abundancy of options

The baseline shows there is an abundance of options for energy measures. The energy supply of de Bronnen has to comply with the following criteria. These apply to the entire residential area.

The increase in EPC will be a positive factor for the energy consumption. On top of that, equipping the residences with heat pumps will have a further positive effect on the energy consumption.
A large part of the remaining energy needs can be provided for by the residential area itself. Sanitation and gasifying wood cuttings will offer a contribution of approximately 1% and 10 % respectively. The choice for any of these measures can be prompted by other motives than energy, such as improved methods of collection. These measures can be increased if linked to collection at village or municipality level. The conversion of the biomass claimed from de Bronnen can heat the MFA.

For now, a large windmill or the PV yields the most possibilities for generating the remaining energy needed. Approximately one third of the necessary energy for the residences can be generated from the rooftops. The MFA can even generate a surplus that equals the energy need of 24 residences with a heat pump. A solar park can generate proportionately with the development of the energy need during the development of the area. A windmill of 2 MW will produce more than needed.

The study provides a first indication and provides direction when making decisions regarding the energy supply of the energy producing residential area Vries de Bronnen. The energy investigation has to be worked out further. There are still a few questions that need to be answered before deciding on the energy supply and the implementation thereof.

12.2 Criteria for further research

12.2.1 Integral design energy saving and generating

The aim is to develop an energy producing area. The residential area is divided into parts that use energy and parts that can generate energy. Sectors include the houses, public spaces, street lighting, the scenery and the MFA. The balance of the total area should be positive. Certain parts can generate more energy than is needed , producing excess energy for other parts. To utilise this potential, we need an integral approach and a sophisticated design. The regulations regarding the infrastructure and the residences are connected, just like central and individual options.

12.2.2 Placement in the Landscape

The landscape is the base of the design of de Bronnen. Apart from a connection at the urban development level, all further details per cluster will have formulated requirements that relate to the materialisation and the visual design quality, allowing for the energy measures.

12.2.3 Flexibility

Flexibility is an important base for various reasons:
Vries De Bronnen will be developed in phases. The long-term planning means that during the development of this area, the transition to a sustainable energy supply becomes a reality. The last chapter of this report outlines the background hereof.
The world of energy is very dynamic and this will possibly lead to new perspectives for residential areas. The aim is to develop in a way that is focused on demand and consumers. During the project, it is possible that these demands change.
One assumption is that every residence and the MFA have their own installations.

12.2.4 Consumer Advantages

The willingness of consumers to invest more for these energy measures depends on their confidence that the costs will be recovered and whether or not they will benefit from them. The energy supply for de Bronnen should, therefore, not just be of extra value to the environmental but also be attuned to the consumers' demands.
Consumers' demands are:

- Lower taxes or monthly overheads
- More added value in the future
- Exceptional architecture
- Less maintenance
- Quality of life
- Amenities or comfortable living

12.2.5 Financial aspects and Feasibility

More research is necessary into the possibilities of financing and utilising heat pumps, individual PV panels on residences and a solar park. The costs and benefits are heavily dependent on market development and policy.
The energy supply must be remunerative and third parties must be prepared to design the facilities. It must be possible to develop the measures in a business model.

13 Local baseline in short

Name of the Region	Province of Drenthe, in particular the Municipality of Tynaarlo	
Goal of regional energyplanning	The province of Drenthe aims at 30% reduction of CO2-emissions in 2020 related to 1990. Drenthe signed the *Noordelijk Energieakkoord* which aims at a production of 40-50 PJ renewable energy and 4-5 Mt CO2 reduction of emissions. The part of Drenthe in is 25%. On the short term, Drenthe has to stay under the amount of 4,1 Mt CO2 by the end of 2011. As part of Drenthes regional energypolicy Tynaarlo wants to build an energyproductive housing development De Bronnen (The Sources), which will be developed in a green, landscape setting. They want to use the local resources and possibilies for innovations in the design of the housingdevelopment and energy-, waste- and waterinfrastructure.	
Area (Drenthe)	2626,4 km2, and has 12 municipalities.	
Area (Tynaarlo)	147,65 km^2 (3,92 km^2 water, 1263 ha wood and nature)	
Area (The Sources)	56 ha (35 ha gross living area, 20 ha landscape, 1 ha school).	
Population Drenthe	490.870 inhabitants (per 31-12-2009). Drenthe has the lowest density of all provinces in the Netherlands.	
Population Tynaarlo	32.458 inhabitants in the municipality (per 31-12-2010)	
Size of De Bronnen	350-550 households in 2030, 2,3 persons a household, so population of 1265	
Energydemand per capita in the Netherlands	Total energydemand of all households in the Netherlands: 424,7 PJ. Per 2009 7,31 milj households = 58 PJ per household a year and 25,5 PJ per capita per year (based on 16,9 milj inhabitants)	
Energydemand in study area	In the study area traffic was not included. we counted only the energydemand of heating, hot water and electricity in the household (lighting, computers etc). The energydemand (based on buildinglegislation 2011 and a medium sized home) is approximately 40.500 MJ per household per year (26.045 MJ heat, 15.000 MJ electricity).	Without extra energymeasures, the average energydemand between 2013-2030 will be 12.400 GJ = 3.444 MWh a year for the whole area (550 houses, streetlights and schools).
Energymix for the country (counts for regional levels too)	Of the total Dutch energydemand, 300 PJ (70%) is use of gas, 100 PJ (24%) use of electricity and 24,7 PJ (6%) other fuels. This ratio will count for the region too.	
Distributionsystem	Mainly gas and electricity	

	Identified potential for sustainable energy in De Bronnen			
Identified potential for renewables in the planning area De Bronnen.	Wind	Windspeed at 100 m height is 7,5 m/s. In municipality of Tynaarlo there is no current potential for large windmills due to provincial legislation. Based on the study, a windmill of 2MW would be sufficient combined with other renewables.	2MW can deliver 18.720 GJ/y=	5200 MWh/year
	PV on roofs	Solar PV on roofs: Little potential in *existing* village of Vries due to bad orientation of the houses. Good potential in new area De Bronnen:	6.000 GJ/y (550 roofs, 20m2 PV per roof, 140 Wp/m2 = total of 14.000 m2 PV)	1666 MWh /year
	PV in park	Solar PV in the field (solarpark). Average potential for a park is 4860 GJ/ (average based on two scenario's of 4169 GJ/3,5ha – 5551 GJ/5,7 ha). Real potential depends on spatial aspects in the final design.	4860 GJ/y (4,6 ha)	1350 MWh/year
	Biomass	The landscape of De Bronnen has an energetic value of 3015 GJ (based on local production of 335 ton/year of biomass from trees, gardens).	3015 GJ	837,5 MwH/YEAR
		Geothermal:due to low density area no real potential for deep geothermal. Potential for 100m deep geothermal open system is 290 till 406 KW. Potential for an individual system is 2,6 KW.		
		Districtheating/industrial waste heat: No large heatproducing industries in the municipality or near residences. On a small scale, waste-heat is reused in the process of the wastewatercleaning installation.		
		Sewers and decentral sanitation: 62.272 kWh (based on 550 homes) which is 2% of the electricty demand of the full grown housing development.		
Identified potential for energysaving		Based on the trias energetica, the first emphasis is to reduce the energydemand from households. The potential in the new residential area is 2700 GJ. This is the difference between the reference situation based on current building legislation and a scenario with all 550 homes build on a passive level.		
Average enduser price of electricity		22 ct/kWh		
Average enduser price of heat(based on gasprice)		65 ct/m3 gas Prices of geothermal heat and heat of rest-heat is linked to the price of gas.		
Feed-in tariffs		0,05 ct for PV and wind electricity that goes in the national grid. No special tarifs.		

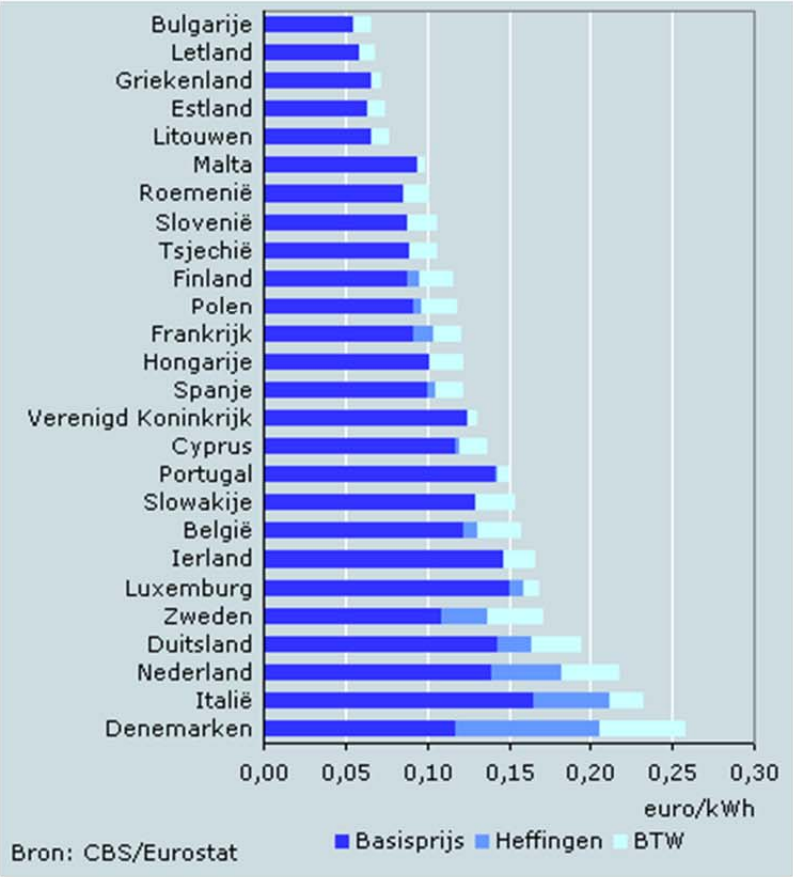
The Interreg IVB North Sea Region Programme
European Community
European Regional Development Fund

14 Sources

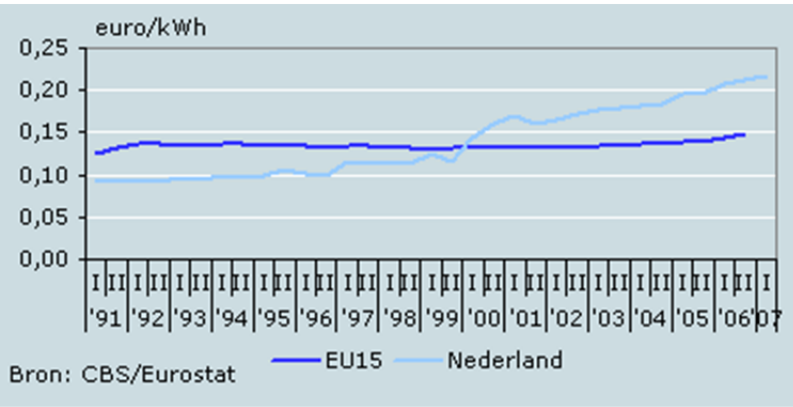
- North Sea Sustainable Energy Planning Template for analysis of energy context Stewart Russell and Dave Hawkey, ISSTI, University of Edinburgh
- Globaal ontwikkelkader Vries Nieuwe Stukken, municipality of Tynaarlo june 2009
- Ten Kroode & Van Zee,study dated october 11th 2010, rapportnr. 117.001
- Deerns, combineded study with Wiertsma & Partners rapport uitgebracht op 24 maart 2011, rapportnr. 160-11-03584-03
- Programma klimaat en energie Actieplan 2010, Provincie Drenthe
- Stedenbouwkundig programma Vries de Bronnen, january 2011, municipality of Tynaarlo
- CBS
- Baat het niet dan gaat het niet, Bouwfonds NAW dossier december 2009
- Urgenda regio tour 2010

15 Appendix

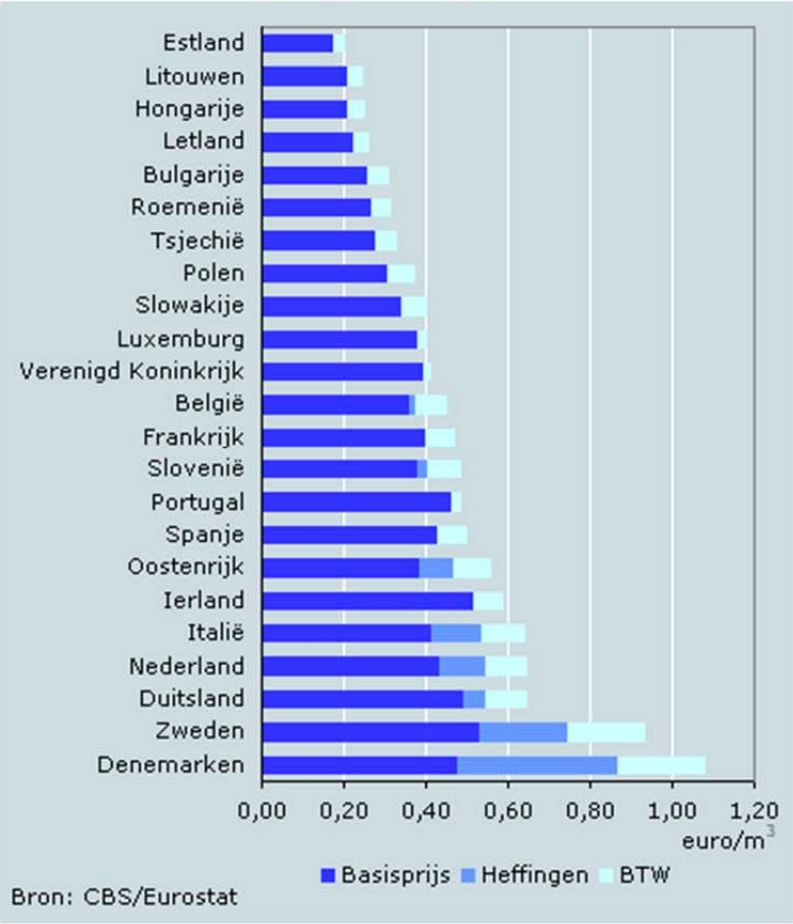
15.1 Prices for electricity in Europe. Split up in baseprice, extra costs and VAT



15.2 Development of electricity price , Europe compared to Netherlands



15.3 Prices for gas (heating)



15.4 Development of gas price , Europe compared to Netherlands