LOCAL ACTION PLAN

of Regio Achterhoek (The Netherlands)

5 October 2012

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I Summary Local Action Plan 2020 for the Achterhoek

In the frame of the project EU2020 Going Local, the Achterhoek Region has elaborated a Local Action Plan (LAP) covering four themes:

- Renewable energy and waste to energy
- Sustainable public transport and non-motorised transport
- Local/regional climate impact and sustainable management
- Energy efficiency measures.

Renewable energy and waste to energy

As stated in the ""Agreement of Groenlo" the Achterhoek region strives to 100% renewable energy on the long term. Based on an inventory of available resources and detailed analysis of existing installations, current initiatives (bottom up approach) and an assessment of possible other investments in renewable energy (top down approach) the possible share of renewable energy in the Achterhoek in 2020 has been assessed.

Table 1 and Table 2 show the targeted contribution of renewable heat and electricity in the Achterhoek in 2020. The combined target of 3926 TJ corresponds with 34% of renewable energy in the Achterhoek and an emission reduction of 327,000 tonnes of CO_2 in 2020. Figure 1 illustrates the share of the main renewable energy resources to this target.

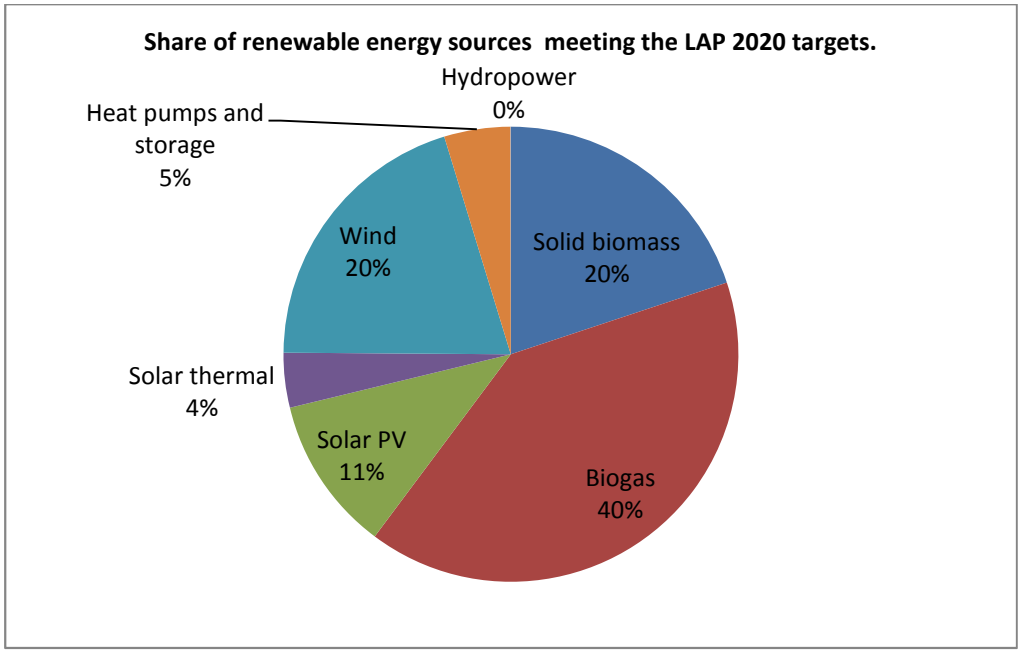

Figure 1 Share of renewable energy sources to LAP 2020 target (heat & electricity combined)

Biomass and biogas will contribute considerably to the renewable heat production; solar PV and wind have an important role for renewable electricity production.

Biomass can play a more important role if imported sustainable biomass would be included (now only biomass generated within Achterhoek region is considered).

Table 1 Renewable heat targets of the Local Action Plan in 2020

	Target 2030	Target 2020			
Renewable heat production	**mln. m^3 natural gas equivalent**	**mln. m^3 natural gas equivalent**	**TJ**	**% renewable heat**	**Carbon savings (ktonne CO2/year)**
Biogas	100	50	1583	21%	89
Solid biomass	24	23	717	10%	40
Solar thermal	13	5	152	2%	9
Heat pumps and storage	12	6	184	2%	10
Total Achterhoek	**149**	**83**	**2636**	**36%**	**148**

Table 2 Renewable electricity targets of the Local Action Plan in 2020

	Target 2030	Target 2020			
Renewable electricity production	**GWh**	**GWh**	**TJ**	**% renewable electricity**	**carbon savings (ktonnes CO2/year)**
Solar PV	325	120	432	11%	60
Wind	275	220	792	19%	110
Biomass	25	18	65	2%	9
Hydropower	1.4	0.4	1	0.04%	0.2
Total Achterhoek	**626**	**358**	**1290**	**32%**	**179**

The required investments in additional equipment are in the order of 467 million Euro. See Figure 2.

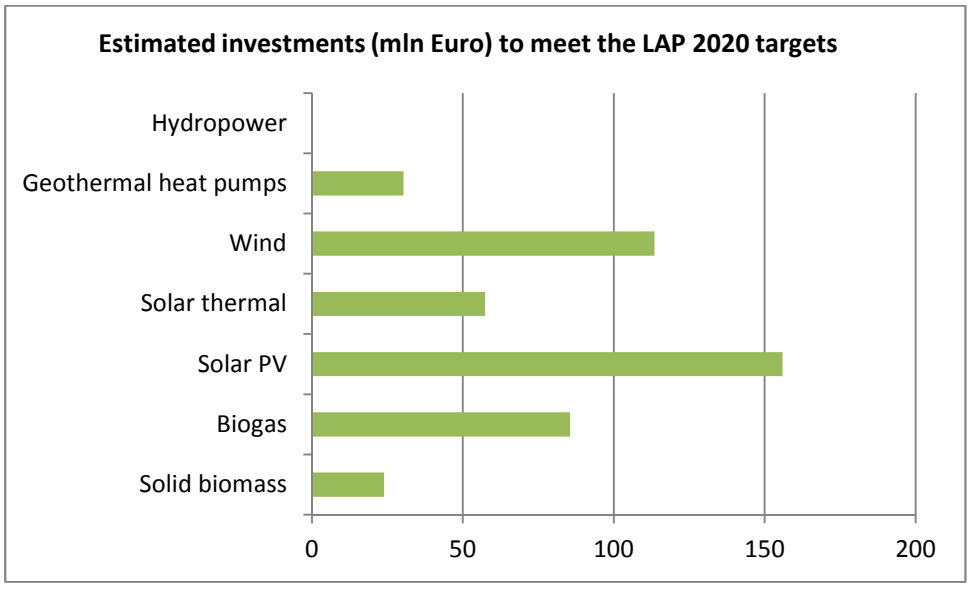

Figure 2 Investments needed to meet the LAP 2020 targets in the Achterhoek Region

For a large number of renewable energy options (solid biomass, biogas, solar PV, solar thermal, wind, geothermal heat pumps and hydropower) actions plans have been developed that are presented below. The actions combine a bottom up approach, facilitating current initiatives, and a top down approach, with measures to facilitate new initiatives. Benchmarks from good practise examples have been taken into account during the identification of solutions to the main obstacles.

Solid biomass

Wood from landscape management, residues from the wood industry and chicken manure form the most important solid biomass resources of the Achterhoek[1]. The wood from landscape management is scattered and currently collected wood is mostly exported outside the Achterhoek. In cooperation with regional nature organisations, the supply of biomass within the region should be promoted. Also the demand side needs to be addressed, by promotion and measures to make investments attractive and easy to finance. The following actions points have been determined:

Organize a regional collection structure for local wood supply

- Development programme for regional collection structure
- Development programme for supporting management system
- New long-term biomass contracts

Promotion of bioheat

- Promotion campaign for bioheat

Financing and realization of solid biomass installations

- Identification of project sites and facilitating potential investors
- Feasibility study / business plan for poultry manure gasifier
- Development of wood fired installations
- Facilitate start-up companies for delivering of heat
- Investment programme for solid biomass installations

Biogas

In the Achterhoek vast amounts of cattle and pig manure are available and a considerable number of co-digestion initiatives are under development. Biogas is a flexible energy carrier that could be used to produce heat, electricity, green gas for natural gas replacement and as vehicle fuel. On the long term 100 mln m^3 of natural gas equivalents could be used for these applications. Half of this amount could be produced and used in 2020. However, high prices of cosubstrates form an important barrier to these initiatives. Actions are needed to make sustainable local

[1] Biomass imported from outside the Achterhoek is not taken into account.

cosubstrates available and to develop feasible manure mono digestion options (avoiding the need for cosubstrates), and are listed below.

Farm level manure mono-digestion

- Development of low emission farm model incl. mono-digestion
- Investment programme for mono-digesters
- Inclusion of mono-digestion as agricultural activity in land use plan
- Lobby for obligatory manure digestion.

Manure codigestion

- Support current initiatives to extend or establish new biogas installations
- Supply of verge grass meeting quality requirements of positive list
- Detailed inventory of possible sustainable cosubstrates available in the Achterhoek region, including nature grass and methods to increase biogas yield of cosubstrates
- Lobby for SDE+ subsidies available for (co)digestion, on long term obligatory blending of green gas.

Other biogas plants

- Development of large manure digestion and processing plant, for instance 2 stage gasification and nutrient extraction.
- Development of RWZI biogas installation
- Claim CO2 credits from GFT from the Achterhoek

Biogas energy infrastructure

- Development of biogas network for 25 mono-digesters
- Master plan green gas in natural gas network of Achterhoek
- Improvement public perception of (co)digestion in the Achterhoek.

Solar PV

The past years the price of solar PV systems has become more attractive and potential users generally have a positive attitude towards PV. Households can apply net metering which makes solar PV financially attractive. Private home owners need to be made aware of these opportunities. For public organisations and business, solar PV systems are less attractive because they pay a lower electricity tariff. However, in general roof top PV is financially feasible. Ground mounted PV may be financially feasible but development of the projects is far more complex. Smart business structures are required. AGEM is expected to play an important role in facilitating solar PV in the Achterhoek. The following action points have been formulated.

Households PV

- Development of offer for potential AGEM-customers for electricity and gas, including plan for PV, thermal and energy saving in cooperation with St. Achterhoek Duurzaam Verbouwen and energy partner
- Development of an Achterhoek-version of "Zonnig huren" in cooperation with Sité and other housing companies
- Development of several 1000-roofs plans

Large roofs PV

- Development of proposition for company roofs in cooperation with local suppliers and Industry circles
- Development of proposition for municipal roofs and societal organisations
- Development of proposition for swimming pools, farmers and other large heat users

Ground mounted PV

- Development of proposition for housing location owners and/or developers, starting with current initiatives
- Development of proposition for business location owners and/or developers, starting with current initiatives

Solar thermal energy

Solar thermal energy solutions receive generally less attention than solar PV options. It financial performance is generally somewhat lower and energy supply needs to fit heat demand well. The suggested approach is to stimulate and promote solar thermal energy jointly with solar PV. The following action points have been formulated:

- Stimulate the interest of new coming inhabitants of Achterhoek Region in Solar Water Heating
- Develop an appropriate offer for them and distribute through channels of real estate agents and municipalities.
- Stimulate the use of solar energy in existing and new buildings (see above on Solar PV).
- Help local authorities to promote solar energy when citizens apply for building permits.
- Check the possibilities to apply solar water heating in (public) swimming pools.
- Organise meetings with large heat users like farms, (possibly combine with (co-)digestion of manure), swimming pools, etc.

Wind energy

Although the Achterhoek is not the most wind-rich area of the Netherlands, there is a considerable potential for wind energy. This is also proven by the fact that in neighbouring Germany, wind power has developed well. The LAP foresees 100 MW of windmills (equivalent to 40 turbines with an average capacity of 2.5 MW) in 2020. In the Achterhoek lengthy procedures, financial matters and local resistance are the main barriers to wind energy.

Actions related to lengthy procedures

- Support to current initiatives to establish new wind energy capacity
- Produce a manual on the siting of wind turbine parks ("Toolbox wind energy")

Actions related to financial matters

- Lobby for higher SDE subsidies for low wind resource areas
- Establish an investment programme for wind turbines
- Develop innovative financing mechanisms such as crowd funding

Actions related to local resistance

- Run an information campaign to improve public perception
- Apply participatory financing mechanisms (such as crowd funding)

Geothermal heat pumps

Geothermal heat pumps can be applied in large buildings and in newly built homes. Currently a number of open source geothermal heat pumps are installed in the Western part of the Achterhoek. Closed loop heat exchangers could be applied in the whole Achterhoek and should be promoted. The following actions are proposed:

- Implement geothermal heat pumps in public buildings and homes
- Inform and cooperate with real estate project developers
- Support housing associations integrating geothermal heat pumps when developing plans for new buildings
- Implement closed loop heat exchangers where possible to reduce technical risks.

Hydropower

Options for hydropower in the Achterhoek are limited to the Berkel and Oude IJssel, two relatively small rivers with a limited energy potential. However, every kWh counts, technology is available and the water body "Rijn and IJssel" is working on the implementation of a hydropower station in Ulft.

Sustainable public transport and non-motorised transport

An important part of rendering the Achterhoek more sustainable is the Action Programme Sustainable Mobility. In 2010 the overarching vision document Achterhoek Sustainably Mobile was drawn up, which should enable checking the compliance with sustainability targets of all measures in the Achterhoek in the field of mobility. This set of measures will lead to a comprehensive Mobility Agenda which will include a prioritisation on the basis of the contribution of each measure to increased accessibility and sustainability targets.

A number of actions have been implemented

- FIETSTAS project of Achterhoek Region to realise a network of bicycle and scooter electric battery charging points

- Concession public transport to company with low CO2 emission, by the use of smaller and lighter public buses where possible
- Green gas filling stations

In addition a number of possible actions have been identified:

- Promotion of cycling by various measures (co-funding bicycle storages, grants for electrical bicycles, strengthening bicycle infrastructure)
- Emission reduction targets in public transport concessions
- Fuel substitution in local passenger trains
- Increased capacity at train route Arnhem-Winterswijk
- Better and faster connections with Germany.

Other possible measures include:

- Sustainable design of areas and roads
- Agreements with local and regional businesses and public service providers (hospitals, schools etc.) on mobility management.
- Promote The New Driving (TND) concept
- Stimulate the use of cleaner and more efficient vehicles
- Encourage the supply of car sharing services in the municipality / region / province
- Widen the time window for clean and energy efficient vehicles to supply city centres
- Realise filling stations for alternative fuels and charging points for electric cars.

Local/regional climate impact and sustainable management

No specific measures are foreseen related to regional climate impact and sustainable measures. The carbon emission reduction of the other measures will have a positive contribution to greenhouse gas emission reduction in the Achterhoek region.

Energy efficiency measures

The Achterhoek Region has set reductions target for 2030 of 40% for natural gas consumption and 20% for electricity consumption. In line with the priorities at the provincial level it is intended to achieve most if not all of the energy saving in the built environment, in particular in the existing housing stock, by focusing primarily on building shell insulation. For the Regio Achterhoek the focus on existing houses is of particular relevance as the number of new houses that will be built in this "shrinkage region" will be modest. A number of energy conservation initiatives are on-going under the Regiocontract with the Province of Gelderland.

- Future proof houses – energy transition. A working group of 6 housing corporations (collaborating as ACO, short for Achterhoeks Cooperatie Overleg) and the Achterhoeks Centrum voor Technologie (ACT) aims at realising market-driven projects to make older houses (with poor energy performance) more sustainable.

- Another activity funded under the Regiocontract Achterhoek 2011-2105 involves (among others) the establishment of Centre for Sustainable Reconstruction (Stichting Achterhoek Duurzaam verbouwen). The aim is to give advice on, and implement, concrete energy saving measures meeting the energy and indoor climate demands in 1000 houses and 400 commercial buildings in a period of 4 years (2012-2015).
- "De Achterhoek Bespaart". As a follow-up to the earlier mentioned pilot projects, province Gelderland allocated funds for a subsidy to replicate the "best practices" in building shell insulation of houses. This provincial subsidy is targeted at achieving energy conservation by insulation of the building shell including ground floor, walls and roof. Glass insulation is explicitly excluded (as this is already tackled by national subsidies).
- AGEM considers specific activities: For the professional market: operate as a focal point for energy saving and develop activities when appropriate.

It is estimated that until 2020 a total of 16,000 houses (2,000 houses per year) can be insulated. The costs involved would amount to 400 million euro in total, or 50 million euro per year. The proposed measure would contribute to a natural gas consumption reduction of 7,824,000 m^3. This is about one-third of the target set for the housing sector in the Achterhoek, and about one-sixth of the target set for the economy as a whole in the Achterhoek. Obviously, additional measures (probably beyond the housing sector) are needed to achieve the ambitious long term (fossil) energy consumption reduction targets.

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2 Introduction

2.1 Background

On 30 September 2009, the municipalities of the Achterhoek Region have stated in the 'Agreement of Groenlo' that they will, among others, strive for 100% renewable energy and 50% CO_2 reduction on the long term. After the conference the 'Table of Groenlo' was created. This roundtable consists of businesses, educational institution, social organisations and governmental organisations, who all signed the goals of the 'Agreement of Groenlo' on the 30th of September 2009. As follow up, the municipalities of the Achterhoek have decided to establish a Green Energy Company for the Achterhoek, (In Dutch Achterhoekse Groene Energie Maatschappij (AGEM)). This organisation will promote, stimulate and invest in renewable energy, where needed. In the frame of the project EU2020 Going Local, a Local Action Plan (LAP) has been developed providing interim renewable energy targets for 2020, and presenting a pathway and actions how these targets can be met.

2.2 Establishment of the LAP

During spring 2012 BTG has prepared a document on behalf of the Achterhoek Region showing how 100% renewable energy can be achieved in the Achterhoek, partly based on the Business Plan AGEM. During summer 2012 BTG has worked out this document into a Local Action Plan for 2020 on behalf of the Achterhoek Region and Province of Gelderland. This LAP is prepared by Martijn Vis, Lud Uitdewilligen, John Vos and Rik te Raa of BTG, with the exception of chapters 6 and 7 on solar energy, which were kindly taken care of by Arien Scholtens of AGEM. Representatives of Achterhoek Region, province of Gelderland (including BION), and companies in the Achterhoek were consulted during the preparation of the LAP and resulted in valuable contributions. Benchmarks from good practise examples have been taken into account during the identification of solutions to the main obstacles. On 5 September the interim results were presented and discussed during a plenary session. The LAP forms a good basis for further actions to realise the renewable energy ambitions of the Achterhoek Region.

2.3 Status of the LAP

This Local Action Plan translates the long term targets of the Achterhoek Region into intermediary targets in 2020 and shows actions to meet this target. Specific actions are formulated for a large number of renewable energy options: solid biomass, biogas, solar PV, solar thermal, wind, geothermal heat pumps and hydropower. The actions combine a bottom up approach, facilitating current initiatives, and a top down approach, with measures to facilitate new initiatives. For each renewable energy option, lists of existing installations, current initiatives and additional required equipment are given, which are found in the background document to the

LAP. The lists of additionally required equipment are not meant to be prescriptive, but make concrete how the targets could be met. The LAP will be offered to AGEM, who will play a key role in the follow up of this action plan.

2.4 Guidance for reading

In the frame of the project EU2020 Going Local the Achterhoek Region has elaborated a Local Action Plan (LAP) covering four themes:

- Renewable energy and waste to energy
- Sustainable public transport and non-motorised transport
- Local/regional climate impact and sustainable management
- Energy efficiency measures.

In this document, the targets of the first theme 'renewable energy and waste to energy' have been elaborated in chapter 3. For each renewable energy carrier (i.e. solid biomass, biogas, solar PV, solar thermal, wind, geothermal heat pumps and hydropower), the specific targets, an analysis of problems and solutions including benchmarks from good practise examples, and subsequent actions are presented in chapters 4 to 10. The other three themes are covered more briefly in chapters 11 and 12.

The actions have been worked out in action tables that can be found in a background document. For each renewable energy carrier a more detailed analysis of installed capacity, current initiatives and additionally needed equipment to meet the LAP targets is presented in the background document.

3 Renewable energy targets

3.1 Long term contribution of renewable energy source

In 2009, the municipalities of the Achterhoek Region stated in the "Agreement of Groenlo" that they will among others strive for:

- 50% CO_2 reduction in 2020 compared to the base year 1990
- 100% renewable energy production in the long term.

In 2010, these general targets were specified further (Willemsen 2011), as follows:

- 40% savings on gas use in 2030 compared to the year 2009
- 20% electricity savings in 2030 compared to the year 2009
- The use of several renewable energy options to replace all natural gas heating in 2030, which corresponds with replacing 234 million m^3 natural gas equivalents per year. This equals **7.4 PJ** or 177 ktoe[2].
- The use of several renewable energy options to produce 100% renewable electricity in 2030, which corresponds with **1,132 million kWh/year**, 4.1 PJ or 97 ktoe.

In spring 2012 BTG has developed a preparatory report for the Achterhoek Region showing the needed contribution of each renewable energy carrier to actually meet the long term targets of 100% renewable energy (in 2030). An important observation is that large amounts of biomass and cosubstrates produced outside the Achterhoek region are needed to meet the 100% renewable energy target[3].

3.2 Contribution of renewable energy sources in 2030

In the preparation of the Local Action Plan (LAP), this background document, and thus the aim for 100% renewable energy in the Achterhoek, has been used as a starting point. An additional assumption made was that import of cosubstrates for biogas production and solid biomass should be limited in 2030 and absent in 2020. Although this assumption is rather theoretical, it helps to focus action points and policy development to the renewable energy sources available in the Achterhoek. This assumption has affected the potential impact of bioenergy to a large extent.

Furthermore, the contributions of other renewable energy options have been investigated in more detail and led to the following adjusted renewable energy targets of 2030.

[2] 1 ktoe = 1000 toe = 41.868 TJ. It represents the energy value of 1000 drums of crude oil, an often used energy unit in national energy plans.

[3] These imported resources include yearly 120,000 tonnes of pyrolysis oil, 175,000 tonnes of wood chips and 343,000 tonnes of maize equivalent amount of sustainable co-substrates.

Table 3 Renewable heat targets for 2030

Renewable heat production	million m^3 natural gas equivalent	TJ	% renewable heat	Carbon savings (ktonne CO_2/year)
Biogas	100	3165	43%	178
Solid biomass	24	760	10%	43
Solar thermal	13	426	6%	24
Heat pumps and storage	12	373	5%	21
Total Achterhoek	**149**	**4724**	**64%**	**265**

Table 3 shows that biogas is the main source of renewable heat. Part of this biogas could also be used for electricity production instead of biogas and green gas for heat. Locally available solid biomass is the next important option. In total renewable heat could replace 64 % of the fossil heat demand in the Achterhoek (provided that also 40% energy savings on natural gas use are realised).

Table 4 Renewable electricity targets for 2030

Renewable electricity production	GWh	TJ	% renewable electricity	Carbon savings (ktonne CO_2/year)
Solar PV	325	1170	29%	163
Wind	275	990	24%	138
Biomass	25	90	2%	13
Hydropower	1.4	5	0.1%	1
Total Achterhoek	**626**	**2255**	**55%**	**313**

Table 4 shows that the targets for electricity are for a large part dependent on solar PV systems that are installed at households, on roofs of companies/institutes and on idle land. These could include solar panels owned by households that rent space on roofs of companies and institutes. This option is realistic when remote balancing of electricity metering is allowed. 50 wind mills of 2.5 MWe can deliver the target amounts of wind electricity. Although technically relatively simple, the public resistance is sometimes strong. The contribution of biomass is low as only biomass from within the Achterhoek region is considered. The local sources can provide 55% renewable electricity in 2030 provided that the energy saving targets are also met.

3.3 Targets for the Local Action Plan in 2020

Table 5 and Table 6 show the targeted contribution of renewable heat and electricity in the Achterhoek in 2020. Biomass and biogas will contribute considerably to the renewable heat production; solar PV and wind have an important role for renewable electricity production. Biomass can play a more important role if imported sustainable biomass would be included (now only biomass generated within Achterhoek region is considered).

Table 5 Renewable heat targets of the Local Action Plan in 2020

	Target 2030	Target 2020			
Renewable heat production	**mln. m^3 natural gas equivalent**	**mln. m^3 natural gas equivalent**	**TJ**	**% renewable heat**	**Carbon savings (ktonne CO2/year)**
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Total Achterhoek	**149**	**83**	**2636**	**36%**	**148**

Table 6 Renewable electricity targets of the Local Action Plan in 2020

	Target 2030	Target 2020			
Renewable electricity production	**GWh**	**GWh**	**TJ**	**% renewable electricity**	**carbon savings (ktonnes CO2/year)**
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Hydropower	1.4	0.4	1	0.04%	0.2
Total Achterhoek	**626**	**358**	**1290**	**32%**	**179**

The carbon emission savings for heat are based on natural gas saving, the savings of electricity on replacement of fossil electricity. Additional greenhouse gas savings are possible in the biogas sector (especially methane emissions) but these are not taken into account.

The targets for the Location Action Plan in 2020 are derived from the 2030 targets, taking into account the following considerations:

- The time frame: in case of a linear development of renewable energy generation, in the period 2012-2020 about 45% of the needed capacity in 2030 should be installed. However, also time for project development and execution of the action plan should be taken into account, which means that a contribution of 30-40% in 2020 to the 2030 target is more realistic.
- Combinations of renewable energy sources, technologies and markets with better financial performance are supposed to grow faster. For instance, solar PV for households has currently better perspectives than solar PV for companies.
- Existing installations also contribute to the 2020 targets, and current initiatives give perspective to new capacity that could be added within the next years (bottom up approach). An overview of additionally required installations is determined for each renewable energy source (top down approach). Several iterations have been taken place to determine the 2020 target for each renewable energy source.

4 Solid Biomass

4.1 LAP targets for 2020

The amounts of available solid biomass in the Achterhoek are inventoried in Table 7 including the LAP targets for renewable heat. The total LAP target for renewable heat production in 2020 adds up to 717 TJ output per year. It is assumed that all available wood in the Achterhoek is used for local energy generation. For poultry manure one gasifier (CHP installation) will be realised based on a reference installation of 5 MWth input. For this installation a total amount of 12,600 ton dry broiler manure is required (37% of total availability of chicken manure). For 2030 a second installation is included.

The use of waste wood (70 TJ input), straw (345 TJ input) and reed (14 TJ input) is not included for local energy generation towards 2020.

Table 7 Biomass inventory and renewable heat targets for the Achterhoek in 2030 and 2020.

Biomass source	Biomass inventory input / year	LAP target 2030 output / year	LAP target 2020 output / year
	TJ	TJ	TJ
firewood households[a)]	229	135	135
wood landscape maintenance	355	256	256
residues from wood industry[b)]	Unknown (> 284)	284	284
chicken manure	258	86	43[c)]
Total Achterhoek	**842**	**760**	**717**

[a)] Source of firewood is unknown

[b)] Input for boilers in wood industry unknown

[c)] Use of 12.600 ton of dry broiler manure for CHP production

The LAP targets for renewable electricity production are shown in Table 8.

Table 8 Biomass inventory and renewable electricity targets for the Achterhoek in 2030 and 2020.

Biomass source	Biomass inventory input / year	LAP target 2030 output / year	LAP target 2020 output / year
	TJ	GWh	GWh
wood landscape maintenance	355	9.8	9.8
chicken manure	258	15.4	7.7
Total Achterhoek	**842**	**25**	**18**

Table 9 and Table 10 respectively show how the LAP targets (for 2020) for renewable heat and electricity production can be met by a combination of (1) existing installations, (2) current project initiatives and (3) additional required installations.

Table 9 Division of LAP targets for renewable heat production between existing installations, current initiatives, and suggested additional installations (TJ/year).

Biomass source	LAP target 2020 output / year	Existing installations	Current initiatives	Additional required installations
firewood households	135	135	-	-
wood landscape maintenance	256	59	11	186
residues from wood industry	284	284	-	-
chicken manure	43	-	-	43
Total Achterhoek	**717**	**477**	**11**	**229**

Table 10 Division of LAP targets for renewable electricity production between existing installations, current initiatives, and suggested additional installations.

Biomass source	LAP target 2020 output / year		Existing installations		Current initiatives		Additional required installations	
	TJ	GWh	TJ	GWh	TJ	GWh	TJ	GWh
wood landscape maintenance	35	9.8	-	-	-	-	35	9.8
chicken manure	28	7.7	-	-	-	-	28	7.7
Total Achterhoek	**63**	**18**					**63**	**18**

4.2 Problems and solutions

In the current situation 25,000 ton (73,000 m^3) of woody biomass is produced in the Achterhoek. Most of this biomass is used outside the region for energy generation. According to Rurealis (2012) another 9,000 and 5,000 ton of wood can be produced additionally by respectively the Agrarische Natuur Verenigingen (ANV's) and the municipalities.

The main challenge for the Achterhoek is to organize a regional collection structure in the Achterhoek in order to collect 39,000 tons of biomass per year for local energy generation. Subsequently the financing and realisation of more wood fired installation in the Achterhoek should be realized which requires continuous

promotion of bioheat. Table 11 shows the most important problems and solutions for the use of solid biomass for renewable heat production.

Table 11 Problems and solutions table solid biomass

Problems and solutions table Theme: Solid biomass		
Problems	**Solutions**	**Benchmarks from Good Practice Examples**
Many different and small scale biomass owners	• development and use of a GIS based management and planning system for harvest, logistics and local supply of wood	• Elzenboom • Betula Rom-3D • Other software
Too many stakeholders work individually	• organize supply chain together with relevant stakeholders in the Achterhoek by clustering activities to create critical mass; • use of standard contracts, currently every municipality has its own biomass contracts	Clustering of ANV's into one organisation Vereniging Agrarisch Landschap Achterhoek (VALA) Proposal by ROVA for optimal collection structure for the Achterhoek
Private owners and companies with wood can join collection structure of Agricultural-Nature Collaborative groups (ANV's). A problem is that each ANV organization has its own collection structure.	• Supply of wood by private owners and companies should get easier and more attractive: o A network of collection points in the Achterhoek with storage and drying facilities o Biomass suppliers pay less or nothing for delivery of clean wood o Forbidding open fires	
Demand and supply does not match; existing market outlets for wood from the landscape are outside the region	• obligatory local outlet of wood chips from landscape maintenance in new contracts	
Landscape maintenance is required but expensive	• reduction of harvesting costs by use of GIS based management system for clustering of harvesting activities;	• Elzenboom • Betula Rom-3D • Other software

	• production of high quality biomass for higher price at end consumer	
Not enough local initiatives; some potential investors experience bioheat as complex and risky	• continuous promotion of bioheat • share of knowledge about possibilities of wood fired installations (e.g. by Stichting Achterhoek Duurzaam Verbouwen) • identification of suitable locations; • use of show cases; • (facilitate) start-up of new companies for delivering of heat by installing wood fired installations (unburdening of customers) • permitting procedure will become easier: from 1 January 2013 only "Activiteitenbesluit" • facilitating specific target groups (public authority, health care institutions, recreation facilities) by permanent appointment of a bio-energy advisor that supports potential investors in developing site specific business plans	
Financing of installation • difficult to get bank loan • potential investors are willing to substitute gas boiler but are reluctant towards extra investment costs besides wood boiler (embedding, required water pipes, system control, etc.)	• portfolio approach for financing of wood fired installations; • soft loans; • investment subsidies for extra costs wood boiler; • large scale installations can apply for SDE+ 2013 in the category 'boiler solid biomass ≥ 0.5 MW'.	BTG, portfolio approach in Czech Republic

4.3 Action plan

In order to achieve the LAP targets for 2020 and to overcome the identified problems, an action plan is needed based on the following three pillars:

1. Organize a regional collection structure for local wood supply
    - Development programme for regional collection structure for wood
    - Implementation of a GIS supported management and planning system
    - New long-term biomass contracts

2. Promotion of bioheat
    - Promotion campaign for bio heat

3. Financing and realization of solid biomass installations
    - Identification of project sites and facilitating potential investors
    - Feasibility study / business plan for poultry manure gasifier
    - Development of wood fired installations
    - Facilitate start-up companies for delivering of heat
    - Investment programme for solid biomass installations

5 Biogas

5.1 LAP targets for 2020

The biomass inventory below shows that 101.6 mln m^3 natural gas equivalents of biogas is potentially available in the Achterhoek region of which 46.7 mln m^3 origins from 2.8 mln tonnes cattle stable manure, 13.9 mln m^3 from 840 ktonnes pig stable manure and 22.8 mln m^3 from 172 ktonnes cosubstrates.

The LAP targets for 2030 are based on the assumption that 60% of all available manure in the Achterhoek can be digested. The target of 100 mln m^3 natural gas equivalents corresponds with the long term target of BION Achterhoek and the Achterhoek Region. The table shows that in order to meet this target, substantial amounts of cosubstrates need to be imported from outside the Achterhoek.

Table 12 Biomass inventory and targets for the Achterhoek in 2020 and 2030 (mln m^3 natural gas equivalent per year)

Biogas source	Biomass inventory[a)]	LAP target 2030	LAP target 2020
Cattle manure	46.7	27.4 (60% of total)	13.7 (30% of total)
Pig manure	13.9	8.2 (60% of total)	4.1 (30% of total)
Sustainable cosubstrates	22.8[b)]	22.8	19.7
Verge grass	4.1	4.1	1.4
Nature grass	0.3	0.3	0.3
Kitchen & garden waste	3.4	2.2	2.2
Sewage sludge (RWZI)	4.4	4.4	2.6
Industrial waste water[a)]	> 6.0	6.0	6.0
Total Achterhoek	**101.6**	**75.4**	**50.0**
Import sustainable cosubstrates	> 45.6[c)]	24.6	0
Total incl. import	**>147.2**	**100**	**50**

[a)] See the preparatory report of 21 June 2012

[b)] equivalent to 20% of the maize production of the Achterhoek

[c)] equivalent to 40% of the maize production Achterhoek

The LAP target of 2020 is set at 50 mln m^3 of natural gas equivalents, which is 50% of the total target of 2030. It is assumed that 30% of the total amount of cattle and pig stable manure will be digested in 2020 and that import of cosubstrates from outside the Achterhoek is reduced as much as possible.

Table 13 shows how the LAP targets for 2020 can be met by a combination of (1) existing installations, (2) current project initiatives and (3) additional required installations.

Table 13 break down of LAP targets in existing installations, current initiatives, and suggested additional installations. Biomass inventory and targets for the Achterhoek in 2020 and 2030 (mln m^3 natural gas equivalent per year)

Biogas source	LAP target 2020	Existing installations	Current initiatives	Additional required yearly production
Manure	17.8	0.6[a)]	2.5[a)]	14.8
Sustainable cosubstrates	19.7	5.5[a)]	12.8[a)]	1.5
Verge grass	1.4	0	0	1.4
Nature grass	0.3	0	0.3	0
Kitchen & garden waste	2.2	0	0	2.2
Sewage sludge (RWZI)	2.6	1.1	0	1.5
Industrial waste (water)	6.0	4.0	2.0	0
Total Achterhoek	**50.0**	**11.2**	**17.5**	**21.4**

[a)] It is assumed that the existing installations and current initiatives apply codigestion with 50% manure and 50% sustainable local available cosubstrates; the biogas yield of manure is assumed to be 25 m^3/tonne, the yield of the cosubstrates 200 m^3/tonne.

5.2 Problems and solutions

The two main challenges are (1) to get implemented the existing initiatives for codigestion and (2) to develop pathways to make small scale mono-digestion possible. Table 14 summarises the main problems and solutions related to biogas utilisation in the Achterhoek.

Table 14 Problems and solutions table biogas

Problems	Solutions	Benchmarks from Good Practice Examples
Farm scale mono digestion: high investment / low yield → not financially feasible	Development of business model for low emission farming (& manure processing)	Studies currently carried out by Prov GLD
	Development of cheaper mono-digesters	Microferm installation developed by Host.
	Biogas pipelines, avoiding investments in CHP or upgrading on farm level	Biogas pipeline initiatives as developed by BION
	Obligatory manure digestion	
Environmental (WABO) permit for monodigester	Inclusion mono-digestion as agricultural activity in land use plan	Handreiking co-vergisting 2012
Increasing costs cosubstrates	Alternatives like nature grass (and verge grass)	Codigester initiative Leemkuil
	Increase yield of sustainble cosubstrates	Drentse Aa, pilot with milled nature grass
Location codigesters not too far	Allow codigestion on local business parks,	BVA initiative

from the manure supply	not only on regional parks	
Low public acceptance	Promotion and participatory investments	Participatory investments in some wind parks
Budget for incentives exhausted too quickly	Lobby for structural incentives / obligatory blending of green gas	The consistent German support system for renewable energy
Limits in green gas capacity of natural gas network	Inventory of possibilities; inclusion of smart grid options; biogas pipelines	Current green gas initiatives elsewhere.
Need for information on innovative biogas technologies	Cooperation with Achterhoeks Center for Technology (ACT).	Biogas project Orebro

5.3 Action plan

Actions are focused on the development feasible manure mono digestion (avoiding the need for cosubstrates), make sustainable local cosubstrates available, to promote other biogas initiatives, to strengthen the biogas infrastructure and to address public perception.

Farm level manure mono-digestion

- Development of low emission farm model incl. mono-digestion
- Investment programme for mono-digesters
- Inclusion of mono-digestion as agricultural activity in land use plan
- Lobby for obligatory manure digestion.

Manure codigestion

- Support current initiatives to extend or establish new biogas installations
- Supply of verge grass meeting quality requirements of positive list
- Detailed inventory of possible sustainable cosubstrates available in the Achterhoek region, including nature grass and methods to increase biogas yield of cosubstrates
- Lobby for structural support of (co)digestion, on long term obligatory blending of green gas.

Other biogas plants

- Development of large manure digestion and processing plant, for instance 2 stage gasification and nutrient extraction.
- Development of RWZI biogas installation
- Claim CO_2 credits from GFT produced in the Achterhoek.

Biogas energy infrastructure

- Development of biogas network for 25 mono-digesters
- Master plan green gas in natural gas network of Achterhoek
- Improvement public perception of (co)digestion in the Achterhoek

6 Solar PV

6.1 LAP targets for 2020

Early 2012 an inventory for internal use was made of the current local production of sustainable energy in the Achterhoek. Table 15 shows the LAP targets of 2030, which are based on the following assumptions:

- For households: It is assumed that 15000 households will have placed a solar PV system with the average capacity of 2 kWp (18 m^2), generating 1800 kWh/year. This corresponds with 15% of all houses in the Achterhoek (excl. apartments). Reasoning: Assuming roofs to be oriented ad random towards the incoming sun: 50% is unsuitable because of east-west-orientation. 25% is unsuitable because of north-orientation and an additional 10 % is lost because of chimneys, dormer's windows, trees, etc.
- For (flat) company roofs we assume that all panels will be oriented southwards, regardless the orientation of the underlying roof surfaces. We assume loss of occupied space (due to rotation of the panels) to be 20% and an additional 10% to be lost due to chimneys etc. Thus, of the estimated 212 ha of available roof surface on companies/institutes, about 70% or 148 ha surface is available for solar PV.
- It is assumed that about 150 ha of idle land can be found to place solar PV systems. This would be about 50 ha (500 x 1000 m) per municipality. This number still needs to be verified.

Table 15 Targets for the Achterhoek in 2020 and 2030 for solar PV

Solar PV option	LAP target 2030 (GWh/year)	LAP target 2020 (GWh/year)
Solar PV in households	27 [a)]	12
Solar PV on company roofs	148 [b)]	54
Solar PV on (idle) land	150 [c)]	54
Total solar PV	**325**	**120**

[a)] Based on 2 kWp solar PV system (18 m^2), generating 1800 kWh/year, placed on 15,000 houses (15% of all houses in the Achterhoek (excl. apartments).

[b)] 212 ha of roof surface companies/institutes Achterhoek, 148 ha (70%) suitable for solar PV, generating 100 kWh/m^2/year

[c)] 150 ha of idle land, generating 100 kWh/m^2/year.

The targets of 2020 are estimated at about 36% of the targets of 2030:

- Households: 12 GWh (44% of target 2030)
- Company roofs: 54 GWh (36% of target 2030)
- (Idle) land: 54 GWh (35% of target 2030).

For the sake of illustrating the level of ambition in the Achterhoek: Solar PV generation in the Netherlands by 2020 is estimated to be 1% of the total renewable

energy production (nREAP) (See LAP1 report, June 2012). (570 GWh PV as part of 50,317 GWh). Almost 40% would then be generated in Achterhoek alone.

6.2 Problems and solutions

Problems

In addition to the recommendations for PV Solar in Report LAP1, Green Spread's "Master plan Zon-PV" (June 2012) describes obstacles per category of PV business case. In brief:

- In general, organisations and private home owners, despite their positive attitude towards PV, are not aware of and/or familiar with the PV-potential of their roofs.
- Public organisations suffer from long pay back times, because of a relatively large electricity consumption and a low kWh-tariff.
- Public organisations do not have the same fiscal possibilities as private companies do. On the other hand public organisations (here: governments) do not have to pay BTW.
- In addition housing companies suffer from a "split-incentive": the housing companies pay the costs of solar PV while the tenants profit directly because of the lower energy bills.
- Private home owners may not have the funding available for solar PV.

Solutions

Derived from an overview of financially feasible business cases for AGEM (Jan Willem Zwang, June 2012) we see the following solutions:

- Rooftop PV is financially feasible in general.
- Groundmounted PV may be financially feasible but development of the projects is far more complex.

In case AGEM can operate as a company all fiscal possibilities and incentives will be made available to the Achterhoek PV projects. By establishing "VOF's" together with "IB" entrepreneurs the business cases improve even more and the VOF's partners can achieve a 10% return on their investments in three years. Crowd funding can be of interest as well, because the general public can show their sustainable commitment and intentions by co-funding and co-investing in the projects (www.greencrowd.nl).

Table 16 Problems and solutions table solar energy

Problems and solutions table Theme: Solar Energy		
Problems	**Solutions**	**Actions**
Market for early adaptors only so far, so little routine and experience	The current market situation for solar PV systems offers interesting opportunities for household use	Offer to customers including plan for PV, thermal and energy saving
Weak business cases larger installations	It is important that net-metering stays in place in the long term (saldering)	Lobby possibly
	Remote net-metering for households should be promoted at government level (saldering op afstand)	Lobby possibly; Develop alternatives
	Municipalities could actively promote/include solar PV in land-use plans	Check land use plans municipalities
	Tax opportunities should be included in PV project development by AGEM and partners	Make sure AGEM can operate as a company and find partners (IB entrepreneurs)
Integration with other technologies	Business case development considering all options per location	Use proper instruments
Mobility of large installations on idle land	Suitable "onderstel" either existing or to be developed e.g. from SolarWorldWide's prototype	Contact Pfixx, SolarWorldWide and ACT

6.3 Action plan

The action points for solar PV are presented below.

Households

- Development of offer for potential AGEM-customers for electricity and gas, including plan for PV, thermal and energy saving in cooperation with St. Achterhoek Duurzaam Verbouwen and energy partner
- Development of an Achterhoek-version of "Zonnig huren" in cooperation with Sité and other housing companies
- Development of several 1000-roofs plans

Large roofs

- Development of proposition for company roofs in cooperation with local suppliers and Industry circles
- Development of proposition for municipal roofs and societal organisations
- Development of proposition for swimming pools, farmers and other large heat users

Ground mounted

- Development of proposition for housings location owners and/or developers, starting with current initiatives
- Development of proposition for business location owners and/or developers, starting with current initiatives

All: In cooperation with schools, local action groups, "kleine kernen", organisational enablers, etc. When market parties are interested in (part of) the work, AGEM will step aside.

btg
REGIO ACHTERHOEK
provincie Gelderland
INTERREG IVC
European Union
European Regional Development Fund

7 Solar thermal energy

7.1 LAP targets for 2020

Like solar PV, solar water heaters can be installed on roofs of houses and companies/institutions as well as for swimming pools for hot tap water and space heating. The LAP targets of 2030 and 2020 can be found in the table below.

Table 17 Targets for the Achterhoek in 2020 and 2030 for solar thermal energy

Thermal solar option	LAP target 2030 (TJ/year)	LAP target 2020 (TJ/year)
Solar water heaters households	52	21
Solar PV on company roofs & swimming pools	374	131
Total solar PV	**426**	**152**

[a] Based on 2 kWp solar PV system (18 m^2), generating 1800 kWh/year, placed on 15,000 houses (15% of all houses in the Achterhoek (excl. apartments).

[b] 212 ha of roof surface companies/institutes Achterhoek, 148 ha (70%) suitable for solar PV, generating 100 kWh/m^2/year

[c] 150 ha of idle land, generating 100 kWh/m^2/year.

The following considerations have been used to determine the 2030 targets:

- It is assumed that 15,000 roofs (15% of the roofs in the Achterhoek excl. apartments) are suitable for solar water heating. Compared to solar PV systems, the solar water heaters are smaller and could be possible on more roofs, however given the lower financial performance, a target of 15,000 households is already challenging. Each system produces 3.5 GJ/year of heat.
- Assumed that 50% of the 212 ha roof surface of companies/institutions is suitable for solar water heating, and assumed that 20% of these companies have a suitable heat demand, about 21 ha of SWH collectors could be placed in the Achterhoek. Given the energy output of 490 kWh_{th}/m^2/year, this could lead to total renewable energy production of 374 GJ/year. Part of this 21 ha surface could also be filled in by swimming pools that need hot water.

The targets of Adjusted Solar Water Heating targets by 2020 for this LAP are estimated at 152 TJ:

- Households: 21 TJ (40% of target 2030)
- Companies/institutions/swimming pools: 152 TJ (35% of target 2030).

7.2 Problems and solutions

In addition to the problems mentioned for Solar PV in chapter 6 some remarks will be made on Solar Thermal projects (Table 18).

Table 18 Problems and solutions table for solar thermal energy

Problems and solutions table Theme: Solar thermal energy		
Problems	**Solutions**	**Actions**
Market for early adaptors only	Develop financial instruments for consumers and companies wishing to invest in solar water heating	Include in offer to customers
Weak business cases	Develop options to rent/lease solar water heating for households and companies	
	Organise meetings with large heat users such as farmers and swimming pools	Combine with other actions

7.3 Action plan

- Stimulate the interest of new coming inhabitants of Achterhoek Region in Solar Water Heating
- Develop an appropriate offer for them and distribute through channels of real estate agents and municipalities.
- Stimulate the use of solar energy in existing and new buildings (see above on Solar PV).
- Help local authorities to promote solar energy when citizens apply for building permits.
- Check the possibilities to apply solar water heating in (public) swimming pools.
- Organise meetings with large heat users like farms, (possibly combine with (co-)digestion of manure), swimming pools, etc.
- If necessary, develop options to rent/lease SWH for households and companies and/or develop green loans to consumers and companies wishing to invest in SWH.

8 Wind Energy

8.1 LAP targets for 2020

The target for 2030 was estimated at 125 MW, or 50 wind turbines of 2.5 MW, or 990 TJ. For the period under consideration in the LAP (the year 2020) it is assumed that in total 100 MW of wind turbines capacity can be installed (40 turbines with an average capacity of 2.5 MW). With 2,200 full operating hours these turbines can produce around 220 million kWh (or **792 TJ**) annually.

Table 19 shows how the LAP targets can be met by a combination of (1) existing installations, (2) current project initiatives and (3) additional required installations.

Table 19 break down of LAP wind energy targets in existing installations, current initiatives, and suggested additional installations

Energy source	LAP target 2020 (TJ)	Existing installations (TJ)	Current initiatives (TJ)	Suggested additional installations (TJ)
Wind	792	126.7	285.1	380.2
Total Achterhoek	**792**	**126.7**	**285.1**	**380.2**

8.2 Problems and solutions

Problems

The largest bottlenecks by far in the Achterhoek, as almost everywhere else in the Netherlands, are **spatial planning issues**. Assigning four dedicated search zones in the Achterhoek where the installation of wind energy turbines would be permitted was intended to give project initiators security. However, the measure has not proven to be very effective. Bronckhorst, one of the municipalities in the search zones, continues its objection to wind energy, whereas another municipality (Winterswijk), located outside the search zones, would welcome wind energy initiatives.

Due to lengthy procedures wind energy projects typically take a long time to be completed. Windpark Hagenwind in Aalten took 7 years of preparation, and the development of projects in Netterden has been underway at least since 2003. Factors that cause the long development time include changes in legislation and regulations, inconsistency in the national governments policy in stimulating renewable energy (no long-term price guarantees; changes in the renewable electricity production support scheme) and problems linked with radar interference, aviation safety, external safety and noise. In particular legislation and regulations in the frame of nature management and conservation have undergone significant

changes in the zeroes (2000-2010). As a result two initiatives in municipality Bronckhorst (4 turbines of Pelgrum Rentmeesters, planned east of Rha and southwest of Steenderen, and 8 turbines of KDE Energy BV, planned at the location Bakerwaard, west of Baak) were blocked by the local government (later confirmed by the province) due to the closeness to Natura 2000 areas.

In one case where an initiative in the Achterhoek faced objections from the municipality (Windpark Bijvanck initiative of Raedthuys Windenergie BV) the province Gelderland planned to overturn the municipality using powers invested in provincial governments under the Crisis- and Herstelwet. However, up to now the municipality of Zevenaar persists in its objection and decided in April 2012 not to co-operate with the required change of the zoning plan. The stalemate in Zevenaar has yet to be resolved.

Other common barriers for wind energy include low public acceptance (or even local resistance) and poor financial performance. The relatively poorer wind resources in the Achterhoek as compared to other regions in the Netherlands put it at a disadvantage when competing with other renewable energy projects for subsidy under the SDE-scheme. Very recently (21 August 2012) the province publicly expressed its concern that various wind energy projects, including Windpark Netterden-Azewijn in Oude IJsselstreek/Montferland, do not proceed due to difficulties to obtain exploitation subsidy.

Finally, the reduced availability of credit, *inter alia* as a result of the economic crisis, is often mentioned as an important problem. In recent years the investment share that commercial banks were willing to finance has dropped significantly. Before the economic crisis an equity: debt ratio of 1:2 was common. However, banks have become more reluctant to invest in wind energy (and other types of renewable energy generation) and will now contribute a smaller percentage (e.g. equity: debt ratio of 2:1).

Solutions

Province of Gelderland is currently reconsidering its wind energy zoning approach, which has not been very effective. However, unless it considers forcing and/or overruling municipal governments to co-operate with the implementation of wind energy projects the Province of Gelderland would have rather limited room to manoeuvre.

A general measure, that can help to overcome a mix of problems (including lengthy procedures, local resistance and even lack of financing), is to offer the local population the possibility of participating in the financial awards of wind energy production. The report *Participatie in windenergieprojecten* (SenterNovem, 2009) gives an overview of various opportunities to boost local participation in wind energy, including:

- Offering a Sustainability Package, in particular to the group of residents living directly near the new wind turbines.
- Offering Achterhoek Power (wind energy produced sustainably in the Achterhoek) at a specified rate to residents from the local area.
- Issuing a bond for the wind energy project to residents from the local area.
- Construction of an (additional) Achterhoek Turbine, an (extra) unit the proceeds of which can be used for social purposes in the local area.
- Establishment of a Sustainability Fund, to which proceeds of the wind turbine operation (e.g. those of the Achterhoek Turbine) and of other sustainable activities are added and from which social goals and / or sustainable activities in the area can be funded.
- Development of a Sustainability Network consisting of recreational cycling and hiking trails which construction is combined with the infrastructure needed for the construction/maintenance of wind turbines.

Boosting local participation goes hand-in-hand with creating local support for wind energy. Both require a bottom-up, rather than top-down, approach. A successful example of this approach can be found in Lochem (a town in Gelderland, located just outside the Achterhoek). **Crowd-funding** (an innovative method of raising capital, commonly through the Internet) can also be part of such participatory approach, and is already being tested elsewhere in the Netherlands to raise capital for wind energy projects[4].

To address the relatively poorer financial performance of wind turbines in areas that are not as windy as the Dutch coastal zones (including the Achterhoek and other regions in Gelderland), the wind energy coordinators of the Dutch provincial governments have started talks with the national government. Aim is to set up a special tariff category within the Incentive Scheme for Sustainable Energy Production for such areas. The idea is that such fine-tuning of the SDE+ scheme would make wind energy projects in the Achterhoek financially just as attractive as wind energy projects elsewhere in the Netherlands.

Table 20 Problems and solutions table wind energy

Problems	Solutions	Benchmarks from Good Practice Examples
Lengthy procedures	Awareness raising on relevant procedures (e.g.	Toolbox Windenergie: Handleiding plaatsingstrajecten windturbines

[4] Under the name "Winddelen" Windcentrale (www.windcentrale.nl) launched a crowd funding initiative in the summer of 2012 to support wind energy. Citizens and other small power users can co-operatively own part of two 4-year old wind turbines in Delfzijl, called "Grote Geert" and "Jonge Held" respectively. For a total investment of € 607 (a down-payment of € 345 and 16 annual maintenance payments of on average € 16.40) a co-operation member gets a supply of 500 kWh of wind energy annually for a period of 16 years. Disregarding inflation the payback period comes to 9 years for co-operative members. The original owners of the wind turbines can free up their capital to invest in new green energy projects (and maximise use of accelerated investment depreciation arrangements).

	by issuing a manual)	(Provincie Zuid-Holland, Nov 2010)
Local resistance	Participatory approach (including participatory investments)	Participatie in windenergieprojecten (SenterNovem, 2009)
Poor financial performance	Crowd-funding	A crowdfund specialised in RE recently entered the Dutch market ((http://greencrowd.nl)

8.3 Action plan

Three categories of actions, each including 2 or 3 individual actions, for a total of 7 actions have been identified, as follows:

Actions related to lengthy procedures

- Support to current initiatives to establish new wind energy capacity
- Produce a manual on the siting of wind turbine parks ("Toolbox wind energy")

Actions related to financial matters

- Lobby for higher SDE subsidies for low wind resource areas
- Establish an investment programme for wind turbines
- Develop innovative financing mechanisms such as crowd funding

Actions related to local resistance

- Run an information campaign to improve public perception
- Apply participatory financing mechanisms (such as crowd funding)

9 Geothermal heat pumps

9.1 LAP Targets for 2020

In the Achterhoek, sixteen geothermal heat pumps (aquifers) are currently in use. These are generating a natural gas equivalent of 0.73 million m^3 per year. The target for 2020 is to implement geothermal heat pumps that can save up to 5.82 million m^3 of natural gas annually. An overview of the current capacity and the targeted capacity is given in Table 21.

Table 21 Geothermal heat pump inventory and targets for the Achterhoek in 2020 and 2030 (mln m^3 natural gas equivalent per year)

Geothermal heat pump	Current capacity	LAP target 2030	LAP target 2020
Public buildings, hospitals, large community buildings, etc.	0.73	3.92	2.32
New houses	-	7.88	3.5
Total Achterhoek	**0.73**	**11.80**	**5.82**

Geothermal heat buffers are divided into two categories: on the one hand large buildings, and on the other hand new houses. The current capacity, the targets for 2020 and the number of installations that is still required is shown in Table 19.

Table 22 Geothermal heat pump inventory and targets for the Achterhoek: existing installations, current initiatives, and suggested additional installations (mln m^3 natural gas equivalent per year)

Geothermal heat pump source	LAP target 2020	Existing installations	Current initiatives	Additional installations required
Public buildings, hospitals, large community buildings, etc	2.32	0.73	-	1.6
New houses	3.5	-	-	3.5
Total Achterhoek	**5.82**	**0.73**	**-**	**5.1**

9.2 Problems and solutions

Table 23 Problems and solutions table

Problems	Solutions	Benchmarks from Good Practice Examples
Aquifers are more suitable for cold and heat production in large buildings.	Suitable for community buildings, hospitals, offices, houses for the elderly, etc.	Rabobank Didam, City Hall Hengelo, etc.
Only suitable for buildings using low temperature heating systems.	Easy for buildings which are under construction or refurbishment.	City Hall Hengelo
A heat pump consumes electricity.	The electricity consumption for heat production of a geothermal heat pump is	

	given in the coefficient of performance (C.O.P.). On average, the C.O.P. is 4 and this is improving slightly. For carbon neutral energy production, buy green electricity	
Most of the eastern half of the Achterhoek is unsuitable for open water buffers.	Use closed loop heat exchanger. These heat exchangers are used in new houses.	Many are implemented in houses in Etten-Leur, Zetten, Groesbeek.
Closed loop heat exchangers are not used extensively.	Due to a lack of information about closed loop heat exchangers few of these units are implemented. The soil in the Achterhoek is suitable for these systems.	
Every building needs a customised geothermal heat pump solution, in line with its specific heat and cold demand	Determine heat and cold demand. Design geothermal heat pump to the specified needs of the building.	Newly built houses in Etten-Leur, Zetten, Groesbeek.
Peak boilers are necessary in colder periods and as back-up.	Installation of a natural gas boiler	

9.3 Action plan

The application of geothermal heat pumps is limited to buildings that are designed for low thermal heating (and cooling). Most of the existing building stock is designed for high temperature heating. Thus, geothermal heat pumps are easiest to implement in new, or fully renovated, buildings.

Public buildings, offices and large residential buildings (such as houses for the elderly) are large heat consumers and also require cooling. In such buildings, geothermal heat pumps may find easy application.

Local governments should play an active role to stimulate the use of geothermal heat pumps in public buildings. Also, housing corporations and real estate developers should be informed about development and realization of geothermal heat pumps.

10 Hydropower

10.1 LAP targets for 2020

The theoretical potential of hydropower is about 4 GWh, and includes 5 locations in the Berkel river and 4 locations in the Oude IJssel. The Waterschap Rijn en IJssel has selected three most promising installations located in the Achterhoek: De Pol, Ulft, Voorst, with potential production capacities of 0.75, 0.4 and 0.25 GWh. These form the LAP target of 2030. The LAP target of 2020 is set at 0.4 GWh by installation of hydro power in Ulft. See Table 24 for more details.

Table 24 Potential and targets for the Achterhoek in 2020 and 2030 (GWh)

Location	Theoretical potential	LAP target 2030	LAP target 2020
De Pol	0.75	0.75	0
Ulft	0.40	0.40	0.40
Voorst	0.25	0.25	0
Other locations	2.6	0	0
Total	4.0	**1.4**	**0.4**

10.2 Problems and solutions

Hydropower facilities should be fish-friendly, therefore turbine systems are not acceptable. A better solution is the use of large screw (vijzel) technology, or the Vivace technology. Of course the grid connection needs to be made. Furthermore there are no major problems: the technology is reliable, and requires low attention and maintenance.

Table 25 Problems and solutions table Hydropower

Problems and solutions table		
Problems	**Solutions**	**Benchmarks from Good Practice Examples**
Hydro power turbines not fish friendly	Use large screw (vijzel) or Vivace technology	Installations of Waterschap Veluwe

10.3 Action plan

The plans of the Water board Rijn and IJssel to install a hydro power station in Ulft deserve further support by AGEM or the public authorities where appropriate.

11 Sustainable public transport and non-motorised transport

11.1 Policy Framework for Sustainable Mobility in Regio Achterhoek

Since 2010 “sustainability” is the overarching theme and touchstone for all mobility issues in the Regio Achterhoek.

An important part of rendering the Achterhoek more sustainable is the **Action Programme Sustainable Mobility.** This action programme serves as an umbrella above a range of themes. The aim is to develop and approve a feasible and widely supported mobility policy in which sustainability is interwoven. Eventually the Action Programme Sustainable Mobility will become an integral programme, overarching all sustainable mobility projects.

In 2009 several parties, including entrepreneurs, government officials and policy makers, guided by a mobility consultant, jointly filled in the concept of sustainable mobility. In addition, the "sustainability agenda" for the policy document **Achterhoek Sustainably Mobile** was drawn up.

In 2010 the overarching vision document **Achterhoek Sustainably Mobile** was drawn up, which should enable checking the compliance with sustainability targets of all measures in the Achterhoek in the field of mobility. This set of measures will lead to a comprehensive **Mobility Agenda** which will include a prioritisation on the basis of the contribution of each measure to increased accessibility and sustainability targets. The four tracks of the Mobility Agenda are: 1. Good access to the region, 2. Fostering road safety, 3. Improving public transport and 4. Stimulating cycling. Two specific projects within Achterhoek Sustainably Mobile targeting lower consumption of fossil fuels are (a) Electric battery charging points and (b) Conversion of diesel cars to natural gas & Construction of natural gas filling stations in the Achterhoek.

From the various vision documents and (policy, action and attack) plans priorities, spearheads, measures and reduction targets (for greenhouse gas emissions and/on fossil fuel use) will be derived and formulated. An example of this is the **Public Transport Agenda** (Dutch: OV-visie), a programme of short-term and long-term measures that was drawn up in 2011. The Public Transport Agenda is not a vision document; multiple initiatives, including Achterhoek 2020 and Achterhoek Sustainably Mobile together make up the Public Transport vision. The Public Transport Agenda operationalizes this vision by identifying priorities and spearheads and coupling these to concrete measures.

11.2 Implemented actions

Non-motorised transport

The aim of the project FIETSTAS of Regio Achterhoek was to realise a network of bicycle and scooter electric battery charging points. Winterswijk served as pilot municipality. In the last few years a total of 90 electric battery charging points have been implemented at establishments in the hospitality sector (pubs, hotels, restaurants, etc.), making the Achterhoek the first Dutch region offering region-wide coverage of such charging points. Multiple parties were involved in the project: Syntens, Royal Horeca Netherlands, RAL, energy distribution company Alliander, the municipalities and the province.

Sustainable public transport

The last time the concession to operate the public transport network in the Achterhoek was assigned a responsibility of the province of Gelderland) was in the late zeroes. The concession is for ten years (public bus route Arnhem-Winterswijk) and eight years (passenger train routes Arnhem-Zevenaar-Doetinchem-Winterswijk and Zutphen-Winterswijk) respectively. The concession, which was held by Syntus until then, was awarded to a competing company, Arriva. One of the reasons to award Arriva's tender bid was the CO_2 emission reduction they will achieve by applying smaller and lighter public busses and more energy-efficient trains.

Stadsregio Arnhem Nijmegen is responsible for assigning the public bus route Arnhem-Doetinchem. At this stretch the public transport company Hermes will take over in December 2012 from Arriva, the current concession holder.

Other measures in the transport sector

Regio Achterhoek and the province Gelderland financially support several initiatives to promote citizens and companies making the switch to more environmentally friendly transport fuels.

Regio Achterhoek encourages the use of biogas-natural gas by converting car engines and constructing natural gas filling stations. The first of such filling stations (Tankstation Kolkman at Den Sliem in Groenlo) was opened in June 2012. It was realised in co-operation with Groot Zevert Vergisting, a local producer of green gas. The initiative was supported by the municipality Oost Gelre, and made possible with financial support of province Gelderland and Regio Achterhoek. As part of the project seven more filling stations are planned to be implemented across the Achterhoek. The project also supports the conversion of (one or more) diesel cars to natural gas.

Since October 2011 the province of Gelderland financially supports the procurement of environmental friendly vehicles i.e. scooters and cars. The provincial subsidy for electric scooters is 30% of the purchase price, with a maximum of 1,000 euro. The

provincial subsidy for passenger cars and light duty trucks running on green gas, bio-ethanol or biodiesel is 3,000 euro. As of date the subsidy is no longer available; the available budget was depleted in August 2012.

11.3 Possible actions

Non-motorised transport: cycling

Active cycling policy

To maintain or even boost the use of (electric or conventional) bicycles e.g. for commuting the municipalities in the Achterhoek can implement an active cycling policy and develop an optimal cycling infrastructure. As part of this cycling policy, a package of measures can be implemented, including the following:

Table 26 Cycling policy measures

Active cycling policy and an optimal cycling infrastructure - possible measures
• Disseminate information to citizens on the various benefits of cycling (sometimes faster, healthier, greener, cheaper). • Make a link to the national campaign *Heel Nederland Fietst* or other campaigns promoting cycling. • (Co-) funding of bicycle storages. • (Co-) funding of charging stations for electric bicycles and scooters. • Reducing bicycle theft by providing improved security of unguarded bicycle storages. • Inform businesses about the possibilities of making workers cycle more. • Give a good example as municipality / region / province: - Make available company-owned bicycles for short distance business visits; - Give staff its own subscription to "public transport bicycle" that can be used for the last kilometre(s) when making business trips by public transport; - City council members make (visible) use of the bicycle and function as ambassador. • Provide cycling lessons for foreigners.

Grants for electrical bicycles

The city region Stadsregio Arnhem Nijmegen (SAN) ran a successful pilot to promote the use of bicycles by commuters. Employers responded in large numbers to stimulate their employees to take the bicycle. They could ask up for a SAN grant of up to 600 euro per bicycle to co-finance the procurement of an electrical bicycle. A total of 650 grants were awarded, and the available SAN funds are now depleted. Other regions in Gelderland, such as Stedendriehoek and Rivierenland, run a similar scheme, but award lower grants. In these regions subsidies for electrical bicycles are still available. Regio Achterhoek may consider implementing a similar subsidy scheme for electrical bicycles used for commuting.

Sustainable public transport

Emission reduction targets in public transport concessions

Shortly after the year 2020 the provincial concessions to operate public buses and trains in the Achterhoek will run out[5]. An action in line with the ambitions of Regio Achterhoek is to promote the use of alternative fuels and/or electricity in the public bus fleet, by setting tight emission reduction targets in the next public transport tender. The tender procedure for the new concession period will need to be completed two years ahead of the start of the next concession period, and preparations for the tender will have to start several years earlier. It is therefore opportune to include (exploratory and preparatory) activities aimed at the development of such tender documentation well ahead of 2020.

Table 27 Sustainability in public transport concessions

Action title	
Lead partner	Province Gelderland
Objectives	Reduce fossil fuel (diesel) use in public transport
Outputs	(Strict) Emission reduction targets integrated in tender documentation
Indicators	Tender documentation containing such targets
Timescale	Action is needed now to be ready in time for the new concession period (public buses and passenger trains) starting soon after 2020.
Budget	t.b.d. (mainly internal man-hours)
Funding sources	Provincie Gelderland

Municipalities can follow a similar approach with regard to contracted transport, taxis, waste collection vehicles and urban distribution fleets.

Fuel substitution in passenger trains

A measure that may have an impact on a shorter term is to substitute the fuel used in the public transport fleet. For example, in non-electrified trains that currently use fossil diesel (routes Arnhem-Winterswijk and Zutphen-Winterswijk) it may be possible to use biomass pyrolysis oil instead. An explorative study is proposed to assess the feasibility of this concept.

[5] The bus concession of Arriva is valid for the period 12.12.2010 – 01.01.2021 (with a possible 5 year extension) and the train concession for the period 09.12.2012 – 11.12.2027.

Table 28 Evaluation of fuel substitution potential in passenger trains

Action title	
Lead partner	Regio Achterhoek
Objectives	Techno-economic feasibility study. Unknowns include: technical feasibility, relevant legislation, logistics, economics and sustainability.
Outputs	Feasibility study
Indicators	IRR, NPV, carbon reduction
Timescale	2013
Budget	Euro 30,000
Funding sources	Regio Achterhoek; Province of Gelderland

In case the use of biomass pyrolysis oil is not possible or practical it may also be considered to use biogas/green gas as alternative fuel.

Increased capacity at train route Arnhem-Winterswijk
As a result of capacity problems the train route Arnhem-Winterswijk suffers from a low reliability. There are many crossings, the railway tracks between Arnhem and Zevenaar have to be shared with both international trains and freight trains, and the section Zevenaar-Winterswijk is single track. A longer term solution that will help to debottleneck the capacity problems is to add an extra track between Zevenaar and Winterswijk. This will allow different types of services (express trains and local trains) to be offered.

Better and faster connections with Germany
The volume of cross-border traffic between Achterhoek and Germany is growing continuously: more and more Dutch nationals move to reside in Germany, more and more students study across the border, and an increasing number of Dutch people makes use of German airports. Better public transport could meet part of the increased transport demand. A study to investigate the feasibility of re-constructing and re-opening the passenger rail connection Winterwijk - Borken/Bocholt is underway in the frame of Euregio cross-border co-cooperation.

Other sustainability mobility measures
A wide range of additional measures may be considered to reduce transport-related fossil fuel use and carbon emissions. Such measures can aim at recycling car mileage, increasing the fuel efficiency of vehicles, the application of low CO_2-fuels/electricity, or a combination of these. Table 4 presents an overview of such measures

Achievable reductions
To achieve the ambition of 50% reduction in CO_2 emissions in 2030 vis-à-vis 1990 a robust and long-term sustainable mobility programme is needed, especially when considering that actual transport-related emissions in the Netherlands rose by 38% since 1990.

The sustainable mobility programme will have to include measures that are not directly initiated or under the control of Regio Achterhoek.

If all measures were to be implemented successfully the combined impact by 2020 may be in the order of 8-10% reduction in the transport sector vis-à-vis 2010 emissions.

For a proper quantification of possible reductions and a prioritisation of mobility-related policy measures further investigation is required.

Table 29 Theme-wise overview of further possible sustainable mobility measures

Theme	Possible measures
Sustainable design of areas and roads	**Design neighbourhoods, roads and intersections sustainably when (re)constructing residential and industrial areas by adopting the TPL-approach. Design transport axes in accordance with the principle Driving Slowly Is Faster (in Dutch: LARGAS).** Transportation Performance on Location: TPL is an approach designed to stimulate and improve the cooperation between the urban planning and the traffic management units in the urban planning process. Such cooperation helps to ensure that structural attention is paid to the quality of the living environment in the urban plan development. Driving Slowly Is Faster (LARGAS). When restructuring industrial areas also take into account mobility aspects. Consider both the transport of freight and of employees. Provide public transport to new residential and business areas when these are still under construction, before the habit arises to travel by car.
Mobility management	**Make agreements with local and regional businesses and public service providers (hospitals, schools etc.) on mobility management.** Use of mass transport to/from public attractions, possibly in combination with transferiums. Reward the use of electric bicycles by companies with parking / battery charging facilities. Training of the elderly in the use of public transport. Environmental barometer for companies. Let public buses return to smaller communities.
The New Driving (TND) concept	**Offer own staff, employees of local businesses and/or citizens driving training according to *The New Driving* (TND) concept** Offer own staff driving training according to The New Driving concept. Give subsidies to companies offering their personnel training according to the TND concept. Provide /subsidise TND training to citizens, through neighbourhood / consultation meetings.
Cleaner and more efficient vehicles	**Stimulate the use of cleaner and more efficient vehicles** Run experiments with differentiated parking. Greening the own transport fleet. Offer civil servants attractive rates for private lease of fuel efficient vehicles
Car sharing	**Encourage the supply of car sharing services in the municipality / region / province** Provide licenses to commercial car sharing companies. Make available parking lots for shared cars. Provide subsidy to car sharing companies for the construction of parking lots. Give a financial reward to citizens that hand in their parking permit. The municipality / region / province may become a customer themselves of one (or more) car sharing companies or offer shared cars for business travel under its own management.

Clean and efficient supply of cities	**Widen the time window for clean and energy efficient vehicles to supply city centres. Also urban distribution centres and the use of electric vehicles contribute to a cleaner supply of cities.** Widen the time window for clean and energy efficient vehicles (or provide other privileges). Develop urban distribution centres on the outskirts of the town, combined with transport using electric vehicles. Transport management at companies.
Alternative fuels / electricity	**Realise filling stations for alternative fuels and charging points for electric cars. Also, encourage the use of electricity and alternative fuels, where possible.** Provide grants to citizens and businesses to use natural gas or electricity as fuel. Facilitate permits for fuelling stations or battery charging point (as applicable). Switch municipal vehicles (stepwise) to alternative fuels.
Communication about sustainable mobility	**Communicate to citizens and businesses what they can do themselves to reduce CO_2-emissions by limiting mobility. Organise meetings such as the Sustainability Week or the European Mobility Week. (Repeated) campaigns can also be envisaged.** European Mobility Week. "*Heel Nederland Fietst*" "*Met belgerinkel naar de winkel*"
Parking regulation	**Parking regulation can reduce the pressure of parking in a particular area and help create a public space for other functions. In conjunction with the promotion of alternative modes of transport, the modal split can be changed and thus CO_2 emissions be limited.** Paid parking. Blue zone (parking disk area). Permit parking. Parking at a distance.

12 Energy efficiency measures

12.1 Targets for energy conservation

Long term targets

In the business plan AGEM, long term energy reduction targets of 40% for natural gas consumption and 20% for electricity consumption were developed.

- Applying the long term reduction target for the economy as a whole, the reductions to be achieved are 156 million m^3 and 283 million kWh respectively.
- When applying the target at the housing sector only, the reductions to be achieved in 2030 are 46.8 million m^3 and 84.9 million kWh respectively[6].

In line with the priorities at the provincial level it is intended to achieve most if not all of the energy saving in the built environment, in particular in the existing housing stock, by focusing primarily on building shell insulation.

Targets for 2020

As intermediate reductions target for 2020 we assume 12% for natural gas consumption and 6% for electricity consumption.

- For the economy as a whole, reductions of 77.7 million m^3 and 85 million kWh respectively are required.
- Applying the target at the housing sector only, the reductions to be achieved are 23.3 million m^3 and 25.5 million kWh respectively. Table 30 summarizes the reduction targets.

Table 30 Emission reduction targets for energy efficiency measures

	Economy as a whole		Housing sector only	
	2020	2030	2020	2030
Natural Gas (million m^3)	77.7	156.0	23.3	46.8
Electricity (million kWh)	85.0	283.0	25.5	84.9

[6] The energy consumption in the Achterhoek amounts to some 390 million m3 of natural gas and some 1.415 million kWh of electricity. Households consume just over 40%.

12.2 Prior energy conservation initiatives

In its Climate Programme 2008-2011 the province of Gelderland formulated as ambition to make each year until 2020 30,000 buildings 20-30% more energy efficient. In 2010 its Vision Document Climate Policy Existing Built Environment (*Visie Klimaataanpak Bestaande Gebouwde Omgeving,* 2010) discusses how it can best support energy saving in buildings. Based on country-wide research and on experience gained in provincial climate pilot projects, the vision document concludes that to make a difference and to have an impact the province should focus on the insulation of the building shell (floor, roof, glass and façade) of existing privately-owned houses, as shell insulation appeared the most efficient energy-saving measure in terms of achieved CO_2 emission reduction and financial return for residents.

The pilot projects also showed that residents have little insight into their own space heating behaviour and the efficiency of energy-saving measures. Making owners more aware of their behaviour is an important first step for people to incite energy saving. And it is important to minimise the burden to people.

For the Regio Achterhoek the focus on existing houses is of particular relevance as the number of new houses that will be built in this "shrinkage region" will be modest.

The above findings were taken into account when designing new energy conservation programmes and activities in Gelderland and Achterhoek.

12.3 On-going energy conservation initiatives

Toekomstbestendig maken van woningen: Energietransitie
The first activity funded under the Regiocontract Achterhoek 2011-2105 deals with making the existing stock of houses more sustainable. A working group of 6 housing corporations (collaborating as ACO, short for Achterhoeks Cooperatie Overleg) and the Achterhoeks Centrum voor Technologie (ACT) aims at realising market-driven projects to make older houses (with poor energy performance) more sustainable. Targets include: bringing energy costs down, promote renewable energy, improve the local environment and promote energy awareness. Innovative concepts will be applied, that when successful can be replicated across the Achterhoek. The joint housing corporations will play a role showcasing the applied energy conservation concepts to private house owners. The housing corporations are planning different scales of involvement, varying from 20 houses to 600 houses[7]. A total (multi-annual)

[7] This activity works together with the national programme Energiesprong, which is implemented by Stuurgroep Experimenten Volkshuisvesting (SEV) and tries to make a substantial contribution to the conditions under which the energy transition in the built environment can effectively come about. Energiesprong works with experiments and

budget of € 4.012.500 is available, including € 2 million from the province Gelderland, € 412.500 from the municipalities and € 1.6 million from ACO and private home owners. This budget shall also cover three further closely-related activities: (a) joint inter-municipal focal point for energy conservation, targeted at private home owners; (b) development of a neighbourhood-based energy conservation approach in 16 neighbourhoods with 100 houses each (total of 1600 houses); (c) unlocking specific knowledge about energy-neutral renovation in cooperation with the building sector, education sector and ACT.

Toekomstbestendig maken van woningen: Juiste woning op de juiste plaats
Another activity funded under the Regiocontract Achterhoek 2011-2105 involves (among others) the establishment of Centre for Sustainable Reconstruction. Stichting Achterhoek Duurzaam Verbouwen (SADV, www.achterhoekduurzaamverbouwen.nl) targets sustainable (re-)construction in the Achterhoek, in particular of existing houses and also commercial buildings, starting in the municipality of Berkelland. Involved are also some fifty entrepreneurs associated with the construction sector and the Achterhoeks Centrum voor Technologie (ACT). SADV intends developing 3 components:

1. a knowledge platform (with web community) for companies in the construction sector
2. an independent advice and information point
3. a demonstration centre for sustainable energy and materials

The aim is to give advice on, and implement, concrete energy saving measures meeting the energy and indoor climate demands in 1000 houses and 400 commercial buildings in a period of 4 years (2012-2015). A total (multi-annual) budget of € 280,000 is available, including € 140,000 from Berkelland.

"De Achterhoek Bespaart"
As a follow-up to the earlier mentioned pilot projects, province Gelderland allocated funds for a subsidy to replicate the "best practices" in building shell insulation. This provincial subsidy is targeted at achieving energy conservation by insulation of the building shell including ground floor, walls and roof. Glass insulation is explicity excluded (as this is already tackled by national subsidies). According to data from government agency SenterNovem (now Agency NL) the costs of such insulation would vary between 2,000 to 6,000 euro, depending on the building type and the year of construction. The provincial subsidy is channelled through the municipalities. In the Achterhoek the subsidy is known as "De Achterhoek Bespaart", and it is available in all 8 municipalities (Aalten, Berkelland, Bronckhorst, Doetinchem, Montferland, Oost Gelre, Oude IJsselstreek en Winterswijk). Per municipality a budget of up to 150,000 euro is available. As the maximum subsidy per house is 500

through "learning by doing"; it elicits or selects innovative housing projects of market players which it gives financial or process-oriented support.

euro, up to 300 houses can be insulated in each municipality, or up to 2,400 in the Achterhoek as a whole.

In addition, the province planned appointing provincial energy conservation advisers to make housing corporations, associations of owners and utility buildings with a public function aware of energy saving measures they could implement.

AGEM - Achterhoekse Groene Energiemaatschappij
As part of the Tafel van Groenlo the set-up of a company providing energy conservation services was explored. This has since resulted in various steps leading to the establishment of AGEM, as discussed elsewhere in this report.

The involvement of AGEM in the field of energy conservation would address both the consumer and the business market. The idea is that AGEM bundles demand, arranges the procurement of goods and services, and gives professional advice on energy conservation.

Evaluation
Table 31 summarizes key (quantitative) data from the programmes and initiatives discussed above. Firmly allocated is some € 5.5 million in funding to tackle partial insulation of some 5,000 houses (on average € 1,100 per house). With such level of funding only the low hanging fruit, with very short payback periods of up to a few years, can be tackled.

Table 31 summary of on-going programmes, objectives and objectives

Activity	Target	Budget
Energietransitie	ca. 1,600 houses	€ 4.012.500 (until 2020)
Juiste woning op de juiste plaats	1,000 houses (and 400 commercial building)	€ 280,000 (advice only)
De Achterhoek bespaart	ca. 2,400 houses	€ 1.2 million

Best practice examples outside the Achterhoek
Much can be learned from best practises elsewhere, in particular sustainable renovation housing projects in Stoke-on-Trent, Rottherham and NordRhein Westfalia.

12.4 Required energy conservation initiatives

Natural gas consumption
If the total housing stock in the Netherlands would be lifted to energy label-A tomorrow this would lead to energy savings for home heating of about 30-35%. The average natural gas consumption (2006) amounts to 1,466 m^3 of natural gas at an average ground floor acreage of 105 m^2 for a house. With energy label A the natural gas consumption is some 9.3 per m^2. Combining the figures lead to a total natural

gas consumption of 977 m^3, which is a reduction of 489 m^3 or about one-third less[8]. The technology is available to achieve further reduction in fossil energy consumption, of up to 80%, by combining shell insulation and the deployment of advanced equipment (high-efficient boiler, heat pump, etc.), but these measures come at significant cost[9].

Some 47,670 houses would need to be insulated, or some 39% of the total building stock of 121,410 houses. This is considered too ambitious considering the characteristics of the building stock (house types, age classes, ownership, etc.) and the costs involved. Assuming average insulation costs of € 25,000 per house involved, the total cost would approach 1,200 million euro.

A more realistic assumption is that until 2020 a total of 16,000 houses (2,000 houses per year) can be insulated in the indicated manner. The costs involved would amount to 400 million euro in total, or 50 million euro per year. This is twice the amount of what is targeted by AGEM business unit Energiebesparing. In other words, all other initiatives combined should achieve the same market volume as AGEM by itself.

The proposed measure would contribute to a natural gas consumption reduction of 7,824,000 m^3. This is about one-third of the target set for the housing sector in the Achterhoek, and about one-sixth of the target set for the economy as a whole in the Achterhoek (see Table 32 below). **Obviously, additional measures (probably beyond the housing sector) are needed to achieve the ambitious (fossil) energy consumption reduction targets.**

Electricity consumption

Likewise, electricity consumption in households can be reduced e.g. by setting up a campaign aimed at residents to change their (routine) behaviour[10]. For energy conservation through modified behaviour a distinction is made between routine behaviour and investment behaviour. Routine operations include such behaviour as switching the light off when leaving the room. Routine behaviour of residents has an obvious impact on the energy consumption. A home can be very energy efficient, but if residents unnecessarily leave the windows open while the thermostat is set on high or leave chargers sit in sockets energy is wasted. By adjusting this kind of behaviour savings of about 10% (for electricity and natural gas combined are possible.

[8] Liebregts, Bouwjaar en energetische kwaliteit, maart 2012, http://www.bestaandewoningbouw.nl/bouwjaar-en-energetische-kwaliteit/

[9] Telephone interview of Martijn Vis (BTG) with Harrie Beernink (SADV).

[10] Alternatively, or additionally, energy consumption can be reduced (or otherwise!) through investment behaviour.

It is assumed that a reduction of 5% in electricity consumption, or 175 kWh, can potentially be achieved in each household. To achieve the targeted reduction of 25.5 million kWh of power consumption some 145,600 households would need to participate, which is above the total number of households in the Achterhoek and thus obviously too ambitious. Furthermore, interest in energy conservation will vary by household, with some being prepared to do more than others

Keeping these factors in mind, a more realistic assumption may be that **on average** a 2% reduction in energy use is achievable on average in all households. The proposed measures would contribute to an electricity consumption reduction of 8.5 million kWh. This is about one-third of the target set for the housing sector in the Achterhoek, and about one-tenth of the target set for the economy as a whole in the Achterhoek (see Table 32). **Obviously, additional measures (including those aimed at changing investment behaviour) are needed to achieve the ambitious (fossil) energy consumption reduction targets.**

Table 32 Emission reduction targets.

	Identified measures	2020 Target (housing sector)	2020 Target (whole economy)	Additional measures needed (housing sector)	Additional measures needed (whole economy)
Natural Gas (million m^3)	7.8	23.3	46.8	15.5	39.0
Electricity (million kWh)	8.5	25.5	84.9	17.0	76.4

13 Financial evaluation

Building on the previous chapters, this chapter first presents overviews of the renewable energy installations and investments needed to meet the renewable energy targets for 2020. It then moves on to introduce common financing instruments. Subsequently an overview is given of the main government support schemes available at provincial, national and European level. Next some remarks are made about the relevance and potential impact of the different financing instruments and support schemes. The last section presents a description of a new financing phenomenon; crowd funding that may be applied to secure funding for renewable energy investments.

13.1 Required additional investment to meet the LAP 2020 targets

Table 33 and Table 34 indicate the required additional investments needed to meet the LAP 2020 targets for heat/green gas, electricity and CHP options. A total investment effort in the order of 467 mln euro is required to place 162 MWth and 207 MWe of equipment. In order to make comparison between options to a certain degree possible, a column is added showing investment costs per GJ or per MWh produced. It is noted that the financial performance of a technology also depends on the income generated and the variable costs of the renewable energy option. Ultimately the financial feasibility needs to be calculated for each project.

Table 33 Indication of investments needed to meet the LAP 2020 targets - heat

Renewable energy option	Needed capacity (MWth)	Investment per unit of capacity (Euro/kWth output)	Total investment costs (mln Euro)	Investment costs (Euro/GJ per year)
Biomass heating	38	370	14	1.3
Green gas - manure and local sustainable cosubstrates	17	1432	25	2.5
Green gas - manure only	13	3724	48	6.5
Solar water heating, households	10	2110	21	50
Solar water heating, companies	52	700	36	14
Heat pumps	32	950	30	8.2
Total	**162**		**175**	

Table 34 Indication of investments needed to meet the LAP 2020 targets – electricity and CHP

Renewable electricity option	Needed capacity (MWe)	Investment per unit of capacity (Euro/kWe output)	Total investment costs (mln Euro)	Investment costs (Euro/MWh output per year)
Solar PV, households	13	1900	24	106
Solar PV, companies	105	1250	132	63
Wind	84	1350	114	31
Codigestion for heat and power	4.0	3108	12	19
Combustion chicken manure for heat and power	1.0	10390	10	65
Hydropower	0.06	5900	0.3	42
Total	**207**		**292**	

The project owners, like companies, governmental organisations, institutions or households, are primary responsible for financing their projects. Part of the investments and operational costs can be covered by support mechanisms as presented below.

13.2 Government schemes to support renewable energy projects

Barriers to commercial financing of renewable energy projects can be divided into two main groups:

- Real and perceived risks
- Project profitability

These two key factors determine the access of renewable energy projects to commercial financing. Government policies and schemes to support renewable energy projects seek either to reduce (or re-allocate) financing risks, or improve the profitability of the project, or in many cases both.

Government schemes for the promotion of renewable energy are available at different administrative levels. The sections below briefly introduces the main financial support schemes available at provincial, national and European level to economic operators in Regio Achterhoek[11], including:

Provincial support schemes

- De Achterhoek bespaart
- Subsidy programme energy transition: biomass plants
- Subsidy programme energy transition: clean transport fuels
- Solar PV for asbestos roofs

[11] Financial support for renewable energy and energy efficiency measures available at the municipal level appeared very small and were therefore not investigated in more detail.

- Innovation and Investment Fund Gelderland

National support schemes

- SDE
- MIA/Vamil
- EIA
- Green investment scheme
- Energy Innovation Agenda
- WBSO, RDA & Innovatiebox
- Innovatiefonds MKB+
- National subsidy scheme for investment in environmentally-friendly measures
- National subsidy scheme for Clean and Efficient demonstration projects
- National subsidy scheme Solar PV Systems

European support schemes

- Seventh Framework Programme
- Intelligent Energy for Europe
- European Local Energy Assistance (ELENA)
- Joint European Support for Sustainable Investment in City Areas (JESSICA).
- INTERREG
- Horizon 2020.

13.3 Relevance of the various government support schemes

The instruments discussed above can be re-categorised by type of support as follows:

- Participations, loans and guarantees
- Fiscal measures
- Subsidies

Participations, loans and guarantees are usually made available through an (innovation, investment, regional development, economic recovery etc.) fund. In the Netherlands, a number of provincial governments including Gelderland are gradually moving away from making available subsidies to (revolving) fund financing. Funding conditions are similar or somewhat better than regular market conditions. An example is the Innovatie- & Investeringsfonds Gelderland, which went into operation in 2012.

Fiscal measures: the idea behind fiscal measures is to reduce taxable income. Fiscal measures are therefore primarily intended for profit-making companies (and individuals). As shown above, in the Netherlands there are some fiscal instruments that have been in place for a long time (EIA, MIA, VAMIL, WBSO) as well as some fiscal instruments that have been newly introduced (e.g. Research & Development Aftrek; Innovatiebox) or are still under preparation. The budget involved in fiscal

measures to support renewable energy and energy efficiency is estimated to be in the order of 150-200 million euro per year.

Subsidies: by far the largest amount of money earmarked to support renewable energy is involved in the SDE subsidy scheme for the support of renewably generated electricity, heat and gas. The 2012 budget for SDE amounts to 1700 million euro. As SDE support the most cost-effective projects (in terms of specific costs per energy unit) renewable energy technologies do not profit equally; the scheme seems to be particularly relevant for geothermal projects. The budget available to entities in Gelderland of all other renewable energy and energy efficiency subsidy schemes combined is estimated to be less than 50 million euro per year, or not more than 3% of the total SDE budget.

Table 35 summarises the main instruments that are available at different levels to financially support renewable energy and energy efficiency

When disregarding the SDE, which is by far the most dominant source of financial support for renewable energy production in the Netherlands, the amount of funding specifically earmarked for the promotion of renewable energy and energy efficiency is the highest at the European level. Annual budgets are in the order of tens, if not hundreds, of millions of euro per programme, resulting in subsidies totalling 200-250 million Euro per year. However in the EU programmes concerned (FP7, IEE, etc.) there are no fixed national or regional allocations, and the budget has to be shared among all EU Member States. Dutch parties will typically be able to access up to 5-10% of the total budget, and parties from the Achterhoek a small portion of that.

Table 35 Main financial support measures and budgets (2012)

	Provincial	National	European
Participations, loans and guarantees	Innovation and Investment Fund Gelderland (IIG) (Initial budget € 10 million)	Innovatiefonds MKB+ (€ 520 million in 2012)	Structural Funds (ERDF, INTERREG) (INTERREG ca. € 60 million in 2012)
Fiscal measures	n.a.	EIA/MIA/ VAMIL and WBSO/ RDA/Innovatiebox (€ 276 million and € 1759 million)	n.a.
Subsidy - exploitation	n.a.	SDE (€1700 million in 2012)	n.a.
Subsidy - other	Subsidy programme energy	Subsidy scheme Solar	FP7 (Energy call),

	transition; Solar PV for asbestos roofs	PV Systems	IIE (incl. ELENA)
	(A few million euro / year)	(€ 21 million in 2012)	(Last calls: € 314 million and € 67 million resp.)

It is concluded that in terms of volume of renewable energy investments supported in region Achterhoek the following instruments would be the most important (in descending order)

1. Incentive Scheme for Sustainable Energy Production (SDE)
2. Fiscal measures (EIA, MIA, VAMIL, WBSO, RDA, Innovatiebox
3. Energy Innovation Agenda

Relevance of available support schemes for different technology applications
Assessment of the individual support schemes as discussed above revealed that with few exceptions they are (renewable energy) technology unspecific. Many have a broad coverage, covering a wide range of technologies and/or applications.

There are a few examples, however, of (renewable energy) technology specific support measures (involving provincial and national schemes), includes:

For solar PV plants	Provincial subsidy scheme Solar PV for asbestos roofs
	National subsidy scheme Solar PV Systems
For biomass plants	Provincial subsidy programme energy transition
	National subsidy scheme Clean & Efficient demo projects
For wind power plants	National subsidy scheme Clean & Efficient demo projects

13.4 Crowd-funding: an innovative funding instrument

Crowd-funding describes the collective effort of individuals who network and pool their resources, usually via the Internet, to support efforts initiated by other people or organizations. Crowd-funding is used in support of a wide variety of activities, including disaster relief, citizen journalism, support of artists by fans, political campaigns, start-up company funding, movie or free software development, and scientific research.

Crowd-funding is an alternative way to fund a project. In order to finance a project entrepreneurs usually go to the bank to apply for a loan and to obtain seed capital. In the case of crowd-funding there is financial intermediary, but direct contact between investors and entrepreneurs.

Investment through crowd-funding can be done in several ways. The four most common ways are:

- **Donations**: The investor donates money for a particular purpose. Donate implies that the investor gets nothing in return. Crowd-funding by means donations occurs mainly in philanthropic purposes.
- **Sponsorship**: The difference between donations and sponsorship is that the investor gets a non-financial reward from the entrepreneur. Some examples are a ticket to a concert, a copy of a CD or book, or mentioning of a name in a magazine. Sponsorship is the form that is commonly used in creative projects.
- **Debt:** The investor loans a (small) amount of money to the entrepreneur. Over time the entrepreneur repays the investor the deposited amount with interest
- **Equity:** The investor takes a stake in the project of the entrepreneur. This generates start-up capital for the investor in exchange of which the investors shares in the value development of the company.

In the Netherlands, the newly established Stichting GreenCrowd (greencrowd.nl) seeks to support renewable energy projects through crowd-funding. Under the name Winddelen the Windcentrale (www.windcentrale.nl) launched a crowd funding initiative supporting wind energy in June 2012.

14 Political Statements and Signatures

Hans Alberse, mayor of the Municipality of Oude IJsselstreek, Chairman of de regional board for Sustainable Economy and member of the Political Board of the Project EU2020 Going Local, herewith signs the Local Action Plan of the Region Achterhoek and offers it to AGEM. AGEM will have a key role in the realisation of the ambitions of the Achterhoek.

Place:

Date:

Signature: