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1 INTRODUCTION

1.1 Environmental targets

The Netherlands have committed to 6% CO₂ reduction in the period from 2008-2012 within the Kyoto Protocol.

The Fourth National Environmental Plan (NMP4) from 2001 sets the Dutch renewable energy target to 5% in 2010 and 10% in 2020.

For the realization of these targets, a number of plans, programs and incentives were issued. The national targets are divided per sector and, in some cases, per technology.

According to the BLOW document (Bestuursvereenkomst Landelijke Ontwikkeling Windenergie), the target for wind energy is 1500 MW on land in 2010.

The Environmental Policy Document (Uitvoeringsnota Klimaatbeleid) of the Ministry of Housing, Spatial planning and Environment (VROM), defines the target for the CO₂ savings in built surrounding as 5,5 Mton/a in 2010.

Status of renewable energy

In December 2005, the total share of renewable energy in the Netherlands was 13%: 5,9% domestic production and 7,1% import. The share of wind energy in the domestic renewable electricity production in 2005 was 30%. The relations among different renewable energy sources are illustrated in the table and figure below.



Figure 1: Sustainable energy generation in the Netherlands ¹

Table 1: Share of renewable energy in the Netherlands in 2005¹

Source	share
Wind	1,80%
Biomass	4,00%
Hydro	0,10%
total domestic production	5,90%
import of renewable electricity	7,10%
total share of renewable energy	13,00%

The total wind capacity in the Netherlands in December 2005 was 1219 MW². All turbines together generate about 2100 GWh of electricity on a yearly basis. This is enough for a yearly supply of about 620.000 Dutch households. All of these turbines are situated on land. The first offshore wind park is at this moment under construction in Edmond aan Zee.

1.2 Status of urban turbines

In 2006, there are about 30 urban turbines installed with a total capacity of about 80 kW. The majority of the turbines are mounted on the roofs of buildings, some of them are placed on the ground next to buildings.



Figure 2: WindWall, Erasmus Medical Centre, Rotterdam

Photo: Rob Roelofs



Figure 3: Venturi, St. TWG, Tilburg

Photo: George Haex

Urban wind turbines are still not recognized as a technology for electricity generation in the Netherlands. This means that urban turbines are not embedded in the documents and procedures regarding renewable energy. This is mainly because the national environmental targets are expressed in tons of CO₂. With costs per ton CO₂ as the only criterion, urban turbines can not compete with the large scale options like biomass installations and large wind parks. Furthermore, the national authorities do not believe that urban turbines can reach a sufficient capacity to justify the investments necessary to give it a place within the national renewable energy programs. This attitude is based on a report from Royal Haskoning in 2002 in which the potential for urban turbines was calculated to 56 MW in 2020. For this reason, there is no legal framework for urban turbines.

Large wind turbines are placed in open areas outside of buildings surroundings. The existing legal framework concerning wind energy was developed for large wind turbines. Most of the new developed urban turbines do not fit into these regulations due to a different construction, dimensions and capacity.

Four of the 12 Dutch provinces and some municipalities try to create their own local policy for urban turbines, but most of them just wait for the national government to create the necessary legal framework for the implementation of urban turbines.

In the next chapters, we shall describe the current situation regarding the legal aspects of urban turbines from three points of view:

- a. Administrative and planning framework
- b. Survey on local initiatives with urban turbines
- c. Survey on constrains and possible solutions regarding urban turbines

2 ADMINISTRATIVE AND PLANNING NETWORK

2.1 National Planning

In 2001, the National Policy Document on Spatial Planning was issued. This document sets criteria for the spatial requirements regarding wind energy projects. It also describes the policy framework for wind energy projects on regional and local level.

The agreements regarding the realisation of wind energy were formalized in July 2001 by the so called BLOW document. In this document, the target for wind energy is set to 1500 MW on land in 2010. The targets are specified per province. BLOW is signed by five ministries: Ministry of Economic affairs (EZ), the Ministry of Housing, Spatial planning and Environment (VROM), Ministry of Agriculture (LNW), Ministry of Defence (MinDef) and the Ministry of Transport, Public works and Water Management (V&W)), 12 provinces and the Association of Dutch Municipalities (VNG). The document describes the backgrounds, targets, responsibilities of the main stakeholders, organisation, relation to other relevant documents, monitoring and reporting. According to this document, the municipality is the most important party for the realisation of the wind energy targets.

2.1.1 National Laws

This chapter describes the laws and regulations³ related to wind energy installations as well as to renewable energy in built surroundings. Due to the lack of a dedicated set of regulations for urban turbines, at this moment, both kinds of regulations must be taken into account when considering urban turbines.

2.1.1.1 The Law on Spatial Planning (Wet op de Ruimtelijke Ordening (WRO))

This law regulates spatial planning in the Netherlands. It proscribes which regulations are made on national, provincial or local level, how these regulations will be adapted as well as the tasks and responsibilities of different actors. The decisions and procedures regarding building and retrofitting must comply with this law. WRO allows a special procedure for the placement of wind turbines in case that the municipality and the province agree on it. It is called 'article 19-WRO-procedure'. WRO came into force in 1965 and was last adapted in 2003. The new version of this law is expected for 2007.

2.1.1.2 National Spatial Strategy ('Creating space for development', Nota Ruimte)

The National Spatial Strategy contains the government's views on the spatial development of the Netherlands and the most important objectives associated with that development. The document came into force in 17 January 2006.

2.1.1.3 The Fifth National Policy Document on Spatial Planning (Vijfde Nota over de Ruimtelijke Ordening, work title: 'Ruimte maken, ruimte delen')

This is a strategic document about the spatial development of the Netherlands as a part of Europe up to 2020, and on some issues even up to 2030. In this document the national wind energy target of 1500 MW on land in 2010 and 6000 MW on sea in 2020 as mentioned in the NMP4 has been worked out in more detail. It came into force in January 2002.

2.1.1.4 The Law on Environmental Management (Wet Milieubeheer, Wm)

This law proscribes an integral approach to the environmental issues. It defines the environmental standards and describes the competences and procedures. This law dictates that wind turbines can only be placed with a building permit, except for the turbines with a rotor diameter smaller than 2 meters. Wm came into force in 1993. In the next revision of this law, the municipalities will get more strategic tasks when developing the local environmental policy.

2.1.1.5 Decree on Facilities and Installations for Environmental Management (Besluit voorzieningen en installaties milieubeheer, Bvim)

This document falls into the category of general administrative measures (Algemene Maatregel van Bestuur, AMvB). The wind turbines which match the AMvB criteria do not need the environmental permit. These criteria are as follows:

- Wind turbines are mounted on a mast and in direct connection to the ground;
- Wind turbines have horizontal axes (HAT turbine);
- Distance to the nearest house or other sound sensitive object must be at least four times the height of the mast;
- The total installed capacity less than 15 MW;
- The wind turbine must meet the requirements regarding the safety, sound production, shadowing, flickering, vibration and operation as described in AMvB.

2.1.2 Other governmental regulations and policy

Other aspects regarding the wind turbines are regulated in separate documents are nature reserves, birds' area and Public Works and Water Management objects.

The regulations of importance for building surroundings are:

2.1.2.1 Building Act (Bouwbesluit)

The Building Decree describes with which technical requirements regarding safety, health, energy and environment the building objects must comply.

2.1.2.2 Housing Law (Woningwet)

The most important issue in this law in relation to wind turbines is the 'building paragraph' which describes the permit procedure. According to this law, the municipalities are obliged to define the requirements the building objects must meet in order to get the building permit. These criteria are called 'welstand criteria'. Most of them are related to the visual appearance of building objects.

2.1.2.3 EPC, EPL and EPA

These are tools which, in three different ways, create possibilities for renewable energy in built surroundings.

EPC (Energy Performance Coefficient), is a standard related to the energy demand of new buildings. A lower EPC means lower demand for fossil fuels. One way to achieve this is by renewable energy. Per 1 January 2006, the proscribed value of EPC for housing was lowered from 1 to 0,8. The architects and property developers are obliged to follow this standard when developing new buildings.

EPL (energy performance on location) reflects the total share of renewable energy in newly built areas. An EPL =10 means that energy supply is 100% renewable.

2.2 Regulations on the Provincial level

The provincial responsibilities are described within BLOW. Almost all provinces have already developed their own strategy regarding large scale wind energy. This strategy is implemented into the Regional Plan.

2.2.1.1 Regional Plan (Streekplan)

The Regional Plan describes the future destination of a ground in a (part of) province. For example this plan defines in which region the villages or cities will be developed (further) or which parts of the province are reserved for the agriculture or recreation. The Regional Plans must fit into the governmental spatial plans.

2.3 Regulations on the Municipal level

2.3.1.1 Municipal Spatial Plan (Structuurplan)

This document describes the main course of the spatial development in some municipality, especially in relation to other municipalities in the region.

2.3.1.2 Development Plan (Bestemmingsplan)

The Development Plan describes the future destination of an area in a municipality. It defines the rules for the future ground exploitation, but also the maximal heights and widths of the building objects. For example, this plan describes that a certain area is reserved for living, industry, recreation etc. If wind energy generation is not mentioned as a possible destination, or if the wind turbines will exceed the proscribed height, than the plan must be adapted before the municipality can allow the placement of the turbines. This is called the Article-19-WRO procedure. In exceptional cases, the municipality can exempt some objects

from the Development Plan. The exception can be made for temporary objects for the period of five years. This is called the Article 17-procedure. The Development Plan must fit into the Regional Plans and is being renewed every ten years.

2.3.1.3 Environmental Report (Milieueffectenrapportage, MER)

This regulation is related to the wind parks larger than 10 MW.

2.3.1.4 Building Decree (Bouwverordening)

In the Building Decree the municipality defines the local criteria regarding building activities such as: urban planning, connection to the infrastructure, building activities, inspection on the building location etc.

2.3.1.5 BANS Climate Covenant (BANS Klimaatconvenant),

The Climate Covenant, launched in 2002 by the Ministry of VROM, is a framework which makes it possible for municipalities to develop and realize their own action plan for the environmental savings. The municipalities are free to choose the actions which have the best chance in their region, including (urban) wind turbines.

EPA (Energy Performance Advice) is an advisory system about energy efficiency and renewable energy in existing buildings. The energy efficiency can increase by energy saving measures and/or by the implementation of renewable energy.

2.3.1.6 Property issues

There are some new trends in the relation between the municipality and the parties requesting a building permit. One of them is that the municipality can name some special requirements regarding the financing and the maintenance of the objects. This is often the case with wind parks, especially in case of complex financing constructions and public-private cooperation's.

Sometimes the neighbours resist the placing of wind turbines because they believe the value of their properties will decrease. In those cases the investor can offer a financial compensation to the neighbours.

2.3.2 Regional and local Planning

According to BLOW, the main task of the national government is to create the conditions for achieving the national targets.

The provinces have a task to develop a spatial policy and spatial plans which will make possible the implementation of wind energy projects possible. In practice, there are two ways the provinces approach this issue:

- The first approach is to define regions in which the wind turbines are (not) preferred and under which conditions.
- The other approach is to point out the regions in which the wind parks are allowed and integrate the requirements within the spatial plans for those regions.

In both cases, the cooperation between the province and the municipalities is crucial for the realisation of wind energy. Some municipalities chose for a regional approach. In that case they develop a common plan together with other municipalities from the same region.

Figure 2 displays the process from intention to action on three levels: province, region and municipality.

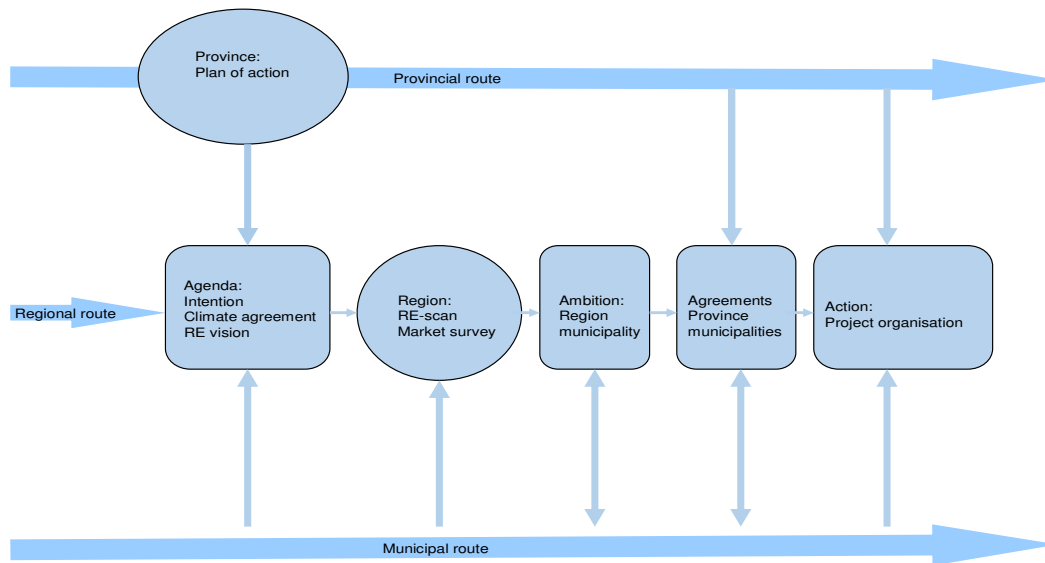


Figure 2: Process description of the common approach to wind energy⁴

2.3.2.1 The role of local authorities

The municipalities have the most responsibilities in achieving the wind energy targets. The activities the municipality can undertake in relation to the realisation of wind parks are:

- developing of active, wind energy friendly, local policy;
- creating a positive attitude with the local parties by offering information and organising wind energy themed excursions;
- defining clear requirements regarding the wind energy projects;
- defining a clear permit procedure and/or managing the permit procedure;
- taking part in the realisation of wind parks.

2.3.3 Standards and regulations

This paragraph describes the existing standards and regulations for wind turbines in the Netherlands.

2.3.3.1 Safety

The wind turbines must meet the international standards:

IEC 61400-1, 2nd edition: 'Design requirements small wind turbines'. This is the only standard for small wind turbines. It is used by NREL in United States. NREL, Germanische Lloyd (Germany) and Det Norske Veritas (Denmark) are accredited for the certification of small wind turbines. In the Netherlands, there are no institutions accredited for the certification of (urban) turbines at this moment.

IEC 60204-1, general requirements.

In the Netherlands, the wind turbines must also meet the Dutch safety standard NEN6096/2 or NVN 11400/0, Instructions for type certification, Technical requirements. This standard defines the criteria regarding safety, sound production, and efficiency.

The sound production must comply with the international standard: IEC61400-11, 'Wind turbine generator system part 11: Acoustic noise measurements techniques'. The municipalities allow only turbines which match these criteria.

When placing the wind turbines along the highways, railways and industrial installations, the ministry of V&W and the Dutch Railways can define additional requirements. Below, in table 2, are the global directions regarding distances between wind turbines and other building objects.

Table 2: Directions for the distance between wind turbines and other objects

Function	Distance to the wind turbine
living and recreation areas	300 - 500 m
roads	30 m (road), 50 m (waterway)
railway	radius+7,85 m
high voltage line	50 m
airport, flying route	1,852 m from flying route, 500 m from airport
highway	30 m
parking area and gas station	30 m
channel, river, haven	50 m from the edge

2.3.3.2 Grid connection

Criteria regarding the grid connection of the installations for decentralised electricity generation are described in the Electricity Law from 1998 and in the document called Netcode made by the Dutch Office of Energy Regulation (DTe): <http://www.dte.nl/engels/home/index.asp>.

All low voltage installations must match the Dutch safety regulation NEN1010.

2.3.3.3 Life time

The technical lifetime of wind turbines is twenty years. The economical lifetime is fifteen years.

2.3.3.4 Visual effects⁴

- There must be enough distance between two different groups of wind turbines in order to keep a harmonious visual impression.
- The distance between the wind turbines in the same group must be at least five times the rotor diameter. All turbines in the same group must be placed on the same distance from each other.
- The turbines in the same group must be of the same type and the same dimensions.
- The spatial arrangement (in line or bow) of the group of turbines must follow the lines of the local landscape.
- The height of axes should be 1,2 times the rotor diameter.

- Turbines with three wings are considered visually less disturbing and more attractive. Turbines with two wings are not allowed any more.
- Colour of wind turbines has an important visual impact on the landscape. The municipality can require a special colour in order to make the turbines more impressive or to make them invisible.

2.3.4 Permit system

2.3.4.1 Building permit

According to the Dutch Housing Law (Woningwet, article 40, lid 1)⁵, it is forbidden to build without a building permit. This regulation concerns all kinds of 'regular' building objects, including wind turbines. Some building objects can be excepted from the building permit. In that case they need just a 'light' building permit or no permit at all. The exceptions are described in the document: 'Besluit bouwvergunningsvrije en licht-bouwvergunningplichtige bouwwerken' (Bblb from 2002). According to the existing legal framework, urban turbines always need a building permit. Figure 3 below describes the existing building permit procedure.

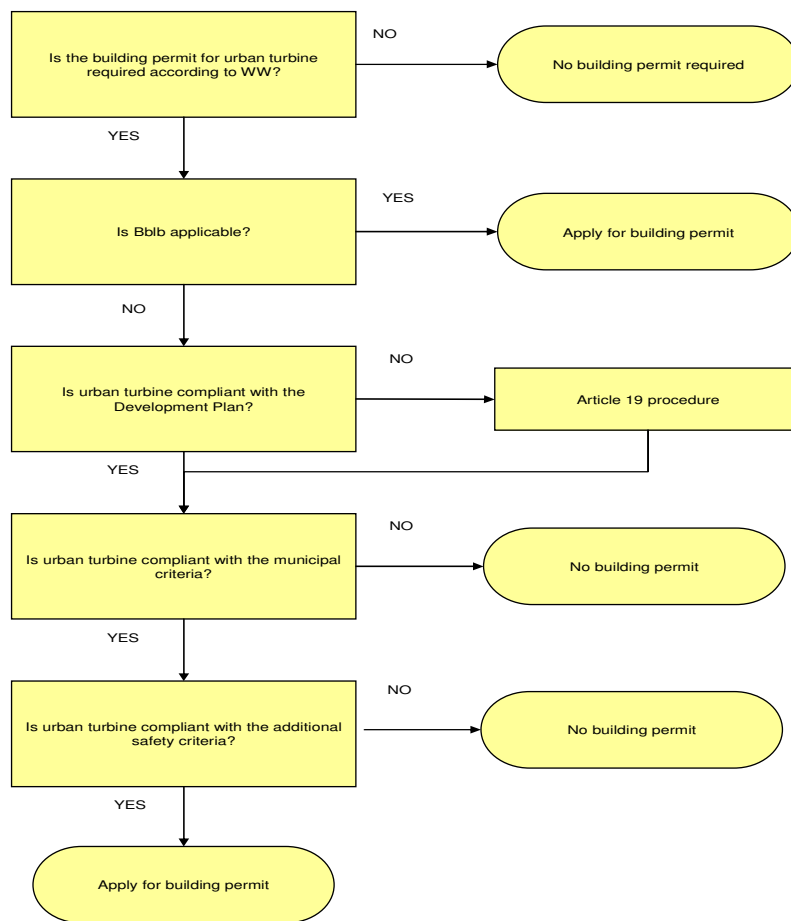


Figure 3: scheme of the building permit procedure

Legend

WW: Woningwet (Housing Law)

Bblb: Besluit bouwvergunningsvrije en lichtbouwvergunningplichtige bouwwerken (Decree on objects with light permit procedures)

Article 19 procedure: the procedure for changing of the Development Plan due to urban turbines

This procedure follows after confirmation that urban turbine requires no environmental permit. Depending on the local situation, the municipality checks the request for building permit on the following regulations:

- Development Plan (Bestemmingsplan)
- Municipal criteria (Welstandscriteria)
- Housing Law (Woningwet)
- Building Act (Bouwbesluit)
- Building Decree (Bouwverordening)
- Municipal Spatial Plan (Structuurplan)
- Regulations regarding monuments

In case urban turbines does not comply with any of the municipal criteria, it is not allowed to place urban turbine. That is the meaning of the outcome: 'no building permit'.

2.3.4.2 Environmental permit

For wind energy projects larger than 15 MW an environmental permit is necessary. Small wind turbines also need an environmental permit in case they will be placed on an object which needs the environmental permit (as for example a factory building).

In cases both permits are necessary, one can apply for the building permit only after receiving the environmental permit. Also, the environmental permit is not valid before the building permit is issued. Therefore, the first check on urban turbines is the one regarding the environmental permit.

Because urban turbine is an installation, it also must be checked on the requirements of: Decree on Facilities and Installations for Environmental Management (Besluit voorzieningen en installaties milieubeheer, Bvim) and The Law on Environmental Management (Wet Milieubeheer, Wm). The procedure regarding the environmental permit procedure is described in figure 4 on the next page.

2.3.4.3 Time planning

The regular building permit procedure takes 12 weeks. The light procedure takes six weeks. The Article 19-procedure takes much longer because the Development Plan must be changed. The procedure for the environmental permit takes half a year.

2.3.4.4 Administrative expenses

The administrative expenses for the handling of a building permit depend on the investment costs and on the local municipal tariffs.

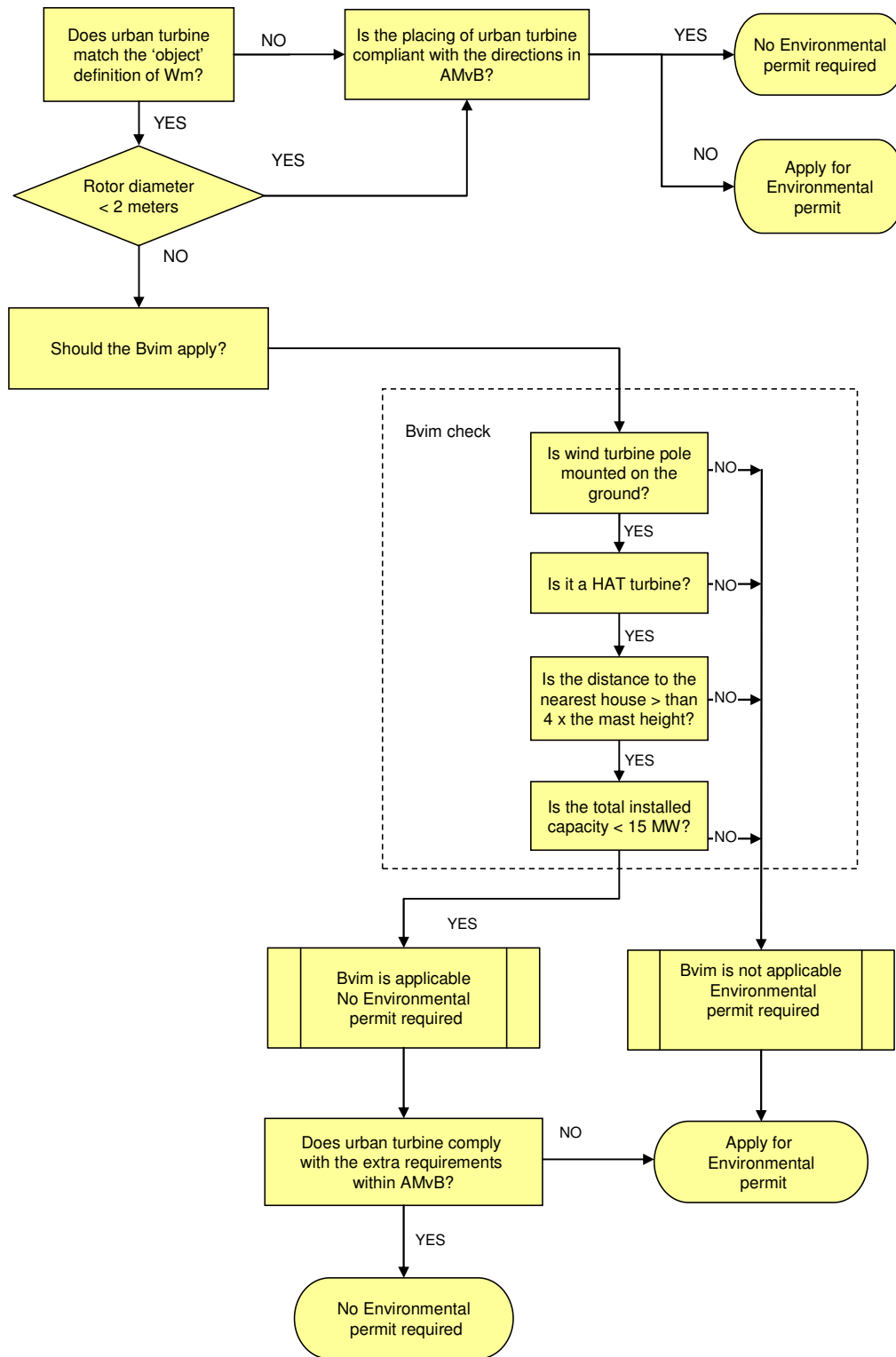


Figure 4: Environmental permit procedure⁵

3 SURVEY ON LOCAL INITIATIVES WITH URBAN TURBINES

3.1 Policy plan for small wind turbines, Province Zeeland

The Dutch Province Zeeland has developed a local policy regarding urban turbines. They recognize that the electricity generated by urban turbines is much more expensive than the electricity from large scale wind installations, but they see a lot of possibilities for small scale electricity generation with urban turbines in building surroundings and on places without the electricity grid.

The Province is aware that urban turbines are not certificated and the certification procedures are far too expensive (€ 50.000 - € 100.000) for the producers of urban turbines. Also, at this moment there are no clear safety standards for these turbines. Therefore they will ask for a safety statement by one of the Dutch institutions specialized in this kind of work like KEMA, TNO, TU-Delft or ECN.

According to this plan, the definition of urban turbine is as follows:

- Wind turbines with a relative small impact on the surroundings in terms of caution, disturbance and visual appearance.
- Suitable for the placement in direct living environment
- Comply to the following description:
 - Maximal height including the rotor and the mast is 15 m
 - Maximal rotor height for turbines with a vertical axes is 5 m
 - Maximal rotor diameter for turbines without wings is 2 m

Table 3: general guidelines for the placing of urban turbines

	Horizontal axes turbines (HAT)		Vertical axes turbines (VAT)	
	on ground	on buildings	on ground	on buildings
built surrounding				
high density	-	-	±	±
industrial area	+	-	+	+
countryside	±	-	±	±
public services	+	-	+	+

- + applicable under conditions
- ± applicable in specific situations
- not applicable

As a guideline for the dimensions, the province proscribes that in case of houses, urban turbine should be a half of the height of the building it is placed on. In case of large apartments and office buildings, the dimensions are less important. Also, on large buildings and on locations in the countryside, more than one urban turbine is applicable.

Urban turbines are obliged to have a building permit. During the permit procedure, the permit request will be controlled on:

- Spatial aspects: Development Plan and the requirements of the local authorities (welstand).
- Environmental aspects: The Law on Environmental Management (Wet Milieubeheer, Wm), Decree on Facilities and Installations for Environmental Management (Besluit

voorzieningen en installaties mileubeheer, Bvim) and the Local Decree (Algemene Plaatselijke Verordening, APV).

- Safety aspects: Building Act (Bouwbesluit), Housing Law (Woningwet) and Building Decree (Bouwverordening).

The policy plan of Province Zeeland is in the attachment of this report. At this moment, the Province of Zeeland is preparing a demonstration project with urban turbines.

3.2 Project in three Northern Provinces: 'Voor de wind gaan'

In the second half of 2004, the three Northern provinces: Drenthe, Groningen en Fryslan, have started a common pilot project with urban turbines. Within this project 22 urban turbines will be placed in three different types of locations: urban surrounding, industrial area and countryside. The turbines will be of 4 different types: HAT, Darrieus, Savonius and Venturi.

The project objective is to find out which kind of location is the most suitable for which kind of urban turbine. The main aspects of the project are: policy and administrative aspects, technical aspects, energy yield, financial aspects, social aspects and safety aspects.

Because of some difficulties regarding the project organisation and building permits, the placing of the turbines is still not finalized. Consequently, the results of the project are not yet evaluated.

3.3 Study on 6 project cases in Amsterdam

This study was ordered by the Energy Service ARC, who is also a partner in the Wineur project. The objective was to inventorize the existing experiences with urban turbines in Amsterdam and to disseminate the lessons learned among the 12 city districts of Amsterdam. The result is described in the report: 'Amsterdamse praktijkvoorbeelden van stedelijke turbines'. The approach at each of the six locations was as follows:

- Local authorities involved and their role in the project;
- The description of the process;
- Laws and regulations related to the project;
- Local policy in urban turbines.

The project cases were as follows:

3.3.1 City District Zeeburg: Turby on a public building



Figure 5: Turby

The process has already taken about two years without any result. The bottlenecks are:

- The location the authorities have preferred was not suitable;
- The local authorities involved at the building permit procedure are not enthusiastic about urban turbines;
- The existing legal framework is not suitable for urban turbines and the Development Plan includes no wind turbines.

3.3.2 City District IJburg: 5 urban turbines on a new, still to build house



More than a year ago, the architect has requested the building permit. The local authorities were positive, but the neighbours have protested against this plan. Therefore she changed the request making it only for the house. If the neighbours will be more cooperative in the future, she will start a new procedure for a building permit for wind turbines.

Figure 6: Draft of the house with 5 urban turbines

The bottlenecks as mentioned for this location are:

- There is no subsidy or other incentives for urban turbines;
- The existing legal framework is not clear about urban turbines;
- The permit procedure is not flexible. If, for any reason, she changes her mind regarding the type of turbine or exact place of the turbines on the roof, than she would have to start a new procedure for a building permit;
- There is no clear local policy regarding urban turbines;
- The neighbours are afraid of urban turbines (safety, birds, shading, value lowering of their houses).

3.3.3 City District Oost Watergraafsmeer: WindWall on the roof of a new office building



The local authorities have taken the initiative for the placing of a WindWall turbine on the roof of their new office building. The building permit, building development and the installation of the turbine went without any problems. Visual appearance of the building with the turbine is very nice and the turbine functions beyond expectations.

No bottlenecks were reported.

Figure 7: WindWall in Oost Watergraafsmeer

The involved persons have reported the possible opportunities for urban turbines:

- The local authority is the owner of the building;
- The owner wanted to realise an energy efficient building. Urban turbine contributes in this objective;
- The producer of WindWall provided a good information, an excursion and active promotion;
- The building owner had enough money for renewable energy in the building;
- Urban turbine was included into the Development Plan;
- The environmental and building permits for the urban turbine were handled together with the permits for the building;
- The responsible coordinator was a good manager;

- The producer of the turbine has implemented extra safety measures in order to match the extra requirements of the municipality.

3.3.4 City District Bos en Lommer, Turby on a public building



The local authorities wanted to place an urban turbine on one of their buildings. The authorities have handled the permit procedure themselves. The turbine was placed, but the owner is not satisfied with the electricity production.

The reported bottlenecks are:

- At a time of placing the turbine still had some technical problems. It took long before these were solved;
- The cooperation between the turbine producer and the consultancy which took care of the building permit was not good;

Figure 8: Turby in Bos en Lommer

- It took a long time before the contracting conditions with the producer were clearly defined;
- The electricity yield is lower than expected.

3.3.5 A WindSide turbine on a housing boat



The boat on which the turbine is placed is used for tourist tours in Amsterdam and for living. The owner of the boat wanted to generate his own renewable electricity. His requirements were: a good working turbine under the bad wind conditions on the channels in Amsterdam, no noise, long life time, safety, no visual disturbances, limited height because of the bridges. He has found that the WindSide turbine fulfils all of his requirements. There was no permit necessary because the boats do not fall within the building legislation.

Figure 9: WindSide on the living boat

3.3.6 Plans of the City District Zuid Oost

This city district has the intention for placing an urban turbine on their new office building. They expect ARC to make a survey and appoint the locations in Amsterdam suitable for the wind energy generation.

3.4 The Decision of the local authorities of the municipality of Haarlem

In 2005, the municipality of Haarlem has decided to allow the placing of urban turbines without building permit in cases where the turbine matches the following conditions:

- rotor diameter 2 m at maximum;
- not visible from the public road;
- when in operation, the turbine causes no vibrations;
- when in operation, the turbine causes no light flickering and shadowing;
- no changes in the roof construction necessary;
- the electrical power is 1,5 kW at maximum;
- when in operation, the noise production measured on the façade of the closest housing is 25 dB(A) at maximum.

The wind turbines which do not match these criteria, but their electrical power is less than 15 kW, will need the building permit, but do not have to pay the administrative fee. With this decision, the municipality wants to stimulate the placing of urban turbines in the city of Haarlem.

4 SUMMARY OF ADMINISTRATIVE AND PLANNING BARRIERS

The administrative and planning barriers were thoroughly investigated within the study of Kristel Meijers, a student at TU-Delft. Jadranka Cace was the external guide for this study⁵ with the title: 'Mini turbines in beweging' (Mini turbines in movement). In this way, the study was managed to give the results required for the Wineur project. In this chapter the summary of the outcomes from this study is presented.

4.1 Decision making criterions

The Ministries of EZ and VROM are the main responsible bodies regarding renewable energy in built surrounding. Together, they develop the new strategy and policy measures. In their decision process, and when evaluating the achieved results, they use the criteria as described in the table no. 4 below.

Table 4: targets and criteria of the decision makers in renewable energy in built areas

targets VROM and EZ	criteria
increasing the share of renewable electricity production	% of renewable electricity in the total production volume
CO2 reduction in building surroundings	Mton CO2 emission per year
appropriate spending of public money	governmental costs per kW or Mton
Safety, no disturbances in living and working areas	safety risks, environmental hazards
increasing of financial effectiveness	costs per kWh generated

4.1.1 Existing situation

The national government has formulated the environmental targets and activated a number of instruments in order to achieve these targets. The figure 10 displays the targets, instruments and relation between the various issues.

The existing programs do not include urban turbines, except for the financing measures MEP and EIA. However, the existing rates are not sufficient to make urban turbines financially feasible at this moment.

Theoretically, there are no constrains for urban turbines to participate in subsidy programmes, except that they can not be marked as 'new technology' any more because they have already been used in many projects, and in other subsidy programs they have to compete with large scale technologies such as large scale wind parks and biomass. These technologies score much better on the criteria as mentioned in table no. 4.

Within this study, TU-Delft has organised a brainstorm session in which the stakeholders from all relevant sectors could say what they think about different aspects regarding urban turbines. The following paragraph summarizes the outcomes of this session.

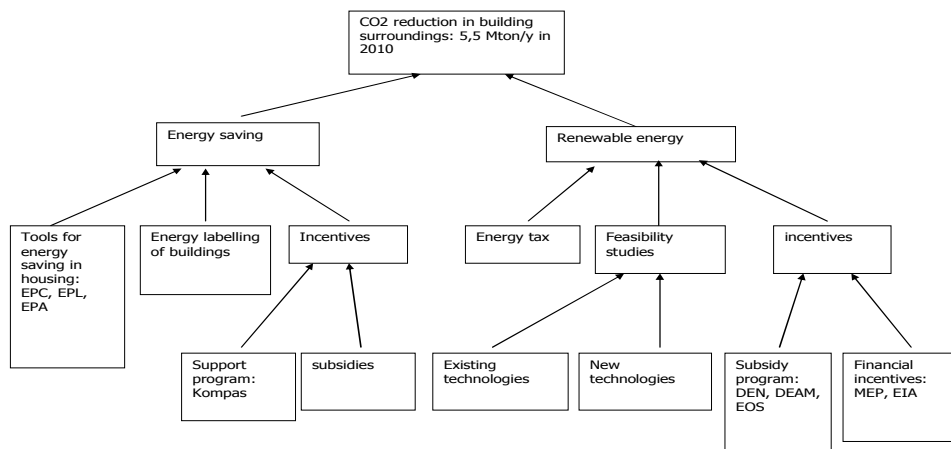


Figure 10: targets and instruments regarding the CO2 reduction in built surroundings

4.2 Statements and recommendations

4.2.1 Statements regarding spatial aspects

- Municipalities are responsible for the placement of urban turbines. They also issue the permits necessary for the placing. Therefore the municipalities should take the initiative of developing an active policy regarding urban turbines. In this, the municipalities should cooperate with the market parties involved with urban turbines.
- The permit procedure is at this moment too complex, especially because there is no general policy for urban turbines. The legislation and procedures are based on large scale wind turbines.
- Different regulations are contradictive: according to 'Bblb', all urban turbines require a building permit while according to Bvim some HAT-turbines require only an announcement.
- The VAT turbines with the rotor diameter >2m also need an environmental permit.
- As a result, the local authorities:
 - do not know how to use existing legislation and do nothing about urban turbines
 - give different interpretations to the legal framework. This leads to different requirements regarding the permit procedures per municipality.
- There are no clear requirements regarding the technical issues.

4.2.2 Statements regarding technical and environmental aspects

- Reliability, sustainability and safety are the most important technical aspects
- Noise and vibrations are the most important environmental aspects.
- At this moment there are no official criteria, no standards, no measuring and control systems for these issues in the Netherlands. Also, the technical data have been

measured by the producers, and not confirmed by independent institutions. There are institutions in the Netherlands which make incidental measurements for the producers, like TNO, ECN and TU-Delft.

- Visual attractiveness also depends on a personal experience, it can not be measured.
- Visibility is an issue: some investors want urban turbines because of their visibility, others want them to be invisible.

4.2.3 Recommendations regarding technical and environmental aspects

1. Government should mandate an independent institution to define a set of technical criteria and/or requirements and standards which urban turbines must match and develop an adequate measuring and control system for these issues. The government is to pay for the costs.
2. Each turbine type must undergo the standard technical and environmental test as described above. The costs of the type test should be proportional to the costs of the turbine. In that case, these costs will be calculated into the price. If the costs are not proportional, the government should subsidize a part of it.
3. Each turbine should undergo an independent, professional technical control before put into operation and later periodically (like cars). The costs of the start-up control make part of investment costs, the costs of periodical control make part of operational costs.
4. The sound measuring should be independent from the surrounding.
5. The requirements regarding the physical installation on the roof should be the same as for other installations on roofs.
6. Disturbance by light flickering and shadowing depend on personal experience. Colour and special surface treatment can help prevent disturbance.
7. The height and the power of urban turbine must be related to the location. There is no need for general constrains regarding these values.

4.2.4 Recommendations to the national government

The government should create the conditions for the market development for urban turbines. For this, governments should develop the following activities:

1. facilitate the development of the standards for urban turbines. The standards should be developed in cooperation with producers. TNO, ECN and TU-Delft are suitable candidates for this job;
2. facilitate a test field for the type testing urban turbines under standard test conditions;
3. facilitate the type testing of all urban turbines in order to generate an objective and uniform datasheet for all turbine types;
4. facilitate an information campaign about urban turbines;
5. take initiative to develop a general policy regarding urban turbines which, in combination with standard tests, will make possible placing of urban turbines without permits, with announcement only;
6. take initiative to integrate the requirements for the physical integration of urban turbines into the new integral legal framework van VROM, named WABO (Wet Algemene Bepalingen Omgevingsrecht) which will come into force in 2007;

7. Develop a feed-in tariff high enough to make a pay-back time under 10 years possible. The tariff should be equal to the feed-in tariff for solar electricity rather than for large scale wind installations. Perhaps it would be good to introduce a DEAM tariff (renewable energy behind the meter) for small scale local electricity generation.

5 INCENTIVES FOR WIND ENERGY USE IN URBAN AREAS

The incentives which can be used for urban turbines at this moment are:

1. EIA: energy investment deduction. This is a fiscal measure which makes it possible for commercial companies to lower the investment costs for approximately 14%.
2. MEP subsidy. This is in fact a feed-in tariff of 65 €/MWh. After registering as an energy producer and installing a dedicated producer's kWh-meter, the owner of an urban turbine can contract the selling of electricity to the grid. The minister of EZ is entitled to change tariffs each year according to the market prices. Since 1 June 2006, the tariff is 6,5 ct/kWh, minimal quantity to be contracted is 1000 kWh. The contract time is 10 years, the tariff stays constant during the whole contract period.

The market parties would prefer the feed-in tariff to be at least equal to the solar electricity (9,7 ct/kWh) or even better, equal to the feed-in tariffs in Germany. German tariffs shorten the pay-back time of the renewable energy installations down to 5-6 years.

In order to illustrate the role of urban turbines in the renewable energy targets for urban areas, we have made the following calculation for the Netherlands:

average electricity demand/household	3400	kWh/y
number of households	6.500.000	
RE targets for 2010	5%	
target per household in 2010	170	kWh/y
average electricity generation per turbine	4000	kWh/y
number of households per turbine	24	
number of turbines in 2010	276.250	

The calculation shows that if we would like to realize the complete target of 5% renewable electricity for households by urban turbines, we would need 276.250 urban turbines. This means one turbine per 24 households in average.



Figure 11: artist impression of urban turbines on the railway building in Den Haag



Figure 12: Fortis Montana turbines on the university building in Renson, Belgium

6 BLUE PRINT FOR PLANNING PERMITS

In this chapter, we delineate the 'ideal' permit procedure. The result of the procedure is a 'placing permit'. The procedure takes into account the recommendations of the market parties as given during the brainstorm session. It consists of three steps, namely: check if the turbine has a type guarantee (safety on technical and environmental aspects), if it complies with the new 'surroundings requirements' (WABO) which will come in place of the existing environmental and building permit requirements and if the roof of the building is suitable for the placement of the urban turbine. If the turbine can not meet any of the requirements, the placing permit cannot be obtained.

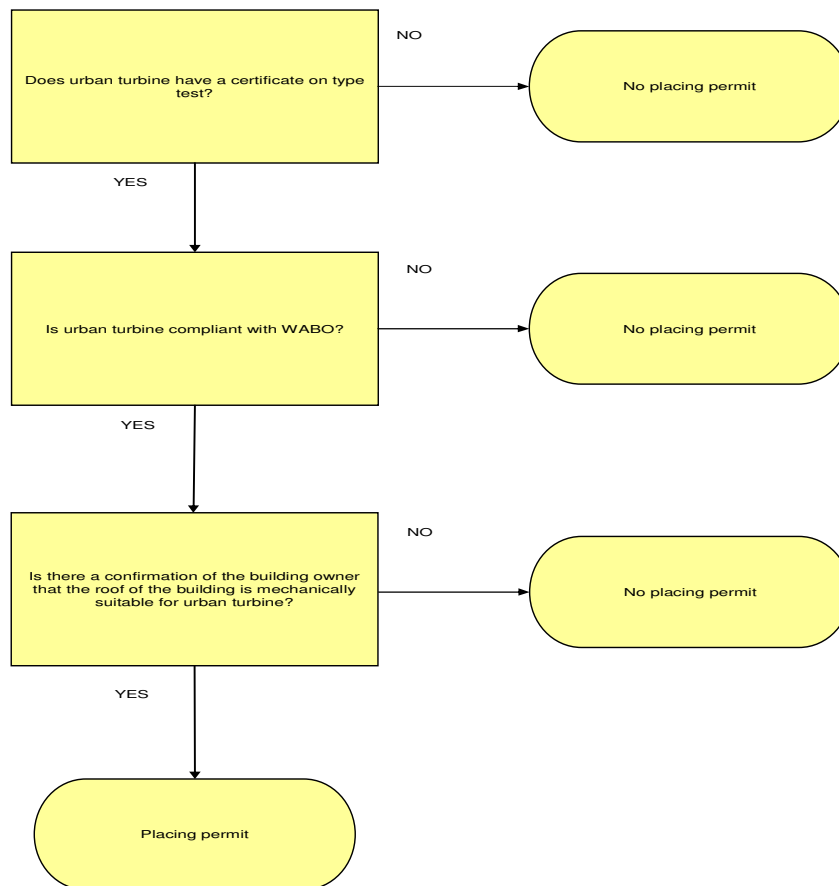


Figure 13: schema of the 'ideal' permit procedure for urban turbines

This 'ideal' procedure requires the following preconditions:

- Urban turbines are embedded into all relevant acts regarding renewable energy. This makes that the effects of urban turbines count for energy and environmental savings within: EPC, EPL, EPA and EPBD.
- There is a set of general safety and (environmental) quality criteria for urban turbines. Also there is an independent institution accredited for testing of urban turbines on those criteria.
- Each producer is (financially) able to obtain the safety guarantee.

- The set of general spatial requirements an urban turbine must meet is embedded into the WABO procedure. This also includes the directions regarding the dimensions of urban turbine in relation to the building the turbine will be placed on.
- Municipalities will not require any other procedures except for the special (for example heritage) buildings.

7 THE WAY FORWARD

In order to create a better market conditions for urban turbines and stimulate the market development, it is necessary to come to better financing conditions and easier placing conditions. Therefore parties involved with Wineur shall undertake the following activities:

Urge the Ministry of VROM to embed urban turbines within all relevant documents regarding renewable energy.

Urge the Ministry of VROM to include urban turbines into the new law on surroundings requirements (WABO) which will come into force in 2007.

Check the proposed placing permit with the wind cities, this will happen during the national meeting of wind cities in September of 2006. After the procedure has been approved, it will be incorporated into the final report of Wineur in which all tools and recommendations regarding urban turbines will be presented.

8 APPENDIX

I. Declaration of information sources:

1. report: 'Energy in the Netherlands 2006', EnergieNed
2. Magazine: 'WindNieuws' June 2006, ODE
3. Website Ministry of VROM: <http://www.vrom.nl/pagina.html?id=18257>
4. report: 'Gemeenten aan de wind', VNG 2003
5. website SBR: <http://www.sbr.nl/windturbines/default.aspx?ctid=4423>
6. policy plan province of Zeeland
7. policy document municipality of Haarlem

II. Overview of participants brainstorm session

Bedrijfsnaam	Contactpersoon	Adres	Postcode
Fabrikanten			
Tulipower	Hans Duivenvoorden	Van der Palmkade 44	1051 RE Amsterdam
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Windwall	Rob Roelofs	De eiken 5	7491 HP Delden
Provane 5	Kees van Hoeven	St. Annastraat 187	6524 EW Nijmegen
Windside	Wim Stevenhagen	Postbus 126	5670 AC NUENEN
Venturi Wind Turbines	Dirk Elzinga	Stationsweg 18	7429 AD DEVENTER
Fortis Windenergy	Johan Kuikman	Botanicuslaan 14	9751 AC HAREN
Neoga - Ecofys	Geert Timmers	Kanaalweg 18/C	3526KL Utrecht
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Windturbojet			
Firanko Techniek BV	Hans Verlaak		Breda
Overheid			
Gemeente Waddinxveen	de heer van Vaalen		
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Provincie Zuid-Holland	Cindy de Groot	Postbus 90602	2509 LP DEN HAAG
EZ	de heer Hondebrink		
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SenterNovem	Addie Weenk	Postbus 8242	3503 RE Utrecht
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			1191 EP Ouderkerk a/d
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Hogeschool	Louis Kanneworff		
Horisun	Emil ter Horst		
Overig			

Eneco	Hadi Akbari		
TH Rijswijk - Rotation	Eize de Vries		
Docenten TU			
TU Delft	Ivo Bouwmans		
TU Delft	Els van Daalen		
TU Delft	Gerard van Bussel	Postbus 5058	2600 GB Delft

9 ATTACHMENTS

1. Policy plan province of Zeeland
2. Survey on 6 urban turbine project cases in Amsterdam