Socio-economic issues related to the installation of small wind turbines in the built environment

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AXENNE Power HORISUN RenCom DMB Energiebureau ARC ADEME

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Contractor:

HORISUN
David Ben Goerionstraat 42
3573 XP Utrecht
The Netherlands
Tel. +31 30 276 0380
Fax. +31 30 276 0381
E-mail: eth@horisun.nl
http://www.horisun.nl

Author:
Jadranka Cace, RenCom

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1 Introduction

This report is a deliverable of WP4 of the WINEUR project, funded by the European IEE program. The report presents the combined results of the socio-economic survey in the UK, France and the Netherlands. The report elaborates the main socio-economic issues related to urban wind turbines (UWTs), like: attitude of different stakeholders, visual impact, safety, noise production, information and communication, possible effects on job creation.

1.1 UWT market in the UK, Netherlands and France

1.1.1 Supply side

In the Netherlands, there are 14 vendors of UWTs. Eight of them sell their own technology, other sell turbines of Dutch or foreign manufacturers. There are more than 13 manufacturers of UWTs in the UK and many more suppliers of both UK and imported UWTs. At a present moment there are no French UWTs suppliers.

1.1.2 Demand side

In both UK and the Netherlands, there is a vivid interest of wide public in UWTs. In the last five years, more than a hundred UWTs have been installed in the UK and 56 in the Netherlands. France has a very few UWTs in operation, all of which in rural areas. The majority of the installed UWTs in the three countries are single turbine installations on the roofs of buildings or on the ground next to buildings in urban, industrial or rural surroundings.

Presently, there are two projects in preparation in the Netherlands were UWTs will be placed in groups on rooftops and on the ground. One of the projects is an initiative of the city council of The Hague to place 30 – 50 UWTs on several visible locations in the city.

1.1.3 Legal and financial framework

UWTs are available in different shapes and types. The horizontal axis models with blades have been on the market for many years already. This type is the most suitable for open space locations in rural areas. The innovative technologies, specially developed for deployment in built surroundings, are not yet mature. Consequently, they are not included in the national renewable energy programs of the three countries and the legal framework regarding UWTs is still not in place.

1.1.4 Financial incentives

The financial incentives differ per country:

In the Netherlands there is currently only a fiscal incentive named EIA which is applicable for all kinds of renewable energy installations. It makes it possible to obtain up to € 5.000 per UWT with a nominal power under 25 kW. The subsidy of 6,5 €cents/kWh generated by UWT, the so called MEP, was stopped in October of 2006, but there are indications that it will be reintroduced at the beginning of 2008.

In the UK, a grant can be obtained from the Low Carbon Building Programme (LCBP) to cover up to 50% of the installation costs.

In France, there are three incentives which can be used for UWTs:

- a feed-in tariff between 7,65 and 9,43 €cents/kWh for UWT under 3 kW,
- 50% tax credit on the investment costs for private persons,

- no building permit required for UWTs smaller than 12 m.

Furthermore, in all three countries, some provinces and municipalities provide additional subsidies as a part of their own renewable energy development programmes. Most commonly these subsidies make part of local measures against climate change and are usually reconsidered on a yearly basis.

1.1.5 Obstacles to the market development

The main obstacles to the market development are:

- Lack of technical standards regarding safety, noise pollution and building integration of UWT,
- Lack of independent, objective product information regarding technical quality, noise production and energy yield,
- Lack of information about UWTs and about the lessons from the ongoing UWT projects,
- Lack of a recognition and support by the national government,
- Lack of financial incentives,
- Long and expensive permit procedures as UWTs cannot be certified due to the lack of standards.

1.2 Stakeholders

All parties involved with UWT, from development to installation and maintenance, are considered to be stakeholders. Each of these parties has a certain role and responsibility in contributing to the product and market development, implementation, information, marketing, physical or electrical integration of UWTs. The table below describes the parties and their roles.

Table 1: Stakeholders and their roles

Parties	***Roles / Involvement***
National government (Ministry of Economic Affaires, Ministry of Spatial planning and Environment)	Define national targets for renewable energy, provide national legislation (including safety), define the R&D program for renewable energy (RE), and develop incentives for the realization of national RE targets. Disseminate the results from pilot and demonstration projects to all stakeholders.
R&D organizations	(market) research, support the development of UWT, solving of identified (technical) problems.
Manufacturers	Development and manufacturing of UWT, market development, safety and durability, information, promotion
Regional governments	Define regional RE targets as a part of national targets, develop regional policies and plans, develop regional incentives, initiate pilot projects with UWT, information and communication, dissemination.
Municipalities	Define local RE targets, develop local policies and plans, develop local incentives, initiate pilot projects with UWT , provide permits, develop local legislation and regulations, information and communication

Educational institutions: high schools and universities	education of technical, legal and financial specialists, development of technical innovation, testing of UWT
Architects and urban developers	spatial integration, building integration, visual aspects, roof constructions
Property developers	Integration of UWT into new to build and retrofit projects involving large buildings with flat roofing.
Engineering companies and consultants	support with acquiring permits, roof construction assessment, project support
Energy agencies	information, communication, promotion, project initialisation
Owners of large buildings (corporations, companies)	Deployment of UWT, providing the roof space to other interested parties who want to apply UWT
Private owners of large free standing houses	Deployment of UWT
Installation companies	Installing UWT, guarantee electrical safety, fit the requirements of the regional grid operator, maintenance
Energy companies	Purchasing and distribution of the produced energy, include UWT into their product portfolio, information, communication, maintenance
Regional grid operator	Connecting UWT to the public grid, metering data collection, registration and administration, safety of the public electricity supply
Metering companies	Supply of measurement equipment for feeding into the grid
Financial institutions	Development of financial products targeting small energy producers including UWT owners
Environmental organizations	Monitoring of environmental effects of UWT, initiate and support pilot projects with UWT, communication, dissemination.

The most active stakeholders at this moment in all three countries are the manufacturers and local governments. The main focus of the manufacturers is the technology and market development. Local governments like provinces and municipalities are developing their programs for energy cuts and environmental protection. Some of them expect that UWTs can play a role in these programs.

1.3 Methodology

In order to get a clear view on the socio-economic issues of UWTs, three different methods have been applied, namely: workshops, inquiries and face-to face interviews with different stakeholders involved with UWTs. The Netherlands, 115 questionnaires were sent out and 52 responses were received. The questionnaires were sent to all parties involved with the different phases of the life-cycle of UWTs, from the development to the maintenance. Figure 1 below shows the share of representatives from different target groups in this survey in the Netherlands.

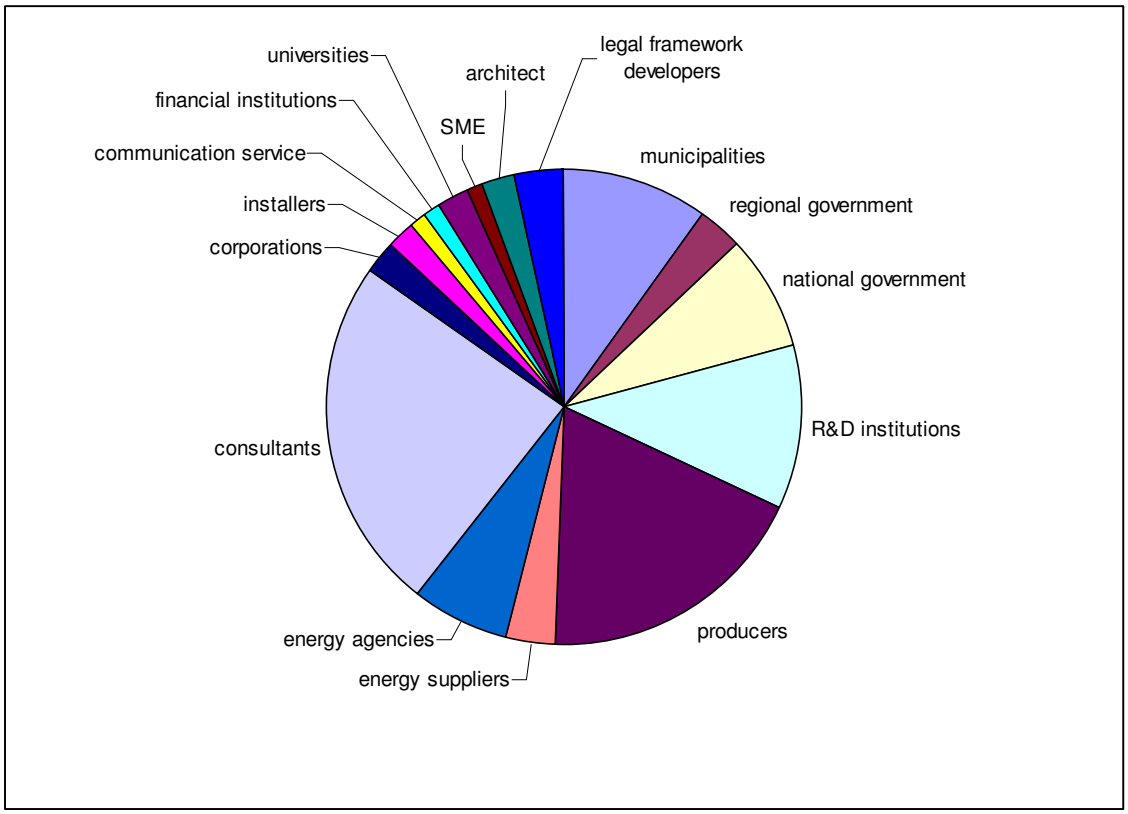


Figure 1. Respondents of the Social-economic questionnaire in the Netherlands

In the UK 186 questionnaires were sent out and 58 responses were received. The questionnaires were sent to a few key groups whose attitude towards UWTs was considered very important for the development of the UWT market. These were: local authorities, homeowners, current owners of UWTs, energy traders, architects and financial institutions.

In France the questionnaire was sent to the building sector, architects and the public housing sector. These groups were considered the most important for the future market introduction of UWTs in France. 30 responses were received. Some issues could not been analyzed by French partners due to the lack of practical experience of the respondents.

This report combines the outcomes from the questionnaire inquiries, workshops and face-to-face interviews per issue.

2 Outcomes of the survey

2.1 Awareness regarding renewable energy

In all three countries a majority of the respondents thought energy is very important. As the main reasons the following options were chosen:

Why do you consider energy issues important?	NL	UK	FR
Energy is important for the future of our society	1	1	2
Energy generation causes greenhouse gasses and acid rain	2	4	1
Energy is expensive	3	2	3
Energy is scarce	4	3	4

The renewable energy was well known to all respondents, especially solar photovoltaic and wind energy. In France, the respondents also preferred solar and wind energy, but did not distinguish between solar thermal and solar photovoltaic.

The majority of the respondents in the Netherlands and the UK named 4 different forms of renewable energy.

Surprisingly, in all three countries, the architects seem to have a rather passive attitude towards renewable energy. They do not actively search for the possibilities to apply more renewable energy in their projects but rather act on demand. In that case, they see it as a requirement, not as an addition to the building which in the future could be applied on a regular basis. This way of thinking is also recognized from experiences with building-integrated solar energy. In the Netherlands, very few architects have accepted the idea that a local energy conservation and energy generation could be a structural part of the building design. Partly, this is a consequence of the attitude of very traditional building branch, focused on financial and logistic efficiency.

Local governments in all three countries are well informed about all types of renewable energy.

2.2 Current renewable energy use

All respondents in all three countries stated that they would like to use renewable energy. More than a half of the Dutch respondents were owners of PV installations and a half of them currently use green energy. As the most important criteria used to choose for renewable energy, the respondents named:

The main criteria to choose for renewable energy	NL	UK
I want an installation of my own	1	2
A product that is simple to get, I don't need to be able to see it, such as green electricity	2	1
A product that is simple to get and visible	3	3

The other criteria the Dutch respondents named are: an acceptable pay-back time, not too expensive and integrated into the house. The majority of the respondents in the Netherlands and France find that the pay-back time for a renewable energy installation should be below 10 years.

In the UK, only 20% of the respondents use renewable energy, mostly in the form of green electricity. 55% thought that renewable energy was too expensive.

The French respondents did not receive this question due to a very low penetration of renewable energy on their market.

Regarding the responsibility for the new energy capacity, the respondents from the Netherlands, UK and France seem to disagree about the importance of different parties.

Who is responsible for the development of the new renewable energy capacity?	NL	UK	FR
Government	1	2	2
energy production companies	2	1	3
Customers	3	3	1

The majority of the Dutch and British respondents think that renewable energy generation should be obligatory by law. Also they assume that using the renewable energy affects their image.

In France, the respondents think that renewable energy has no effects on their image.

2.3 Wind energy

In all three countries the wind energy is well known. and the respondents are aware of the main bottlenecks associated with the implementation of large wind turbines. In the table below the main obstacles as specified per country.

NL	**UK**	**FR**
Scarce space	Visual issues	Noise
Permits	Noise	Landscape integration
Noise	Structural concerns	Not nice
Shadow	Cost	NIMBY
NIMBY*	Impacts on birds	Danger for birds
Not nice	Reliability of wind	Flicker
Danger for birds	Public perception	Reliability of wind
Costs	Energy storage	Vibrations

*NIMBY: not in my backyard. Attitude of people who are positive towards wind energy except when in comes close to their house.

2.4 Urban wind turbines

2.4.1 Attitude

All Dutch respondents were well aware of UWTs and have seen them. 86% of the UK respondents have heard of UWTs, but 40% have never seen one. In France, 65% of the respondents have heard of UWTs, but 35% have seen them.

Figure 2 below shows the personal opinion of the Dutch respondents regarding UWTs. They think it is good to generate electricity on places were it is needed, and that some UWTs are quite nice. The environmental benefits are mentioned in the third place.

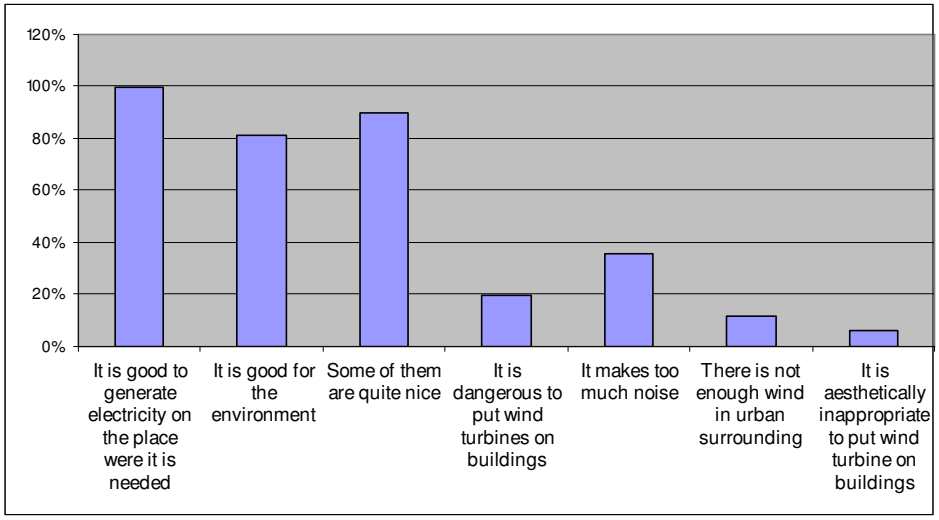


Figure 2: Personal opinion of the Dutch respondents regarding UWTs

The respondents from the UK and France recognize the use of wind turbines in the urban environment as a positive step. Most participants identified that it was good to produce electricity where it is needed and that use of urban wind turbines was good for the environment.

Previous surveys in the field of large wind turbines have shown that people are generally positive regarding wind energy, but it becomes a problem when wind turbines are to be located in the neighbourhood. This is called the not-in-my-backyard (NIMBY) effect. This effect seems to appear also in relation to UWTs. The majority of WINEUR respondents say that they would agree with the placement of UWTs on the building they live in. On the other hand, the survey on five project cases in Amsterdam (Anne Elsen Milieuadvies: Amsterdamse Praktijkvoorbeelden Stedelijke Windturbines) showed that in one case the neighbours protested against a possible deployment of UWTs on a new to build house in their neighbourhood, and as a result the UWT's could not be placed. During the preparations of one project in the province of Zeeland, there were also heavy neighbourhood protests during the permit procedure. In the on-going project in the three northern provinces of the Netherlands, there were several cases of protesting neighbours before the placement, but also after the placement. Protests during the permit procedure make it impossible to get a permit. Complaints after the placing, if the issues were unforeseen and can be objectified, would lead to the project being reconsidered. In one case protests after an UWT was placed have led to it being removed. The main reason for protests is the fear of noise, flicker (sun reflection from blades), shadow, vibrations, safety concerns related to possible incidents (broken blades) and deterioration of property value in the neighbourhood.

About 40% of the Dutch respondents would not accept UWTs due to visual disturbances, noise, too much maintenance and high costs. Some of them also find that their location would not be suitable for UWTs due to the lack of wind, monumental buildings, too much vegetation or expected protest from their neighbours.

All owners, public institutions as well as private persons, were enthusiastic about their UWTs, although the electrical yield in all cases was beneath expectations. It is clear that having an UWT means more than only electricity generation. This is the case in both UK and the Netherlands. Figure 3 below shows there was a positive change in the opinion of a local communities and neighbouring residents from before to after installation.

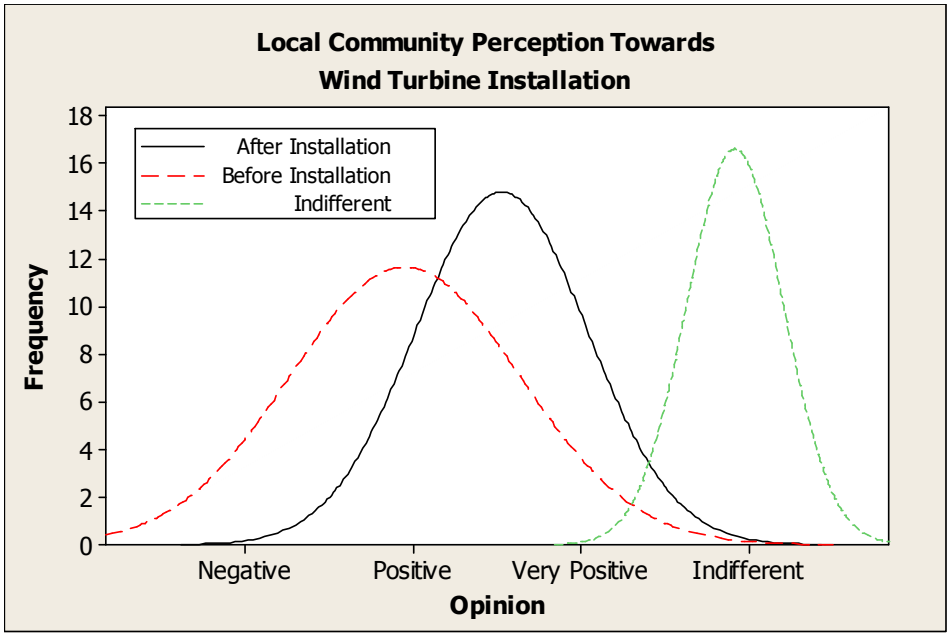


Figure 3: Distribution of attitudes towards UWTs

In the Netherlands, the owners of free standing houses in rural areas see wind energy as a natural and traditional way of energy generation. Therefore the general attitude concerning UWTs is very positive and resistance against the placement of UWTs in the neighbourhood is much lower than in densely built city districts.

Most of the respondents, both those with positive and those with negative attitudes, expect long and difficult permit procedures for UWTs.

2.4.2 Visual appearance

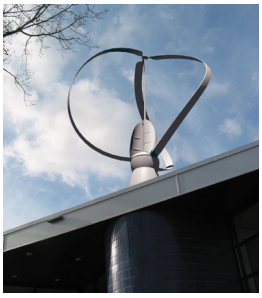
This section of the questionnaire consisted of ten pictures of different urban turbine models of various designs that are available throughout Europe. The images included traditional designs based on old-fashioned wind machines and seen on wind farms internationally, as well as more contemporary designs with both vertical and horizontal axis. The respondents were asked to mark each machine out of ten for appearance.

The average marks in the Netherlands vary from 5,3 for WindSide to 7,2 for Turby. Also interesting is the range of the individual marks per turbine type which varies from 1-9 for Provane to 3-8 for WindWall. This could indicate that some of the respondents have a strong personal approval or disapproval for a certain type of turbine which goes beyond the physical appearance.

In the UK, nine turbines scored between five and six. The only one to score an average of seven was Neoga, a vertical axis turbine from the Netherlands.

The marks of the French respondents went from 5,2 for the Tulipo up to 7,95 for Fortis Montana. It is interesting that Provane, which has almost identical visual appearance was marked only 5,5. Neoga scored 7,75.

Venturi



Neoga

WindWall

WindSide

Turby

Tulipo

Fortis Montana

Provane

Figure 4: Different types of UWTs

The face-to-face interviews with building experts and architects in the Netherlands learned that in their daily life, architects are not considering the possible deployment of UWTs. They only start thinking about it if they get a specific request to develop a building with UWT. In that case, they see it as a requirement, not as a feature of the building which in the future could be applied on a regular basis. This way of thinking is again recognized from experiences with building integrated solar energy. In the Netherlands, very few architects have accepted the idea that a local energy conservation and energy generation could be a structural consideration while designing a building.

2.4.3 Safety

Safety relates to a wide range of areas from installation to necessary maintenance, how securely the machine is fitted and effects on the building stability. Safety is generally a high profile issue, and many people deem it as very important especially with regards to their home and family in general. Therefore it is not surprising that safety of wind turbines was identified by over 80% of participants as being 'very important'.

The Dutch and British respondents state the safety as the most important issue. The French respondents put the quietness in the first place. Also, there are some significant differences regarding other issues. The figures 5, 6 and 7 below illustrate these differences.

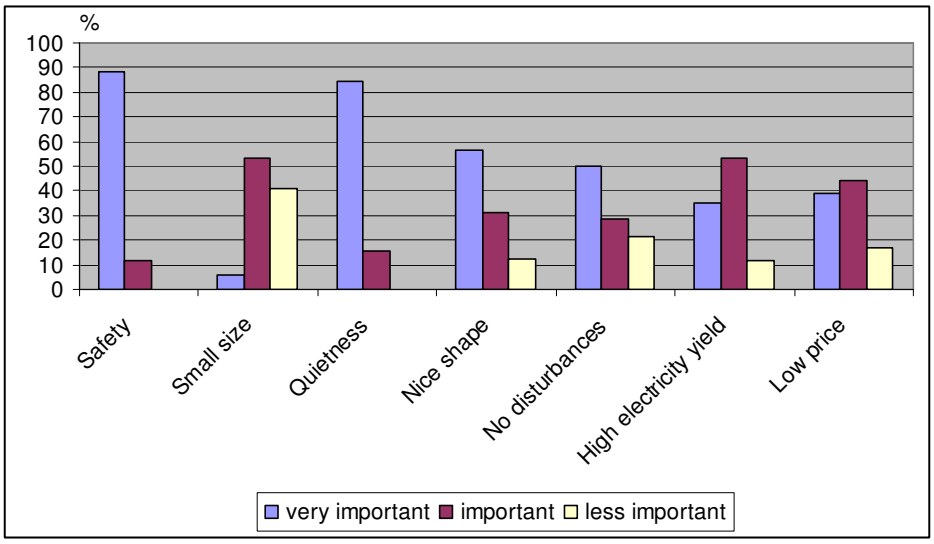


Figure 5. Factors considered important in UWT selection and installation in the Netherlands

The Dutch respondents have found 'safety' and 'quietness' the most important aspects of UWTs. 'Nice shape' and 'no disturbance's were the next two most important issues followed by 'small size', 'high energy yield' and 'low price'. It is clear that respondents of the questionnaire think differently from people who want to buy an UWT, because the first two questions the potential Dutch buyers ask are about 'energy yield' and 'price'.

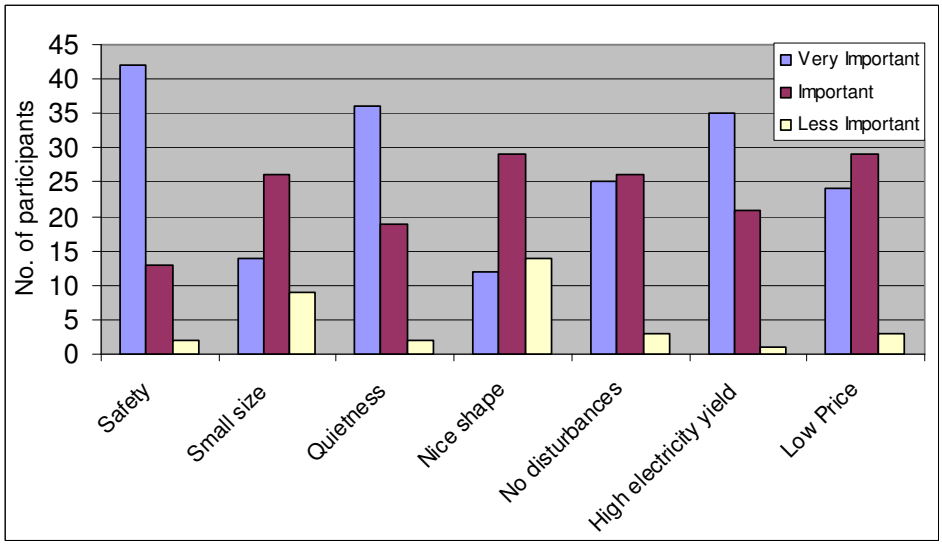


Figure 6. Factors considered important in UWT selection and installation in UK

Safety is in the first place a technical issue, but it has a large impact on acceptance of UWTs. Therefore it is necessary to make safe UWTs, to provide evidence of good test results, demonstrate it in pilot and demonstration projects, and communicate about it. This is a standard approach in the world of technical installations, but has not yet been applied for UWTs.

The most important reasons why UWTs are still not certified are: the technology is (in most cases) not yet mature, the certification standards are not in place and the manufacturers are not able to finance the high certification costs.

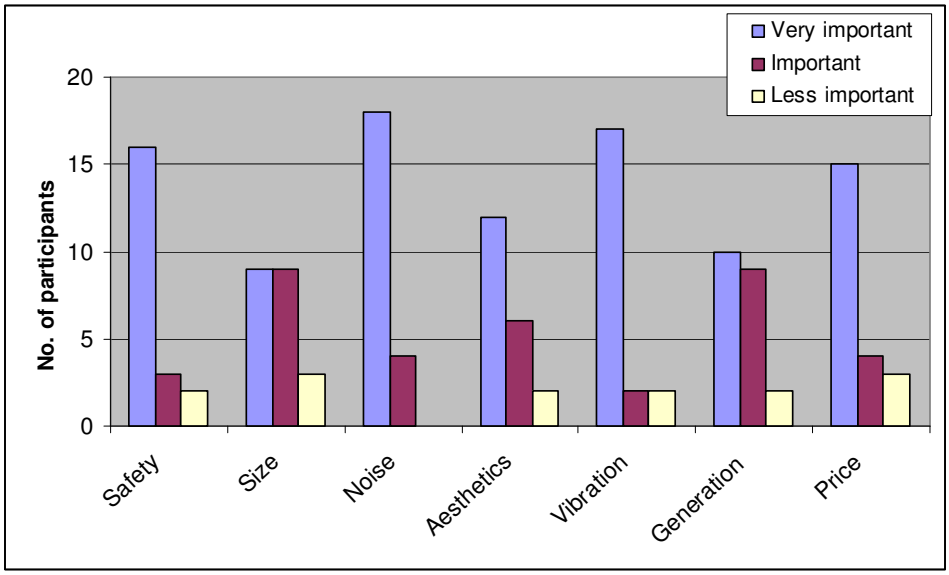


Figure 7. Factors considered important in UWT selection and installation in France

The agreements concerning standards and certification should be made at the international (IEC) level, although at first a start can also be made at the national level as this will be faster. It takes approximately 5 years to agree on an IEC norm. At the national level, safety criteria regarding UWTs will differ by country. This has to do with the environment of the deployment. In the United States UWTs are most commonly deployed in rural areas. The requirements in Europe are different and the deployment varies per country, but urban deployments are a far bigger issue. Therefore it would be a welcome initiative to define a European set of norms for UWTs.

The physical integration of UWTs onto buildings is a complex undertaking, very much dependent on various local conditions. It would be opportune, given the interest in building-mounted wind turbines to produce specific guidelines for safe installation of UWTs on building rooftops. These would have their basis in existing structural assessments and construction norms and guidelines. If there were building integration guidelines for UWTs to comply with, the effort of granting the permit could be reduced to a minimum, simplifying the process and saving time and money.

2.4.4 Noise production

The perceived noise will depend on location (noise above background noise) and on distance from the nearest house. Different models also produce different levels of noise.

Most of the vendors are too optimistic when characterising the noise level of their UWTs. Some of them even state that their UWTs produce no noise at all, although this is physically not possible. The rule of thumb is that the lower the rotation speed, the lower the sound production. Experiences with

large wind turbines have shown that a certain shape of blades can also help lowering the sound level.

In one of the on-going projects in the Netherlands, the noise has been one of the reasons to stop some of the UWTs during night hours. This is because during night the background noise, especially from traffic, is much lower and the sound of UWT is being perceived as much louder. Because UWTs are installed in built surroundings, the sound level is important when it comes to public acceptance.

The legal framework for noise measurements on UWTs is still not in place. Few R&D institutions in Europe are currently investigating these issues.

2.4.5 Impact on urban planning

It is important to prevent UWTs from creating visual disorder, as was the case with TV antennas on rooftops in the sixties and seventies. This could be reached by concentrating UWTs in suitable areas and carefully selecting the types of UWTs which make the best functional and visual composition with the building and the surroundings. It concerns areas with large, robust buildings, industrial areas and open areas along waterways and seashore. Important issues are: dimensions, shape and colour of UWTs, but also the number of UWTs per location. Because UWTs are available in many different shapes and sizes and each type operates best under different conditions, the choice of UWT model for each potential installation site should be studied carefully. Large, robust buildings with flat roofs are the most suitable for UWTs due to better wind conditions and the possibility to place more then one UWT.

It is expected that the new urban areas will be more suitable for UWTs, but existing locations can also be considered, especially in cases of large modernising projects.

Although some UWTs have a visual appearance similar to the modern GSM and UMTs antennas, there is an essential difference: UWTs rotate. Therefore they need a place in a full wind flow, and as a consequence have a more accentuated visual appearance than the still standing antennas. The possibilities of flicker, shadow, noise and other disturbances must be investigated for each location in an early stage, as well as the acceptance of the neighbourhood.

It is preferable to place UWTs in clusters instead of single UWTs. It is visually more attractive to see a group of, for example, 10 UWTs of the same type on one roof than ten buildings with one UWT each. Also, it will be easier and cheaper to get a permit for one location with ten equal UWTs than for ten different locations and the quantity of generated energy will be in better proportion to the electricity demand on location.

The aesthetic quality of the UWT implementation in a certain area should be integrated in the spatial development of the area, both as a part of the procedure as well as budgetary. Usually, the budgets for the development of new areas cover the material costs, but the development costs are often forgotten.

2.4.6 Energy saving and green electricity trading

Renewable energy production is one of the most important reasons for deployment of UWTs. By using the electricity generated from their UWT, the owners save energy directly. The financial savings following to the energy saving depend on the price the owner pays his supplier for the electricity from the grid. For example, customers of ENECO pay approximately 21 €ct/kWh.

In the UK, typical cost of electricity for individual consumers can range from 11 p to 16 p/kWh. The prices depend on the time during the day (or night) when electricity is used.

If there is a surplus of electricity generated from a small wind turbine, in theory it can be sold and the owner decides to whom. Most commonly it would be sold to an electricity supply company. The

price can differ considerably from one electricity company to another, so it is worth investigating several options. For example, in the Netherlands, ENECO pays 4.088 €cents/kWh excluding VAT (2007). The electricity supplier Green Choice gives discount on the supplied electricity to his customers who feed their energy surplus into the grid. Selling electricity to the grid is regulated differently in each country. If the owner of a UWT wants to sell his electricity to the grid, (s)he may need to have a specific type of meter that measures both ways: the electricity sold to the grid and the electricity consumed from the grid. This type of meter is readily available but is not installed as standard and so may need to be installed as part of the wind turbine installation.

2.4.7 Price of UWT

Price is the factor which ultimately effects the feasibility of wind turbines as a source of micro-generation for the general public.

The initial (capital) investment per kW can vary greatly between different UWTs: according to the information provided by suppliers and manufacturers it can be between 2,400 and 9,100 €/kW. In comparison, the initial investments for large turbines are about 1000 €/kW for land installations and about 2000 €/kW for off-shore (investments in solar photovoltaic (PV) systems are approximately 6,200 €/kWp installed).

The expected yield, assuming there is an average wind speed of 5.5 m/s, would very approximately amount to 150 - 400 kWh/m^2/year. The yield of large turbines varies between 800 and 1200 kWh/m^2/year.

The figures indicate that large turbines clearly outperform UWTs and this is not surprising, as the conditions under which they are implemented are very different. However, UWTs are still in a development phase and although it is unlikely that they will ever reach the yields of large wind turbines (since wind resources are not the same in urban environments) it can be expected that costs will fall and the efficiency of UWTs will be significantly improved. Manufacturers of UWTs in the Netherlands and the UK expect a price reduction of about 40% by a ramped-up production of at least 500 turbines per year.

Finally, UWTs generate electricity that can be directly consumed at the site of generation. This means that the produced electricity is effectively being used against the consumer price which is approximately 5 times higher than the price paid for the electricity produced by large turbines.

Considering the installation capacity, costs and the expected yield, it is better to compare the UWTs with solar PV production of electricity. A detailed comparison between PV installations and UWTs is available on the WINEUR web site: www.urbanwind.org.

2.4.8 Preferable locations for UWTs

Participants were asked to say where they thought was the most appropriate place for urban turbine installations. The possible locations for UWTs were listed in the question as:

- On public buildings (sports arenas, exhibition halls etc)
- On apartment buildings
- On office buildings
- On normal houses
- On the ground

According to the Dutch respondents public buildings, office buildings and apartment buildings are the most preferable objects for placing of UWTs.

The majority of British participants thought all the locations listed were suitable for the installation of urban turbines. The least popular location was seen as being on the ground with only 53% identifying this location as suitable for urban turbines.

The French participants think that public buildings and office buildings are the most suitable objects for UWTs.

2.4.9 Current users of UWTs

According to the present owners of UWTs, their decision to have a UWT was motivated mainly by the following reasons:

- contributing to the reduction of CO_2,
- green image,
- communication, sending a message to others.

2.4.10 Motivation for the usage of UWTs

A growing interest for UWTs is directly related to the recent rise of energy prices and the fact that the reliability of energy supply and the need for clean energy generation have become daily news. Commercial organizations use UWT in the first place to communicate about their positive attitude in relation to renewable energy and to establish or strengthen their green image.

Regional and local governments like provinces and municipalities have developed their Climate plans with ambitious targets for CO_2 reduction and the preservation of the environment. They see UWTs as a promotion tool which makes it possible to make a visible statement and send a massage to the public about the necessity of environment protection.

The owners of large buildings consider UWTs partly for promotion purposes and partly to meet the obligations forthcoming from EPBD (Energy Performance in Buildings Directive) and similar directives.

Private house owners see UWTs as a possibility to save on energy costs and/or get independent from their energy supplier.

2.5 Opinion of the respondents from the specific target groups

2.5.1 Municipalities and/or other Local Authorities

The participants from the Dutch local governments have stated that they have renewable energy generation targets in their present program. None of them has any kind of guidelines or directions for the implementation of UWTs.

In the UK, the government has set a national target to reach 20% electricity production from renewables by 2020. Surprisingly, the number of local authorities with targets for renewable energy was very low: only 22%.

2.5.2 Building owners

The Energy Performance in Buildings Directive (EPBD) will affect all building owners in the future, so here we looked at the level of awareness of the directive with building owners, property developers and architects.

All Dutch respondents from this target group are aware of the European Energy Performance in Buildings Directive which will be implemented in the Netherlands in 2007. They also think that it would be good to implement UWTs in built surroundings.

In the UK, the building owners who were also members of local municipalities were all aware of this directive. However, the architects who responded were all unaware and the general public were almost all unaware.

In France, 85% of the architects who took part on the survey have never heard of the EPBD (in French: DEPEB) although it is in force since january 2006. Some of the respondents from other target groups new about this European directive. Probably a poor communication about this issue is the reason of such a low knowledge at the most important target groups.

None of the respondents thinks that implementing UWTs can increase the market value of buildings.

2.5.3 Financial institutions

The respondents from the financial institutions stated that they do not have any special financial products for UWTs and that they do not intend to develop any. They are interested in financing UWTs in the same way they finance other renewable energy technologies, namely on the basis of a good business plan.

2.5.4 Energy Suppliers

The energy suppliers from the Netherlands think that UWTs can play a part in the electricity production in urban surroundings. Consequently, they are going to develop a feed-in tariff for the electricity from UWTs. They expect problems with the use of UWT, especially regarding permits and protesting neighbours.

2.5.5 Possible effects on job creation

It is very difficult to predict the effects of larger production volumes of UWTs for the number of jobs in the UWT business. At this moment UWTs are made in very limited series of 5 to 10 pieces. Most of the manufacturers have contracted out the production of different parts of turbines to various suppliers. Therefore they do not have a precise overview of the total number of ftes (full time employees) working on the UWTs. The estimations vary per manufacturer. The general impression is that the average number of ftes is lower for innovative types of UWTs. According to the information as given by the manufacturers, the production efficiency varies between 8 and 16 UWTs/per person per year.

The ftes at universities and R&D institutions are not included in the fte calculation as mentioned above.

It is not clear whether the large scale production would stay in the Netherlands or would be moved abroad.

2.5.6 Opinions on encouragement of UWTs

On the question what would be their message to the government regarding UWTs, the respondents form the three countries have given the following answers:

- Cut down on paper work,
- Create a clear legal framework integrating noise restrictions, design requirements and building integration requirements,
- Governmental support for technical development,

- Develop a simple certification standards for UWTs,
- When certificated, no building permit necessary,
- Stimulate utilities in providing a level playing field for selling surplus back to the grid,
- Stimulate the use of UWTs. The public will get interested if they see more UWT's
- Local governments should promote UWTs and install them on their own buildings,
- Support the sector with investments. There is a large potential for UWTs in the built surroundings,
- More fiscal incentives,
- Statement on the potential contribution of UWTs to renewable energy targets,
- Publication of results on viability of UWTs.

2.5.7 Information and communication

Previous experiences with other renewable energy technologies have taught that information and communication play an important role in the successful implementation of new technologies. Therefore the WINEUR partners have made a proposal for a communication plan for UWTs. Table 3 below shows the potential senders of the information (initiators), the receivers of the information (target groups), the kind of information that is being sent and the medium used to transfer the information.

Table 2: Communication plan regarding UWTs

Initiators	*Target group*	*Information*	*Medium*
Suppliers	Potential buyers (1)	Product specifications, including also safety guarantees, yield, location requirements, environmental effects, installation guidelines and checklists (2)	Website, flyers, product booklet
Suppliers	All stakeholders	Product development, project information, news	Website, Internet newsletters and feeds, newspapers, press releases, TV/radio
Suppliers	R&D institutions	Unresolved issues, problem areas	Direct communication
Suppliers	Permit issuing authorities	Product specifications, standards, certificates, location requirements including roof construction requirements, environmental effects	Product manuals (3), seminars
Suppliers	Consultants	Product specifications, standards, certificates, location requirements including roof construction requirements, environmental effects, costs and benefits, incentives	Website, Direct communication, product booklets

Suppliers	Buyers	Operation and maintenance	Hand books
Suppliers	Financial institutions	Product description, environmental effects, costs and benefits, incentives	Public meetings, flyers, seminars, direct communication
Suppliers	Construction sector	Product description, location requirements including roof construction requirements, environmental effects, costs and benefits, incentives	Public meetings, symposia and conferences, flyers (4), seminars
Suppliers	Installation companies	Technical requirements regarding placement and electrical connection	Public meetings, symposia and conferences, flyers, booklets
Suppliers, buyers	Energy suppliers, metering companies, network companies	Electricity production: quantity, distribution in time, other technical details	Website, symposia, test and evaluation reports, direct communication
Suppliers	Energy consultants	Product specifications, including also safety guarantees, yield, location requirements, environmental effects	Websites, guidelines, public meetings, symposia and conferences, test and evaluation reports
Suppliers, R&D institutions, municipalities, consultants	Government	Product description, environmental effects, costs and benefits, issues to consider, importance of UWTs, description of steps from idea to UWT implementation	Websites, guidelines, public meetings, symposia and conferences
Government	All stakeholders	International and national targets and importance of meeting them, legal framework, R&D programs, financial measures and incentives	Guidelines, public meetings, symposia and conferences, catalogues, TV/radio, website
Government	All stakeholders	Specific current developments and decisions. Information regarding on-going pilot and demonstration projects	Press releases, Internet news letters and feeds, web pages
Various industry associations: construction, installation, financing	Association members	General information on UWTs, specific branch-connected information (roof integration, electrical installation), product and project information	Internet news letters and feeds, web pages , association magazines,
Renewable energy associations, environmental organisations	All stakeholders	General information about UWTs, product information and financial incentives	Internet newsletters and feeds, public meetings, conferences, association magazines
Energy consultants	Municipalities, businesses, building owners, neighbourhood	General project and product information	Public meetings, symposia, catalogues, magazines, radio/TV, Internet newsletters and feeds, public meetings, website

Municipality, city planners	Actors involved in the development of projects	Information concerning locations, local plans, urbanisation plans, general requirements regarding spatial quality, etc.	"Ruimtelijke kwaliteitsplan" (Spatial quality plan), website
Project initiators	Neighbourhood	General project information, possible disturbance in the neighbourhood during construction activities on location	Information binders, Internet newsletters and feeds, public meetings, website, flyers
R&D institutions	Buyers, project initiators, government	Issues to consider, problems, solutions, testing and monitoring results	Research reports, presentations at conferences and symposia, website
Vereniging Nederlandse Gemeenten (Association of Dutch Municipalities)	Association members	General information, UWT product information, incentives, description of steps from idea to UWT implementation	Booklets, catalogues, magazines, web pages

At this moment all information regarding UWTs comes from the suppliers. Most of it concerns technical information. The stakeholders from different groups are looking for more information and for information on other aspects of UWTs. Especially, there is need for more information about the practical experiences in the realized and on-going projects.

The on-going projects show that parties involved at these projects are poorly informed about the UWTs they are implementing. In most cases it is because the budget reserved for the project is limited to the investment expenses and the costs of acquiring the building permit. This means that there is no budget for other project expenses. In such cases there is no one to take responsibility for the project coordination, information and communication and quality control.

3 Conclusions

Energy was recognised as an important issue by all respondents. Similarly, the respondents recognise the link between the energy production and the environmental issues such as greenhouse gases and CO_2 emissions in particular.

The respondents are well aware of different renewable energy forms. Those employed with local authorities were the best informed. Wind and solar energy were the most recognised forms of renewable energy.

The participants felt that the government should lead by example and introduce stronger incentives to encourage small wind installations in urban surroundings.

It must be taken into consideration that the visual and acoustic impact in urban areas is higher than in rural areas and that there are concerns regarding possible disturbances and dangerous situations. Safety and quietness were the most important issues with regard to UWTs for the respondents in all three countries. Therefore it is important to have UWTs that are safe, silent and visually attractive, but also to pay a lot of attention on communication about these issues to appropriately convince the public of the quality and the safety of UWTs. The easiest way to do that is by developing standards regarding safety, noise and physical building integration and certificating UWTs according to those standards. Also there should be a set of directives regarding the quality of visual appearance of UWTs in urban areas.

All stakeholders of UWTs need more information about the technical and financial side of UWTs and about the outcomes from past and on-going projects. Preferably, this information should be confirmed and published by independent parties.

The main potential buyers of UWTs are the owners of large, robust buildings with flat roofs and in industrial areas.

From the society perspective the development, production and deployment of UWTs means: development of innovative industry, new technology for saving fossil fuels and the production of an export product.