EUROPEAN COMMISSION

Study Tour Report

WINEUR Deliverable 6.1

December 2006

HORISUN

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Intelligent Energy Europe

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1 INTRODUCTION

The following document comprises the Study Tour Report for work package 6 (WP6) of the Intelligent Energy Europe – ALTENER (DG TREN) funded project "Wind Energy Integration in the Urban Environment (WINEUR)".

As part of WP6, whose main focus is 'Information Dissemination', the project partners had to organise a two day study tour. The concept behind the study tour was to raise awareness of the possibilities for the integration of wind energy systems into urban environments in local communities by increasing the knowledge of decision makers from city councils and by facilitating information exchange between town planners and project developers. The study tour would also be an opportunity for actors from the three partners countries to meet and exchange experiences and ideas for projects.

Therefore, a study tour was organised and is an important outcome for this work package. The study tour was held on October 26th and 27th 2006 in the NDSM building in Amsterdam in the Netherlands.

The study tour aimed to provide an international perspective on urban wind power through direct experience of installations in and around Amsterdam, and through presentations from turbine manufacturers and partners engaged in the WINEUR project. This study tour gave the participants the opportunity to share points of view on urban wind turbines and exchange ideas from their own local experience.

Sixteen delegates from the UK Windy Cities Network attended two days of lectures and site visits and discussed the factors affecting the useful and practical deployment of turbines in urban settings. The study tour also hosted representatives from the Netherlands and France, including a delegate from a French municipality.

Further information on the WINEUR project may be found at www.urban-wind.org . The project website contains all the information disseminated during the study tour, including case studies and presentations.

2 OBJECTIVES OF THE STUDY TOUR

The activities under WP6 are designed to communicate with key actors and the public about urban wind turbines and their integration in an urban environment. WP6 aims to raise awareness in local communities, in decision-makers in local councils and amongst potential project developers such as architects. WP6 should also facilitate information exchange and promote the project outputs from the other work packages of WINEUR.

Many of these aims of WP6 were the same objectives for the study tour, which brought together delegates from the UK, the Netherlands and France. The study focused on decision-makers in local councils and its objectives were to facilitate information exchange and disseminate the project outputs from the other work packages. In addition, this was a rare opportunity for the various stakeholders to share their experiences gained during their planned or implemented projects. A full agenda of the study tour is given in Annex 1.

This report outlines the content and learning points so far from the WINEUR project which were presented during the study tour. It also highlights the content of the study tour alongside the participants conclusions relating to each demonstrated technology and to the deployment of wind power in urban settings.

3 ORGANISATION OF THE STUDY TOUR

This event was a two day study tour held on the 26th and 27th October 2006 in Amsterdam in the Netherlands in the building of NDSM. Participants came from the three project countries: UK, The Netherlands and France.

The majority of participants were from England, coming from various fields such as city council employees, city councillors, regional authority staff, private enterprises, national parks officers or public energy services.

Besides representatives from the French partner, including a representative of ADEME, only one representative from France, from the city of Lyon, was able to attend this study tour. Although at least three cities had expressed interest in attending due to administrative delays only the representative from Lyon was able to attend. This also shows in a way that France has not reached the same level of willingness to investigate small wind technologies as has the UK. However, some French cities have seen shown their continued interest by signing supporting letters for a proposed follow-on windy cities project.

The low number of Dutch representatives is partly explained by the fact that this study tour had to be organised during a week of school holidays in the Netherlands. However, a strong network of cities interested in small wind exists in The Netherlands. This was proven during the national workshops held in mid-December, which gathered more than 30 participants from local authorities and other stakeholders.

A complete list of all the participants on the study tour is presented in Annex 2.

Due to the very poor share of the local governments from France and the Netherlands, it was not possible to discuss in detail the issue of building a European network of wind cities. This aspect will be worked out through contacts between the partners and the local authorities in the three countries and then through an agreement on a common charter.

As host country, the Dutch project partner, Horisun, was responsible for the organization of the study tour itinerary in the Netherlands. They organised the reservations for the conference room, the lunch and diner and they recommended appropriate accommodation. They were also responsible for all the logistics needed for the site visits and the exhibition.

All the partners prepared their own presentations with information on the status of small wind energy in each partner country and various other appropriate presentations. They were also responsible for the invitations of national local authorities and other stakeholders and organising travel for participants to the Netherlands.

The first day was split into two parts. The morning was used for presentations from partners (see paragraph below). The afternoon was dedicated to the site visits. All the participants were invited to see 3 types of wind turbines installed in and around Amsterdam. The manufacturers or the owners were present to give more information concerning the installation. This gave the opportunity for participants to ask specific questions and to learn about the implementation process.

The second day consisted of further lectures and discussions. Manufacturers from the Fortis and the Turby wind turbine companies were invited to give presentations on their products. They also brought full-size working wind turbines with them which were on exhibition around the conference room. The participants had the possibility to discuss directly with the manufacturers about their product.

The manager of Turby gave a detailed presentation regarding his technology. The Fortis company showed a video presenting its products and activities. Unfortunately this video is not available on the project website but a lot of information can be found on the Fortis website. The representatives from Fortis erected a fully functioning wind turbine outside the conference room

on open space available. This gave a full demonstration, with inverter, and was running showing the amount of power produced. It was connected to the closest grid available in a nearby building.

In conclusion, networking time was provided for the participants between lectures and visits and during the lunch and dinner. The agenda of the study tour is including in Annex 1 and a list of all the different presentations can be found in Annex 3. These presentations are now available on the website of the project.

4 PRESENTATIONS

The study tour was begun with a welcome to the participants by Ms. Syngellakis, Ms. Cace, Mr. Ter Horst and Mr. Clément, partners of the WINEUR project. The first morning session then followed with a series of presentations on status, technologies and costs in the UK, France and the Netherlands and a general presentations on planning issues. The second day a second series of presentations was made on turbine products and resource assessment presentations. Case studies were also presented. The study tour finished by an open discussion session. Presentations have not been included in this report since this would make it too long but a list of all the presentations is presented in the Annex 3 and these are available online.

4.1 Status, technologies and costs presentations

Mr. Clément (Axenne) gave a presentation on the general framework of the project and the work in progress. He focused at the end on the technologies (e.g. productivity) and the costs (e.g. capital costs) referring mainly to information in France.

Ms. Syngellakis (IT Power) presented the status of urban wind turbines in the UK. She spoke about the wide variety of wind turbines available in the UK and the manufacturers. She raised the issue of cost as well as the opportunities and barriers for the technology from a UK perspective.

4.2 Planning issues presentations

Ms. Cace (RenCom) gave two presentations on planning issues. The first presentation was more focused on the status of small wind turbine in the Netherlands. She spoke about the project partners, the technologies available, the targets and she finally concluded on the current status of urban wind turbine in the Netherlands.

Secondly, Ms. Cace spoke about the opportunities and bottlenecks in the preparation process for urban turbines illustrating her arguments with 5 case studies from Amsterdam.

4.3 Dutch turbines presentations

Two manufacturers have responded positively to the invitation to present their products during this study tour. The manager of Turby bv and the general and commercial managers of Fortis Windenergy were present during almost all the period of the study tour. Apart from their presentations, they made themselves available to the participants for all kind of questions during the site visits and during lunch.

Mr. Sickler (Turby bv) gave a description presenting in details its product. His presentation included monitoring results, calculations for product design and design issues.

Mr. Kuikman and Mr. Klimbie (Fortis Windenergy) introduced their company and then presented a video. This video showed detailed information on the technology, the manufacturing process and all activities of the company.

These presentations were combined with an exhibition of each of the manufacturer's turbine. This was very interesting for the participants since they could ask questions directly to the manufacturer while looking at the turbine.

4.4 Case study presentations and resource assessment

Mr. Clément begun this session presenting the experience of France with site resource assessment. He presented the methodology followed and results for three French locations. He concluded his presentation by highlighting the main findings.

This presentation reflected the issues tackled by the presentation of DHV on research on resource assessment. Mr. Mertens (DHV), who followed Mr. Clement, presented new arguments on urban wind turbine siting. He presented simulations carried out on the behaviour of wind moving around buildings. This presentation strengthened the empirical results obtained from the French wind resource assessment.

A local authority from the UK had agreed to give a case study presentation on building-mounted wind turbines. Ms. Parsons (from Kirklees Metropolitan Council) brought video, photos and presentations to present to the audience the case study of two 6kW wind turbines installed on the roof of a local authority owned building in Huddersfield. She shared with the participants the experience gained by her local authority with the installation of wind turbines on public buildings.

Ms. Cace (RenCom) gave a short presentation on safety standards of urban turbines using the experience gained up to now in the Netherlands.

4.5 Conclusion on the presentations

To conclude the presentation and the study tour, Mr. Ter Horst gave a presentation on urban wind policy. He spoke about ways on developing urban wind pilot projects. This was followed by a discussion session, chaired by Mr. Ter Horst, between all the participants on policy issues, constraints, project development and experiences.

5 SITE VISITS

5.1 Turby Model

The first visit was to a 2.5 kW Turby. This turbine is sited on Local Authority buildings and provides grid connected electricity. At the time of the visit the turbine was stationary due to the wind conditions. The control system uses the generator to brake the turbine should the wind gust to over 14 m/s, or if the wind speed drops to below about 2 m/s. In both cases the turbine is used at predetermined timings as an anemometer, and continues to apply the brake should conditions be measured outside of the operational wind speed window. The participants could not approach the installed turbine, as access to the roof was not possible but there was also a Turby model available on exhibition in front of the conference room which they could examine close-up. The installed turbine was not turning due to the lack of wind but it enabled the manufacturer to explain the cut-in speed process.

Figure 1: Turby, small wind turbine on a public building, Hoofddorp

This turbine's control algorithm effectively almost prevents the turbine form generation during its peak efficiency wind conditions, and consumes energy whilst testing the wind speed to establish favourable conditions, and to start rotation. Priced at approximately 17 500 Euros installed, and with a peak output of 2.5 kW this unit has a cost of installation of 7 000 euros/kW. The vertical axis design is more easily integrated into an urban setting than 'propeller' type designs, and more easily adapts to variations in wind direction. This point is particularly important due to the turbulent wind encountered in urban locations. However, its control algorithm needs to be improved so that more energy can be produced.

5.2 Windside Model

The second site visited was a small savonius turbine (made by Windside, a Finnish company) fitted to a canal boat. The installed turbine was a particularly small model as it was for a canal boat but this kind of wind turbine is also available in much bigger sizes. The peak output of the unit in this case was approximately 120 Watts and it serves alongside solar photovoltaic panels to charge 12 and 24 volt batteries. There was no wind in the urban canal setting at the time of the visit, and consequently the turbine was stationary. As the turbine relies upon wind drag, its efficiency is relatively low, and this combined with the small size rendered the generator ineffective. The turbine however does produce electricity in open water settings and when the prevailing winds are channelled along the line of the canal.

Figure 2: WindSide, small wind turbine on a canal boat, Amsterdam

This turbine is particularly inefficient and as such generates relatively low energy yields. However, its simple design lends itself to easy architectural integration, low cost installation and hostile environments and to opportunistic battery charging. The low elevation of the visited site highlighted the problems of low efficiency turbines in turbulent, inconsistent urban wind conditions.

5.3 Windwall Model

The final visit was to an office building and more particularly a Local Authority depot which has a Windwall turbine fitted. This design uses aerodynamic lift in a Darrieus design rotating about a horizontal axis. This twin 1.8 kW module (3.6 kW total) installation sits at the windward end of the building and has no rotational capacity to accommodate changes in wind direction. The manufacturing company has difficulties at the present time resulting from poor monitored performance. The turbine was turning at the time of the visit.

Figure 3: Windwall, small wind turbine on an office building, Amsterdam

Windwall appears to turn well when it is installed in a consistent prevailing wind. It is unable to adapt to major wind shifts and will be shaded by the building from winds blowing 180° to the norm. The total height of the turbine falls within the reduced wind speed area caused by diversion of air up the face of the building, and the manufacturer has experienced low outputs, probably as a result.

6 SMALL WIND TURBINES ON EXHIBITION

In addition to the site visits, a Fortis Windenery Pasaat 1.4 kW horizontal axis turbine was exhibited outside the conference room. It took 2h30 hours for the manufacturer to install it here. It was connected to the grid of the nearest building and a monitoring system was available which enabled the participants to read the power output.

This turbine is provided to customers for self installation at a cost of approximately 11 670 Euros. An 8 metre guyed tower was used for the demonstration, standing on a weighted girder cross foundation. The turbine has a low cut-in wind speed of 2.5 m/s and peaks at 15 m/s, using a wind vane to adjust the attitude of the blades to the wind. In this way turbine rotational speed can be controlled without electrical intervention. The unit can be grid connected or used as a battery charging unit. Fortis utilises a 'traditional' horizontal axis three bladed propeller design.

Figure 4: Fortis Pasaat 1.4 kW on exhibition in front of the conference room

The Fortis turbine has a relatively low cost at 8330 euros/kW unit which is designed for self installation or installation by a local installer. It is transportable in a large estate car and as such could provide a useful mobile turbine for demonstration use or for installation where there is little vandalism risk. Power outputs vary across the range of Fortis machines and there turbines available from 0.8 kW to 10 kW capacity, rated at between 12 m/s and 17 m/s.

A Turby model was brought by the manufacturer and exposed in the exhibition hall just outside the conference room. This complemented the site visit done the day before. The manufacturer could show and explain in more details the design and the operation process.

Figure 5: Turby small wind turbine on exhibition in front of the conference room

7 CONCLUSIONS

The two days meeting were pleasant and informative. The participants learnt a lot about the behaviour of wind in urban areas such as the effect of buildings on wind flow and on energy yield of wind turbines installed on the roofs of buildings. They exchanged information on practical experiences from the different participating countries and saw installations of a variety of wind turbines.

Two manufacturers of wind turbines gave presentations on the functioning of their turbines. Furthermore, three sites were visited where problems arising in practice in the installation and monitoring process were explained by the manufacturers and owners.

Several key conclusions on small wind energy have been drawn from this study tour which can be implemented in the urban (and rural) locations. These are summarized below.

1. In urban environments the wind speed and direction are unpredictable where adjacent buildings generate turbulence. This was particularly illustrated by the simulations done by DHV and the measurements conducted in France for the resource assessment.
2. Where turbulence cannot be avoided, vertical axis turbines can make better use of the available wind resource. This is the case of the Windwall which used the turbulence coming from the side wall up to the roof building.
3. Wind blowing around a building will be diverted by the wind flowing over the top of the building; in order to make optimum use of the wind blowing over the building there must be a degree of vertical clearance between the building edge and the sweep of the turbine. This must be calculated for each site location.
4. Wind turbulence in urban areas below roof top level can cause horizontal axis turbines to 'hunt' for the wind without finding a useful air stream with which to generate electricity.
5. Where prevailing wind directions are consistent the use of a fixed horizontal axis turbine is be possible, however it must be placed to utilise the diverted wind flow over the building and not sit 'too low'.
6. Up to now, it sounds quite difficult to evaluate precisely the wind potential around a building. Some guidelines have been found by simulations or practical experience and should be followed for site selection. DHV conclusions stated that:
   - A roof should be chosen well above average roof height of surrounding buildings (around 50 %);
   - The height of the turbine should be well above the roof;
   - The significant influence of (local) wind rose and building orientation should be taken into account;
   - Energy yield at roof sites can easily change by a factor of 2 in just 5 metres so the site should carefully be selected.
7. When selecting a wind turbine the power curve must be evaluated against the wind profile. However, the average wind speed will not necessarily provide adequate information, even if measured at the location for the specific installation.
8. By matching the turbine to prevalent wind speeds it may become apparent that numerous small turbines will produce more useful electricity than one larger, higher peak output unit. The inverse may also be found dependant upon wind speed profiles.

Overall, it appears that there exists a wide range of available technologies. However, rated wind speed is not the same for all technologies. There is no independent verification of the energy production and it appears that often wind speeds are overestimated. To conclude, it is obvious that there is a real need for monitoring programmes of small wind installations.

ANNEXES

Annex 1: Agenda of the Study Tour

WINEUR STUDY TOUR

26 and 27 October 2006, NDSM, Amsterdam

Thursday, 26 October 2006

Welcome and introduction to Wineur: P. Clément, Axenne

Status, technologies and costs in France: P. Clément, Axenne

Project cases – 5 pilot projects in Amsterdam: J. Cace, RenCom

Voor de wind gaan, J. Cace, RenCom

Lunch break

Site visits in Amsterdam to working small wind turbine installations

- Turby: small wind turbine on public building, Hoofddorp
- WindWall: small wind turbine on office building, Oostwatergraafsmeer, Amsterdam
- WindSide: small wind turbine, living boat, Amsterdam

Diner

Friday, 27 October

Status, technologies and costs United Kingdom: K. Syngellakis, IT Power

Planning issues: K. Syngellakis, IT Power

Presentation of Dutch turbines and visit to the small wind turbines on exhibition

- Turby: D. Sickler, Turby bv
- Fortis: Johan Kuikman, Fortis Windenergy

Research on resource assessment: S. Mertens, DHV, Netherlands

Case study presentations

- Practical experience with site assessment in France: P. Clément, Axenne
- Case studies in UK: K. Parsons, Kirklees Metropolitan Council

Safety aspects of urban turbines: J. Cace, RenCom

Lunch break

Development of urban turbine pilot projects: Emil ter Horst, Horisun

Discussion about Policy issues and project development: all the participants

Cocktails

Annex 2: List of Participants

Name	Company
List of English Participants	
Katerina Syngellakis	IT Power
John Bell	Hull City Council
John Berryman	Able Fuels Ltd
Charley Rattan	Coronation Power
Judith Holliday	North York Moors National Park Authority
Peter Jones	North York Moors National Park Authority
Lance Saxby	Energy Efficiency Advice Centre, York, North and East Yorkshire
Simon Tao	Kirklees Energy Services
	Planning & Transportation Service,
Emma Coveney	Barnsley Council
	Sunrise Project
Tanya Christensen	Yorkshire & Humber Sustainable Futures Company
	Sustainable Housing and Affordable Warmth Team (SHAW)
	Strategic Initiatives – Neighbourhoods & Community Care
Gary Hunt	Sheffields Council
Andy Horrocks	Wakefield Metropolitan District Council
Councillor Clive Hudson	Wakefield Metropolitan District Council
	Kirklees Metropolitan Borough Council,
Kate Parsons	Kirklees Environment Unit
	Kirklees Metropolitan Borough Council,
Matthew Good	Kirklees Environment Unit
	Kirklees Metropolitan Borough Council,
Don Tyler	Kirklees Environment Unit
Angela Miller	Connect Housing
List of Dutch Participants	
Emil ter Horst	Horisun
Jadranka Cace	RenCom
Dick Sidler	Turby bv
Johan Kuikman	Fortis Windenergy
Balthasar Klimbie	Fortis Windenergy
Sander Mertens	DHV
P.H.A.M. Masselink	SenterNovem

Ruud Van Rijn	Bosch en Van Rijn

List of French Participants

Patrick Clément	Axenne
Maïté Niel	Axenne
Nicolas Fichaux	ADEME
Eric Valenciano	Ville de Lyon – Direction de la construction

Annex 3: List of Presentations

The following presentations were made during the Study Tour of the 26th and 27th of October 2006, in Amsterdam. All the presentations are available to download from the project website at www.urban-wind.org .

N°	Presentation name	Name of the Speaker	Company
1	Wind Energy Integration in urban environment – Status of the project	P. Clément	Axenne
2	Status, Technologies, Costs in UK	K. Syngellakis	IT Power
3	5 Case Studies with urban turbines, Amsterdam: Opportunities and bottlenecks in the preparation process for urban turbines	J. Cace	RenCom
4	Voor de wind gaan	J. Cace	RenCom
5	Turby : Small wind turbine on public building	D. Sickler	Turby bv
6	Planning Issues	K. Syngellakis	IT Power
7	Research on resource assessment	S. Mertens	DHV
8	Practical Experience with site assessment in France	P. Clément	Axenne
9	Safety aspects of urban turbines	J. Cace	RenCom
10	Case Study in UK: Kirklees Metropolitan Council	K. Parsons	Kirklees Metropolitan Council
11	Development of urban turbine pilot projects	E. ter Horst	Horisun