OBJECTIVES OF THE PROJECT

In the existing context, the main objective of the WINEUR project was therefore to identify the conditions necessary for the greater integration of small wind turbines in the urban environment and to promote the emergence of this technology as a real option for electricity supply in towns and cities across Europe.

Thus, the works realized within the framework of the project attempted to analyze the following aspects :

- state of the art and experiences gained;
- technical and economic aspects (constraints and solutions);
- legal and administrative aspects;
- socio-economic aspects and acceptability (e.g. spatial and visual integration);
- potential project identification;
- information dissemination.

In a more general way, the project aimed at raising awareness amongst key decision-makers with regard to the benefits of wind energy systems and their potential role in contributing toward climate change and socio-economic objectives of cities, as well as supporting the move towards creating sustainable communities across Europe.

The main stakeholders were : national government, R&D institutes, manufacturers, regional and local governments, architects and special planners, property developers, engineers and consultants, owners of large buildings (industry, offices, hospitals, apartment buildings, etc.), owners of large private houses in rural areas, installers, energy suppliers, grid owners, metering companies as well as banks and other financing institutions.

Further information on the WINEUR project, all published documents and reports and a brief outline of activities under all work packages are available to download from the project website at www.urbanwind.org

THE TECHNOLOGY

The exploitation of the wind resources in urban areas is a recent idea. The roughness of this environment causes turbulence in the wind reducing the energy production of many commonly used small wind turbines. However, studies on wind movement around obstacles such as buildings have showed that wind also accelerates when getting round them. The angle of incidence on a turbine can also increase its electricity production.

Recently, some manufacturers have developed two new types of wind turbine which could be suitable for conditions in urban areas. They can be split in two categories depending on the axis orientation which could be horizontal (HAWT) or vertical (VAWT).

- **HAWT**: HAWT models, with lift aerodynamic characteristics, these are similar in design to the classic wind turbine encountered in today's large wind farms.
- **VAWT**: VAWT models have been designed to fit as well as possible with the turbulence constraints, they can operate with winds from any direction. VAWT can have drag (Savonius) or lift (Darrieus) aerodynamic characteristics.
  - The Darrieus machine, characterised by its C-shaped rotor blades, are: tapered, cylindrical, or parabolic. A well know model is the Windwall.
  - The Savonius machine using the drag force is composed of two half cylindrical pieces in opposition.
  - Finally, the last design, using a combination of lift and drag and installed in the Netherlands, is the Venturi model.

Photo: HAWT turbine Credit: Fortis Montana

Photo: Turby

Photo: Darrieus turbine Credit: WindWall

Photo: Savonius turbine Credit: Windside

Photos: Venturi turbine

Photo: eurowind 1,3 kw Credit: Ewowind

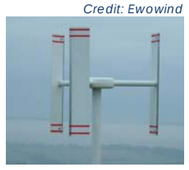


Photo : Building-mounted 6kW HAWT in Plymouth, UK Credit: R.Oldach, IT Power

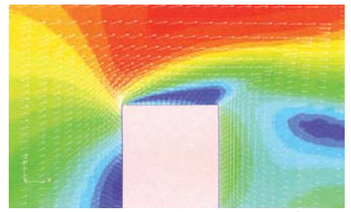
MAIN FINDINGS, OPPORTUNITIES AND BOTTLENECKS

From the various experiences across Europe, the conclusions on urban wind turbine technology are as follows:

- lift Turbines are able to extract more energy from a given wind speed than those using wind drag;
- all Darrieus design turbines require energy to begin self-rotating;
- energy production in urban surroundings will generally be significantly lower than in open, rural areas;
- frequent wind speed and wind direction changes: which implies difficulties to predict wind in built-up area;
- 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;
- when selecting a wind turbine the power curve must be evaluated against the wind profile;
- average wind speed will not necessarily provide adequate infomation, even if measured at the location for the specific installation.

From DHV (consultancy and engineering group) simulation of airflows in urban areas, the first recommendations for urban wind turbines siting are :

- choose roof well above average roof height of surrounding buildings (around 50%);
- HAWT placed in the middle of the roof of a building must be placed above a height higher than 35% / 50% the height of the building to avoid the phenomena related to turbulence;
- take into consideration the significant influence of (local) wind rose / building orientation;
- energy yield at roof sites can easily change a factor 2 on 5 m so carefully select site;
- expected energy yield 200-400 kW/m^2/year.



Source: DHV Study on Airflow over building roof

The study of socio-economic aspects, administrative processes and legal frameworks undertaken, highlights the existence of planning constraints. The problems identified, although relatively different depending on the country are: grid connection, visual issues, noise and flicker, structural concerns (e.g vibration), cost, reliability of wind and therefore energy, public perception, energy storage.

In conclusion, in the three partner countries there is a need of redefinition of the legal framework to support the development of urban wind. These reforms should concern: testing, standards, permits and grid connection.

Photo: HAWT on building roof in Finland

STATUS OF URBAN WIND ENERGY IN THE PARTNER COUNTRIES

There were 57 UWT installations in NL in December 2006. Most turbines are placed on top of buildings in urban areas. There are 13 UWT suppliers, 8 of which have an their own R&D and supply their own turbines.

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.

France has very few installations but has conducted 3 main feasibility studies with wind measurement in Lyon, Grenoble and Lille.

Photo: winside in the Netherlands

No installations has been made for the moment but various cities have expressed their strong interest and are ready to join the European Cities Urban Wind network.

UK is the most active country in Europe with over 100 urban and semi-urban installations (projects from 0.4 kW to 20 kW), over 15 products already on the market and 10 UK manufacturers. Schools and Environmental centres are the predominant owners but local authorities are now getting very involved.

ACTIVITIES TO PROMOTE THE CONCEPT OF URBAN WIND INSTALLATIONS

To achieve the project aims, a wide-reaching mobilisation of key actors including city councillors, town planners, architects, energy agencies, electricity utilities and others has been conducted.

To promote the concept of urban wind, the dissemination phase was really important. Many national meetings were held and led to the creation of national urban wind turbines networks. National workshops with many stakeholders were held in each country partner.

A study tour was organised with local authorities which are interesting in investigating the potential of small wind energy applications in urban, built-up surroundings. A study tour report was issued and is available on the project website.

To raise awareness in local communities and of decision makers in city councils, project partners also wrote several articles which were published in magazines (e.g. REFOCUS) and were present in conferences (e.g. EWEC, Salon des Energies Renouvelables, EDORA).A brochure describing the project was also published. Many of these local authorities are keen to continue receiving and exchanging information and emerging experience on small wind technologies and installations in urban areas. Thus to finalize this dissemination process, a project website was launched to inform about the objectives and action plan of the project but also to communicate all the results and deliverables. Therefore, it seems a logical step forward, in order to continue the dynamic generated by the numerous meetings and workshops on small wind for the urban environment, to create a 'European Cities Network':
a forum to enable the continued exchange of information specifically between local authorities. This network will facilitate interactions between the cities involved regarding project development, financing, implementation and monitoring.

The European Cities Urban Wind Network, will function through a protected area accessible through the WINEUR project webpage.

Photo: Prototype VAWT in the UK Credit: Rugged Renewables

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The popularity of small wind turbines in the UK and other European countries is growing and there is increasing interest from home owners and businesses to install small wind turbines on their homes and buildings. However, the current planning framework is unclear and essential safety checks, such as product standards and certification and installer accreditation are missing. Some guidelines, product standards, certification and accreditation of installers are planned but are still far from completion. This process needs to be accelerated and all countries need to have these procedures in place to avoid the danger of poor quality products and installations ruining the market and consumer confidence. UK has shown promising steps on policy issues but France and the Netherlands still give little encouragement for small wind installations – despite popularity at the municipal level. Large expectations are placed on the drawing-up of a European “Urban wind turbine cities network" which should maintain in the long term the dynamic created during the project

www.urbanwind.org

WINDY CITIES

Wind energy for the urban environment: results of the WINEUR project

Since the European renewable energy directive set the target for 22.1% of electricity generation to be supplied by renewable sources by 2010, there has been increased interest in using renewable energy technologies in the urban environment. The technologies most commonly considered are solar thermal installations and solar photovoltaics.
Nevertheless, in the last few years, a number of manufacturers have developed small wind turbines specially designed for the urban environment. These small scale renewable energy technologies generate clean and renewable energy, while reducing CO2 emissions. Like photovoltaics, urban turbines generate electricity on site, avoiding transmission losses. Urban turbines also provide a visual statement and highlight the commitment to sustainable energy and promotion of a ‘green’ image. As such, there is an increasing amount of interest and support for small wind technologies from politicians, industry, local authorities and the public alike. Urban wind covers all kinds of small wind installations in urban or built up areas. This is a new application for small wind turbines and the associated technologies are still being developed and emerging onto the market. There is a limited experience with the installation and grid connection of these products. As such there is a need for information to be made available and to be exchanged between interested parties.
The Wind Energy Integration in the Urban Environment (WINEUR) project, started in 2005 and supported by the European Commission programme Intelligent Energy Europe, was focused on gathering information on the development of small wind energy in urban areas covering a wide variety of technical, economic, plning and administrative aspects. 3 country partners participated in this project: UK (IT Power), The Netherlands (Horisun / ARC) and France (Axenne / Ademe).

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