Nowak Energie & Technologie AG

PV City Guide / Guide ElectriCité Solaire

Implementing Photovoltaics in the Urban Environment
Applications Photovoltaïques dans le Contexte Urbain

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PV CITY GUIDE – IMPLEMENTING PHOTOVOLTAICS IN THE URBAN ENVIRONMENT

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Zusammenfassung	Résumé	Somario
Solarstrom (Photovoltaik) erlebt in Europa allgemein einen Aufschwung und bietet auf kommunaler Ebene im Siedlungsraum immer mehr und neue Anwendungsmöglichkeiten. Die Photovoltaik ist nicht nur eine neue Energietechnologie, sondern ebenso ein vielfältiges „Baumaterial“. Sie kann damit in den Planungsprozess bestehender und entstehender Siedlungsräume integriert werden. Ziel ist es, die Chancen der Photovoltaik in der städtebaulichen und kommunalen Umgebung für heute und morgen aufzuzeigen und damit eine Perspektive zu einer nachhaltigen Entwicklung des Siedlungsraums zu ermöglichen.	L’électricité solaire (photovoltaïque) est en train de prendre son essor en Europe et offre – au niveau communal - de plus en plus d’applications dans l’espace urbain et l’environnement bâti. Le photovoltaïque n’est pas seulement une technologie énergétique mais en même temps un «matériau de construction» multi-fonctionnel. C’est pourquoi l’aspect photovoltaïque peut aussi être considéré dans l’urbanisme. Le projet a pour but de démontrer les chances et les opportunités du photovoltaïque dans le contexte de l’urbanisme sur le plan communal et, par conséquent, d’ouvrir quelques perspectives pour un développement durable dans l’espace urbain.	In Europa, l'elettricità solare fotovoltaica vive una fase di intensa crescita. Grazie alle continue scoperte di nuove modalità d'utilizzo negli spazi edificati, oggi questi progressi possono essere applicati al territorio anche su scala comunale. In quanto materiale di costruzione polivalente, la tecnologia fotovoltaica si integra facilmente nei processi di pianificazione, sia nei casi di nuovi insediamenti che per quelli già esistenti. Nel corso del progetto mostreremo le possibilità di utilizzo - attuali e future - delle installazioni fotovoltaiche a livello cittadino e comunale, cercando di dedurne le prospettive nel quadro di uno sviluppo sostenibile negli spazi edificati.

INTRODUCTION

The urban built environment provides a unique opportunity for the application and exploitation of photovoltaic (PV) systems. Cities represent a focused and significant energy demand, but also a physical infrastructure that can support localised electricity generation. Walls and particularly roofs are exposed to solar radiation that can be converted into electricity silently, and without producing pollution by means of photovoltaic technology. Calculations of potential estimate that installing PV on the most favourable surfaces in urban areas can contribute up to 25% of the total electricity demand of these areas.

GOALS AND METHOD OF THE PV CITY GUIDE

The application of PV systems in 'stand-alone' buildings and other installations to generate electricity from solar energy is a well-established strategy to reduce the energy demand from non-renewable or polluting sources. PV is often the preferred option either when a conventional electricity supply is unavailable or when the cost of cabling and connection is high. However, connecting PV systems to the existing grid and infrastructure readily available in cities means that surplus energy can be redistributed and is thus not wasted. Furthermore, the integration of PV as an inherent building element - referred to as Building Integrated PV (BIPV) - in the form of for example a shading device or wall / roof cladding system, brings economic advantages in that the PV systems fulfils numerous functions. Throughout Europe there are examples of buildings and projects (figures 1 - 8) which demonstrate such potential. However, the urban context is typically overlooked. This is being rectified by an EU and Swiss funded project - called *PV City Guide* - which targets cities, authorities and related professionals, via municipalities, planners, architects, etc.

Figure 1: Intelligent building design and construction process - Mounting and integration of solar modules into the Mataró library building in Barcelona, Spain. The photovoltaic modules are at the same time façade elements and are part of the solar power station (53 kWp). Source: tfm, Spain.

Figure 2: Urban design on a large scale - Maquette of the settlement project in Heerhugowaard, The Netherlands. A total photovoltaic solar power of 5 MWp is being installed within this project. Source: Municipality of Heerhugowaard, The Netherlands.

Figure 3: Multifunctional use of infrastructure elements - Railway noise barriers in Oerlikon-Zurich, Switzerland. Source: TNC Consulting AG-Erlenbach, Switzerland

Figure 4: Progressive design - Mobile entrance roof with semitransparent PV modules on the "Harmony" building in the City of Tomorrow. Source: Bo01, Malmö, Sweden

The *PV City Guide* project is developing guidelines that address implementation, design, financial and legal aspects in the context of cities, in order to highlight and encourage the exploitation of the significant potential in cities. These guidelines are presented at an international events and meetings in order to provide initial information to interested parties and gain further feedback from a range of experts before final production of the *PV City Guide*.

RESULTS: CITY-SPECIFIC FACTORS AND GUIDELINES

It is clear that a key player in this field is the municipality, both in terms of enabling and in terms of stimulating the use of PV in cities. Demystifying the technology and outlining all the interrelated issues associated with PV is a primary step. This is followed by explicit and clear guidance on setting up conditions that encourage the use of PV from a practical perspective. European examples are exploited to demonstrate best practice.

Figure 5: Architecture and marketing - PV installation of 240 kWp mounted on the Convention Center Basel, Switzerland. Solar electricity is marketed within the local solar stock exchange. Source: photo from Convention Center Basel, montage picture from energieburo® Zurich, Switzerland

Figure 6: Project, policy and players - The famous Nieuwland project in Amersfoort, The Netherlands, included several hundreds of photovoltaic buildings totalling 1.3 MWp of photovoltaic solar power. The project gathered most relevant players like municipality members, building investors, utility and house buyers. Source: Ecofys, Utrecht, The Netherlands.

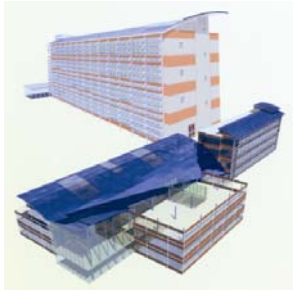

Figure 7: Architectural value for new and refurbished buildings - Maquette of the ECN office and laboratory buildings in an innovative design. Roof integrated PV system (26,7 kWp) and refurbished façade with photovoltaic shading elements (71,9 kWp). Source: ECN, Petten, The Netherlands.

Figure 8: Urban design and factors - One factor allowing some synoptic view is the sky view factor output from street to sky, here for old part of Athens (Greece). Shades of blue resp. grey at street level and on roofs give an indication of the relative building height (the darker the street the deeper the canyon) and urban canopy roughness (the higher the occurrence of blueness resp. greyness on roofs, the 'rougher' the urban canopy). Source: PRECis

It is critical to identify and be able to assess the specific conditions of a particular city, rather than give generalised rules. The character of a city will influence the potential of PV and highlight strategies to maximise this potential. It is interesting to note that the climatic variations from north to south of Europe play a less significant role than one might expect. For example, the annual availability of solar irradiation in Malmö, Sweden is only about 20% less than in Florence, Italy - despite the significant difference in latitude.

The *PV City Guide* provides rules of thumb to determine the potential for electricity production for your city, as a function of climate, demographics and energy demand. It goes on to provide specific recommendations in relation to the urban form of a city - whether for example building heights are homogeneous or not, or whether the street pattern is strongly repetitive (modern) or informal (medieval), etc.

DISSEMINATION AND REFERENCE

The *PV City Guide* in English language form, will be widely and freely available to the key players by the end of the year. National versions - in German, Italian, Spanish, French, Dutch and Swedish - will become available in 2002. In the meantime, the *PV City Guide* web site (**http://pvcityguide.energyprojects.net**) provides further information, and the workshop in Basel on 21 September 2001 will also be an opportunity to participate in the final shaping of the PV City Guide.

ACKNOWLEDGEMENTS

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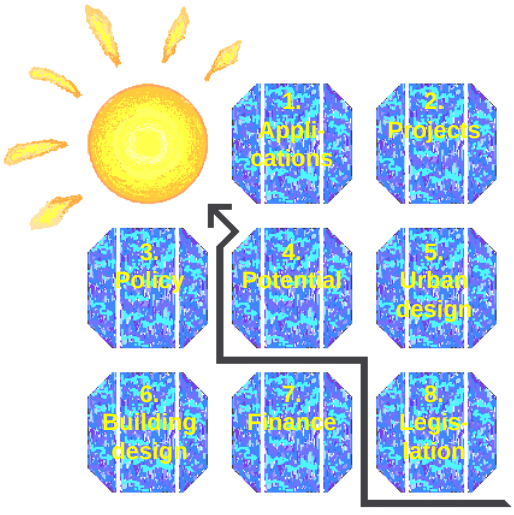

Figure 9: Structure and key topics of the PV City Guide