Ecocity

Book 1
A better place to live

Edited by:
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ecoCITY

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A better place to live

Deliverable of the Project

ECOCITY 'Urban Development towards Appropriate Structures for Sustainable Transport' (2002 - 2005)

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1 Introduction and definitions

1.1 Introduction

According to the Communication from the Commission, 'Sustainable urban development in the European Union: a framework for action', "*around 20% of the EU population live in large conurbations of more than 250,000 inhabitants, a further 20% in medium-sized cities of 50,000 to 250,000 inhabitants, and 40% in smaller towns of 10,000 to 50,000 people"* [Commission of the European Communities, 1998, p.2]. This means that 80% of the European population live in urban areas and the majority of these people live in small to medium-sized towns and cities. This handbook – based on the EU-funded **ECOCITY project** – looks at the sustainable development of just such urban areas with a strong ecological component. The challenges in urban development differ somewhat with the size of the settlement (in small towns it can be more difficult to establish an attractive public transport system, for example), but one problem is common to all:

> During recent decades, urban growth usually happened in ways contradictory to the concept of sustainable settlement development, although this concept is theoretically agreed on in many of the relevant policies. Suburbanisation produced spatially diffused and functionally segregated settlement structures – sprawl – in belts around cities and towns, while the population of the generally more compact historic parts declined. This continuing trend causes growth in traffic volumes, resulting in increased pressures on the environment (such as pollution from exhaust fumes or climate problems due to carbon dioxide). It also compromises the effects of many measures aimed at promoting sustainable transport modes.

As a result of these growth patterns, resources such as land and energy, which should be preserved for future generations, are used excessively. Large areas are occupied by the structures of sprawl and the consumption of limited fossil fuels continues to increase, especially for transport. The environment, which should provide a basis for the life of future generations, as well as human health and overall quality of life are impaired by the effects of this excessive use of resources.

In contrast to these trends, the objectives of the European Union for the development of sustainable settlements and for the improvement of urban environments specifically call for "*support [for] a polycentric, balanced urban system* and *promot[ion of] resource-efficient settlement patterns that minimise land-take and urban sprawl"* [Commission of the European Communities,1998, pp. 6 and 15].

Such patterns are further described in the Communication from the Commission 'Towards a thematic strategy on the urban environment' (and in other EU policy documents on this topic) as, *"the **favoured vision** of high-density, mixed-use settlements with reuse of brownfield land and empty property, and planned expansions of urban areas rather than ad hoc urban sprawl…"* [Commission of the European Communities 2004, p. 30].

High density and mixed use are characteristic for pedestrian-oriented settlement patterns. The need to design urban patterns which are favourable for sustainable transport is emphasised in many recent concepts and also in the Key Action 'City of Tomorrow and Cultural Heritage' (under which the ECOCITY project was realised). The objective for the projects within this Key Action was "*to reduce radically urban pollution and congestion, while ensuring safe, accessible and affordable mobility, through long-term strategic approaches towards land-use patterns favourable to the development of alternatives to the private car"* [European Commission,1998-2002].

The need for such strategic and long-term approaches is particularly crucial because of the long lifespan of buildings and the resulting slow rate of change in existing building stock. The effects of today's land-use and urban planning measures on travel demand are therefore long-term, meaning "*that land-use planning measures set the urban patterns upon which mobility patterns are based for generations*". Thus unsustainable developments cause long-term problems, "*but if we can 'build in' sustainability-oriented (e.g. travel-minimising) features into new development, we could expect these to be a worthwhile investment prevailing over decades to come*" [PLUME, Cluster LUTR [1)], 2003].
The EU-funded **ECOCITY project** (entitled 'Urban Development towards Appropriate Structures for Sustainable Transport') was conceived to contribute to the implementation of such sustainability objectives by designing model settlements for specific sites in seven communities (see Chapter 4). The aim was to demonstrate the feasibility and desirability of future urban living compatible with sustainability requirements. Settlement patterns for the future need to be sustainable in the sense that future generations should also be able to organise their lives in these settlements at a high-quality level.

Responding to the 'favoured vision' of the European Commission and the EU objectives cited above, the core focus of the ECOCITY project was the development of a compact, space-saving settlement structure enabling an environmentally compatible transport system. This involves giving priority in urban planning to the requirements of sustainable transport modes by designing structures convenient for pedestrians, cyclists and public transportation as well as providing for efficient distribution logistics.
There are also some structures which are definitely not compatible with an ECOCITY and must be avoided. Most of these could be summed up as 'elements of (urban) sprawl': for example, detached, single-family houses or large shopping and leisure centres on greenfield sites. Their impact on the ecological quality of an urban structure is immense.
As changes in existing urban structures and new urban development (mainly on greenfield sites) are currently occurring in parallel, strategies are needed to direct both towards sustainable solutions, to avoid future problems. An ECOCITY can be realised in new urban quarters or by adapting existing ones. New quarters are advantageous for the development of 'model settlements', because they allow optimised structures to be designed. However, considering the slow rate of change in the existing building stock, the main challenge to urban planning will be to adapt existing quarters to an ECOCITY concept. In this context, the example of the model settlements should help to achieve greater acceptance for the necessary regeneration of existing settlements.
Alongside positive examples, a framework of incentives and legal/administrative instruments is also needed to encourage, support and promote sustainable urban development and design, while discouraging the development of sprawl, which in itself is not really 'urban'. Possible incentives could include restricting private development subsidies and applying them only to residential buildings in an urban pattern of higher density, thus also discouraging detached, single-family houses. An example of a useful legal instrument to promote the implementation of new urban developments in parts of a town is the "urban development measure" (*Städtebauliche Entwicklungsmassnahme*) in Germany, which helps to regulate the prices for buying and selling plots of land.

[1)] The ECOCITY project was a component of the Land Use and Transportation Research (LUTR) cluster, which linked 12 synergetic projects looking at sustainable urban mobility in conjunction with land use and environmental issues. The common objective was to develop strategic approaches and methodologies in urban planning which contribute to the promotion of sustainable urban development. This includes the connections between transportation demand and land-use planning, the design and provision of efficient and innovative transportation services, including alternative means of transportation, and the minimisation of negative environmental and socio-economic impacts (more information at: *http://www.lutr.net/*).

What are the characteristics of an ECOCITY?

The idea of an ECOCITY is that it should be in balance with nature. This can be achieved through space-saving and energy-efficient settlement patterns, combined with transport patterns, material flows, water cycles and habitat structures that correspond to the overall objectives for sustainability (see Definitions, Section 1.2).

An ECOCITY is composed of compact, pedestrian-oriented, mixed-use quarters or neighbourhoods, which are integrated into a polycentric urban system in public-transport-oriented locations. In combination with attractively designed public spaces, integrating green areas and objects of cultural heritage to create varied surroundings, an ECOCITY should be an attractive place to live and work. Such sustainable and liveable structures contribute to the health, safety and well-being of the inhabitants and their identification with the ECOCITY.

How does an ECOCITY differ from other exemplary developments projects on the one hand and the currently common urban developments on the other?

Compared to the most comprehensive model projects, the main difference is a more intensive adaptation of the urban structure to the requirements of pedestrians, cyclists and public transport. However, compared to currently common new urban development (including sprawl), there are additional differences comprising more efficient use of energy, reduced impairment of nature and more attractive environments for the inhabitants.

The ECOCITY offers many benefits, ranging from personal convenience to global sustainability. All the actors involved – individuals, groups and institutions – can gain: an ECOCITY offers more space for people in an attractive, safe and quiet environment and also has lower life cycle costs and is less costly in relation to repairing negative impacts on human health and the environment[2)].

[2)] **See also** Chapter 2 in Book II for a more detailed discussion of these benefits.

What disadvantages can be identified for the different actors?

The answer to this question must be framed differently for the actors responsible for planning and implementation, the people living in the direct neighbourhood of the planned ECOCITY and its future inhabitants:

- The more complex planning and implementation process (consideration of many different, sometimes diverging requirements and achieving agreement between many actors and stakeholders) is a challenge for planners, developers and the community. Accordingly, more time may be necessary for this process.
- Neighbours are affected by an ECOCITY only to a minor extent. They can generally continue their way of life as usual – in contrast to new conventional settlements, the increased impairment to be expected from car traffic is small. However, there may be some negative impacts during the construction phase (noise, construction traffic).
- The future inhabitants know about the circumstances of living in an ECOCITY (such as reduced car traffic, but also fewer facilities for motorists) before they decide to move there and should not consider them a disadvantage. Investment costs may be higher, but life cycle costs are lower.

Thus most of the potential disadvantages of an ECOCITY are either the same as or, mostly, considerably reduced compared to a conventional development. The greatest problems are generally related to the fact that ECOCITIES challenge established views, routines and patterns. The resulting task for those wanting to establish an ECOCITY is thus to communicate the advantages clearly and convincingly and to dispel the worries and fears often associated with the new and the unknown.

However, the nature of an ECOCITY as an urban development project makes it impossible for the stakeholders to test the 'product' before deciding about it. All the parties involved must therefore imagine the 'functioning' of the ECOCITY and all the benefits of living there. The description and visualisation of the ECOCITY concept in this handbook should form a valuable aid in this.
The concepts for the seven model settlements were developed for different sites (brownfield, greenfield and existing structures) in communities of different sizes and in different climate zones. These concepts are an attempt to advance the vision for ECOCITIES (see Chapter 2), visualise their urban patterns in plans and promote their implementation as examples of good practice, supporting urban stakeholders in the decisions they make towards urban sustainability.

The ECOCITY handbook consists of two parts:
'ECOCITY Book I - A better place to live', includes general information on the ECOCITY approach: the vision of an ECOCITY is developed and translated into objectives for the planning of model settlements; the seven settlements planned as part of the ECOCITY project are introduced and the main conclusions drawn from the experiences made during the project are presented.
'ECOCITY Book II - How to make it happen', includes general guidelines for the development of an ECOCITY, explaining the objectives in Book I in more detail. It also provides techniques and tools for the planning process. Book II is mostly aimed at planners and other decision-makers who are involved in the development of urban settlements.
Additional information: 'Public reading' section of the project website: ***http://www.ecocityprojects.net***.

1.2 Definitions

The overall concepts of sustainable development and sustainable mobility at the heart of the ECOCITY project have been stated and defined elsewhere in different contexts. The following sections clarify the understanding of what these terms mean within the ECOCITY project.

1.2.1 Sustainable development

Sustainable Development was defined as follows in the report entitled 'Our common future', published by the World Commission on Environment and Development (also known as the 'Brundtland Report'):
"Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs." [1987, p.24].
There are many things people may want to sustain: an activity, an institution, economic transactions or, as in the context of this book, a human settlement. These things are all part of, or in fact constitute, a system, and thus what we want to sustain is these systems and their operability. The **main requirement** for making human activity sustainable in the original sense is to focus on the **(external) relationships** of the system (e.g. the human settlement) with its natural environment, which ultimately provides the basis for all our activities. To achieve sustainability, the input into and the output from the system must fulfil the following requirements:

- The rate of resource use (inputs: materials and energy) must not be greater than the rate of their regeneration
- The rate of emission (outputs) must not be greater than the rate at which the pollutants generated by the system can be absorbed.

But to meet these requirements, one must consider the **internal relationships** between different elements within the system, as these processes determine the steps which need to be taken towards

greater sustainability. To deal with the complexity of the overall system of human society, it has been divided into different subsystems by various authors. In the most frequently cited approaches [e.g. Camagni, R. et al., 1998; Castells, M., 2000] the original focus on environmental/ecological issues was complemented by emphasising social and economic matters as well which should be brought into balance (the 'three pillars/dimensions model'). Achieving this balance necessitates compromise, as the requirements of the three dimensions at times contradict each other. Since we might be able to learn, for example, to use natural resources more efficiently but ultimately have no way of changing the laws of nature to meet excessive human demands, human systems must be adapted to the capacities of the natural environment if we want to survive and thrive.

To deal with the complexity of the urban system, it is helpful to consider the main sectors of urban development as subsystems. For the ECOCITY project, the following main sectors were chosen: urban structure, transport, energy and material flows and socio-economic aspects. These subsystems must be sustained and need to interact in the overall 'urban settlement' system to meet the above-mentioned two main requirements for sustainability.

Fulfilling these requirements can be achieved by meeting the following goals:

- Minimising use of land, energy and materials
- Minimising the impairment of the natural environment.

These goals have been extended by additional sector-focused ones to produce a list of 'Overall ECOCITY Goals' (they are stated in more detail in Chapter 2), including:

- Maximising human well-being (quality of life)
  Although meeting the overall objectives for sustainable settlements contributes to a higher quality of life, other contributions are also necessary, especially in the social sector.
- Minimising total lifecycle costs (for production, utilisation and disposal)
  Costs are an important factor in deciding on the implementation of a project, but priority should be given to its quality in relation to sustainability.
- Minimising transport demand
  Appropriateness for sustainable transport is an essential requirement for the sustainability of an urban system. The achievement of the main objective for this sector is closely linked to achieving the other 'Overall ECOCITY Goals'

The sectoral objectives derived from these goals are also presented in Chapter 2.

1.2.2 Sustainable mobility and accessibility

Mobility

A general definition of 'mobility' is to be found in the Glossary of the European Environment Agency [EEA multilingual environmental glossary[3)]]: *"The ability of groups or individuals to relocate or change jobs or to physically move from one place to another".*

[3)] *http://glossary.eea.eu.int/EEAGlossary* [accessed January 2005].

However, in recent decades, mobility has become a value in itself. Travel distances have increased along with travel speeds and people generally now have to cover greater distances than they used to in order to fulfil the same needs as before: getting to school and to work, doing the shopping, visiting friends and family, etc. In the context of the ECOCITY, therefore, a more specific definition of mobility is used. High mobility – as a characteristic of people – is determined by the ability to reach a great number of destinations within the shortest possible time while covering the shortest possible distance. Short travel times are thus not a function of high travel speeds but mostly of short distances. This kind of mobility can only be achieved within ECOCITY types of urban structures.

Accessibility

A general definition of 'accessible' is to be found in the Merriam-Webster Online Dictionary[4]: *"Accessible means to be capable of being reached (being within reach) or capable of being used (being available)"*.In urban planning accessibility is defined by the time necessary to reach a desired destination. This time depends mainly on the physical distances between origin and destination but also on travel velocity. Maximising accessibility could thus in theory be achieved by increasing velocities. Since the inherent problems of the transport system (e.g. congestion) as well as the uneven availability of private cars and general sustainability requirements (including minimising pollution and energy consumption) set very definite limits to this option, the preferred alternative is to decrease the distances that people need to cover.

Thus, in the context of the ECOCITY, good accessibility is understood as the close provision of necessary facilities in space and time, complemented by the availability of high-quality, environmentally compatible transport links (direct, barrier-free pedestrian and cycle routes and attractive public transport routes).

In an ECOCITY, therefore, **good accessibility** (as a characteristic of urban structures) **is the basic requirement for high mobility** (as a characteristic of people). Both together can be achieved in a sustainable way by creating a city of short distances.

[4] *http://www.m-w.com* [accessed January 2005].

1.2.3 ECOCITY

There are different approaches to sustainable urban development which focus partly on adapting existing settlements in small, gradual stages and partly on developing completely new solutions. While some approaches concentrate on developing theories of urban development as frameworks for action, others focus on implementing alternatives.

The term *Ecocity* has so far been used mainly by movements which were aiming to realise new, consistent urban solutions as alternatives to current developments. A pioneer in disseminating the Ecocity idea is the Ecocity Builders organisation in the USA [5], which is dedicated to reshaping cities, towns and villages for the long-term health of human and natural systems, by organising a series of 'International Ecocity Conferences'. Ecocity Builders and similar organisations describe an Ecocity through a number of principles, as for instance in the declaration of the 5th Ecocity conference in Shenzhen, China (August 2002). One of the core tenets is to build cities for people and not for cars. A further example, in Germany, is the Förderverein Ökostadt e. V. [6], which is trying to find a site for an Ecocity just outside Berlin.

[5] Ecocity Builders, Berkeley, California, USA, *http://www.ecocitybuilders.org* [accessed March 2004].

The approach of the ECOCITY project is a step towards combining theory with practice, including both the development of a vision and the planning of concrete model settlements. For this project, an ECOCITY was defined as a **vision** of a **sustainable** and **liveable city or town** to be implemented in a smaller settlement unit, i.e. a model quarter or neighbourhood as an example for the community as a whole.

[6] Förderverein Ökostadt e. V., Berlin/Lychen, *http://www.oekostadt-online.de* [accessed March 2004].

In the ECOCITY project, **an urban quarter** was defined as part of a city with identifiable functional or spatial borders and a small-scale mixture of functions. An urban quarter is usually composed of more than one neighbourhood.

The following chapters will explain in more detail the objectives for the different aspects of ECOCITY planning (Chapter 2), the ECOCITY planning process (Chapter 3) and the concepts developed for the seven different ECOCITY sites (Chapter 4). Chapter 5 summarises the experiences gathered during the planning and evaluation of the ECOCITY concepts.

2 ECOCITY – Objectives

This chapter outlines the main framework for ECOCITY development (see also Figure 2.1). It presents the ECOCITY vision (Section 2.2) and ECOCITY objectives (Section 2.4), both of which are based on sustainability requirements and the related overall ECOCITY goals. The objectives are structured according to the ECOCITY elements of urban planning (context and the four sectors of urban development: urban structure, transport, energy and material flows, and socio-economy, (Section 2.3). The objectives were developed as an aid to translating the vision into reality at the level of a sustainable neighbourhood. They also help to give readers a better idea of what such a neighbourhood could be like. The concrete measures associated with these objectives can be found in 'ECOCITY Book II – How to make it happen'.

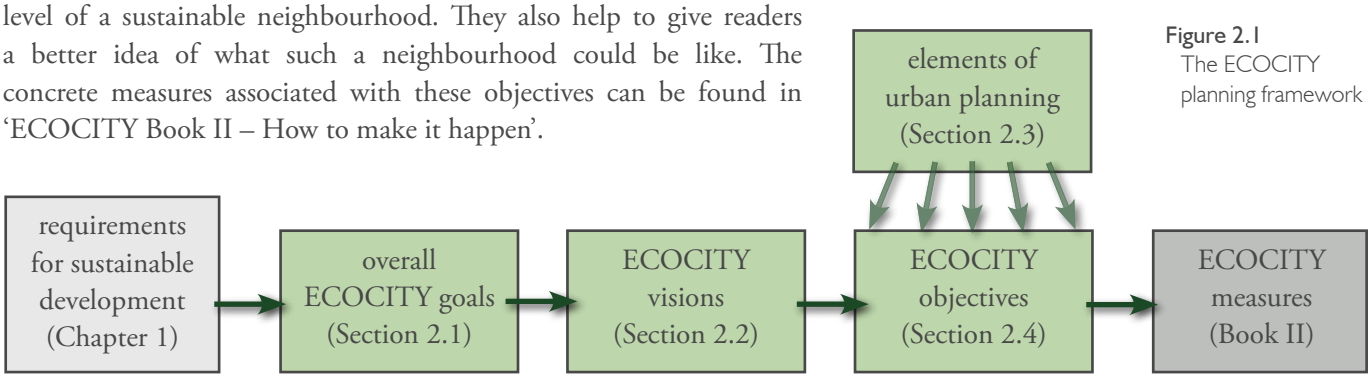


Figure 2.1
The ECOCITY planning framework

2.1 Overall ECOCITY goals

To provide more concrete guidance for the ECOCITY planning process, the overall goals for sustainable development (see Section 1.2.1) were devised and supplemented with some more sector-focused objectives to produce the following list of 'Overall ECOCITY goals' (Figure 2.2). Many of these goals have been formulated as maximising or minimising an attribute of urban planning. In this context, to minimise something (e.g. land use or energy consumption) does not mean to reduce it to 0%, but to reach an optimal minimum which takes into account other related objectives.

> Minimise demand for land (particularly for greenfield sites)
> Minimise primary material and primary energy consumption
> Optimise interaction with municipal and regional material flows
> Minimise impairment of the natural environment
> Maximise respect for natural context
> Minimise transport demand

> Satisfy basic needs & realise structures for human care
> Minimise impairment of human health
> Maximise mental well-being and community feeling
> Maximise respect for anthropogenic context
> Create a framework for good governance
> Maximise awareness of sustainable development

> Realise a diversified, crisis-resistant and innovative local economy
> Minimise total lifecycle costs (maximise productivity)

Figure 2.2
Overall ECOCITY goals

Similarly, to maximise something (e.g. maximise respect for natural context) means to achieve an optimal maximum.
Most of the objectives are interdependent. They either point more or less in the same direction or they require a solution to be found for two apparently opposed objectives (for example, minimising transport demand versus satisfying basic needs, e.g. for mobility). For an optimal fulfilment of these goals, local conditions must also be taken into account (climate, culture, environmental problems, etc.) and planning solutions must thus be determined individually for each development task or project.

2.2 The ECOCITY vision

Alongside the overall ECOCITY goals, a number of historic and contemporary concepts of urban planning played an important role in developing the vision of an ECOCITY. These concepts are presented in the following section.

2.2.1 Concepts of urban planning contributing to the ECOCITY vision

Although the term chosen to describe it has not always been the same, the idea of urban sustainability can be traced through the development of urban planning concepts and practices back to the first appearance of urbanism as a discipline in the middle of the 19th century. It is not possible here to explore this development in great depth, but reference will be made to the aspects which are most relevant to the central idea of the ECOCITY. These aspects include the interdependence of urban and transport planning, the relationship between rural and urban tissue, urban density, the territorial context of cities, the city as a social stage and the preservation of material and energy resources. The following ideas developed between the 1860s and the 1970s are of particular relevance:

- General theory of urbanisation – Ildefonso Cerdá: public transport, mix of land use and the presence of nature as the basic elements of a geometrical urban grid (1867); partially applied in the Barcelona Extension Plan
- The linear city – Arturo Soria y Mata: extensive linear urban development as appropriate structure for trams or railways, allowing the proximity of city and countryside (1882); partially applied in the 1949 Copenhagen 'Finger Plan' in combination with a satellite town concept
- The garden city – Ebenezer Howard: green areas integrated into settlements of medium density and limited size to allow proximity to the surrounding green spaces (combining the advantages of urban and rural structures); interconnection of these settlements into a polycentric urban development by railway lines (1898); origin of an extensive movement very influential in Europe
- Fields, factories and workshops – Piotr Kropotkin: proximity and mix of land use (industrial, residential and cultural), resource self-sufficiency (1898)
- The organic city – Patrick Geddes and Lewis Mumford: cities as living organisms evolving as they adapt to a changing environment; decentralisation and mix of land use (1915)
- The neighbourhood unit – Clarence Perry: the city composed of 'cellules' of a maximum radius of a quarter of a mile or about 400 meters (i.e. walking distance) around a mixed-use centre (1923); applied in some British New Towns and in Abercrombie and Forshaw's Greater London Plan of 1944
- The Radburn model – Clarence Stein and Henry Wright: hierarchy of roads and paths forming separated networks for motorised traffic and pedestrians; applied in the Radburn Garden City, USA (1928)
- The social city – Jane Jacobs: the street as a main attractor of urban life; bottom-up approach to planning (1962)

- Design with nature – Ian L. McHarg: a multi-layered design approach on the regional scale with an ecological orientation (1969)
- A pattern language – Christopher Alexander: systematisation of timeless urban and constructive patterns in the form of a new community-oriented design tool (1979)

These ideas have been of varying but continuous influence throughout the second half of the 20th century. However, urban planning ideas and activities have undoubtedly been most influenced in Europe by the Charter of Athens and in the USA by the effects of urban sprawl. Nevertheless, several currents aimed at counterbalancing these mainstream practices have developed in parallel and have given birth to new formulations. These have been based partly on the historical examples quoted above and partly on new ways of thinking and new areas of knowledge applied to solving the urban problems arising during the 20th century. Among the ideas and concepts formulated in the past two decades, the following are of special importance to ECOCITY planning:

- New urbanism – Andres Duany, Sim van der Rijn and others: mostly North American anti-suburbanisation approach based on reviving the traditional community values of medium and small towns. Smart growth is the term applied when referring to the more general concept beyond pure urban planning
- Pedestrian pockets – Peter Calthorpe: urban growth based on compact multifunctional settlement units (appropriate for pedestrians) linked by transit lines. The idea belongs in the context of new urbanism
- Transit-oriented development based on the 'Charter of the New Urbanism'[7]: focusing regional growth in regional or town centres and around transit corridors in compact mixed-use, mixed-income developments, scaled for pedestrians; realised in some cities in the USA, e.g. Portland, Oregon
- European compact city: reconsideration of the traditional European compact city as the best example of sustainable urban values: compactness, mix of land use, street-based public spaces, proximity, etc. With regard to sustainable mobility, the concept is closely connected to the idea of traffic calming; appears in several sources, especially in the European Commission's 'Green paper on the urban environment' published in the 1990s; conceptually developed by René Schoonbrodt, Leon Krier, Andreas Feldtkeller, Richard Rogers and Salvador Rueda among many others
- Sustainable mobility: consideration of mobility as a structural factor for urban sustainability that should be approached as a whole through a wide set of measures; Jeff Kenworthy, Peter Nijkamp, John Whitelegg, David Engwicht, William H. Wythe and Jan Gehl have, among many others, contributed to this approach which is still under development
- Ecocities and ecovillages – Richard Register: ecocity zoning as a tool for polycentric restructuring of car-dependent cities (including sprawl), increasing the density around centres and recovering natural and agricultural landscapes in the interspaces(strong focus on scale of ecosystems and habitats)
- Netzstadt – Franz Oswald and Peter Baccini: a new model for urban redevelopment and reconstruction based on regional co-operation of adjacent communities in Switzerland, forming a 'net city' (e.g. Netzstadt Mittelland Aarolfingen, consisting of the towns of Aarau, Olten and Zofingen); co-ordinating the spatial development of the core living and working sectors with transport development to attain synergies
- Landscape urbanism: application of landscape architectural design tools to the urban territorial scale; formulated, among others, by James Corner and Charles Waldheim in the USA and Kees Christiaanse in Europe; principles applied in the Fresh Kills Park Competition by James Corner (New York)

[7] Congress for the New Urbanism (2001), *http://www.cnu.org/cnu_reports/Charter.pdf* [accessed January 2005]

2.2.2 Features of an ECOCITY

The ECOCITY vision not only conveys an overall impression of what an ECOCITY can be like, it also aims to promote awareness of sustainable urban planning issues. A vision shared by the people involved helps to focus on a common goal and to guide the steps of urban development towards an ECOCITY. The ECOCITY vision comprises features of a sustainable community from all the relevant sectors of urban development. In addition to aspects related to the design of the urban structure and the transport system, there are also features relating to energy and materials, a community's way of life and the urban economy (see Figure 2.3). The realisation of the ECOCITY vision and the related goals and objectives thus relies on an integrated planning approach (see Chapter 3).
The focus of the vision lies in the overall aim of the ECOCITY project ***to develop settlement patterns for sustainable cities, emphasising the implications for an environmentally compatible transport system***. It relates to an entire urban community, but is also intended to guide the planning of ECOCITY quarters as elements of such a community.
These features are interconnected in many ways. To demonstrate the need to balance the manifold requirements of sustainable urban development, two important features have been selected as examples and their connections to other features are explained below.

The feature ***City of short distances*** is strongly related to the overall aim of the ECOCITY project and therefore occupies a central position. It is closely connected to urban development *(City as network of urban quarters)*, to the selection of an ECOCITY site preferably close to the city centre or a sub-centre *(City of accessibility for everyone)* and to a high potential for attractive public transport *(City of development concentrated at suitable sites)*. Bringing living, working and the fulfilment of everyday needs together again *(City of balanced mixed use)* in a dense urban pattern *(City of qualified density)* promotes accessibility by the environmentally compatible transport modes *(City for pedestrians, cyclists and public transport* and *City of accessibility for everyone)* and reduces the dependence on private cars *(City of sustainable lifestyle)* and thus motor traffic decreases. This minimises noise and air pollution *(City of health, safety and well-being)* and contributes to public spaces with little or no disturbance by cars and a high amenity value *(City with public space for everyday life)*.

A ***City of qualified density*** facilitates the reduction of land consumption e.g. by re-using brownfield sites and through dense building layouts *(City of minimised demand for land)*. It is also a precondition for an efficient energy supply with community heating networks, based for example on wood chips or biogas *(City of minimised energy consumption)* and promotes interaction between people through a high social density *(City of public space for everyday life)*. At the same time, density is limited by the citizens' need for open spaces *(City with integrated green areas)*, the requirements for rainwater management and even wastewater treatment facilities on the site *(City contributing to closed water cycles)*. Density is also restricted by the need for sufficient sunlight and daylight conditions *(City of health, safety and well-being* and *City of bioclimatic comfort)* and the passive use of solar energy through south-facing façades *(City of minimised energy consumption)*.

Figure 2.3
Features of an ECOCITY as an illustration of the vision

2.3 Elements of ECOCITY planning and development

There are five elements which are relevant to urban planning for an ECOCITY: context and the four sectors of urban development: urban structure, transport, energy and material flows, and socio-economy (see Figure 2.4). These elements each comprise a number of aspects which are used to structure the presentation of the objectives in Section 2.4.

Figure 2.4
Elements of ECOCITY planning

CONTEXT refers to all the physical and virtual surroundings affecting, affected by and interconnected with the city, which provide a general framework to understanding its internal functioning. Associated aspects of ECOCITY planning: **natural environment, built environment**

Sectors of urban development

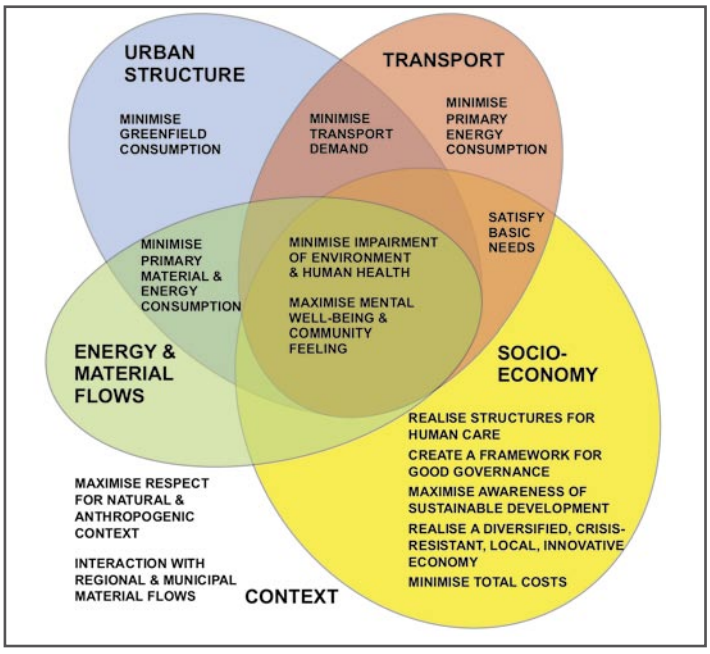
URBAN STRUCTURE refers to the physical reality of the city considered as an interconnected system. Associated aspects of ECOCITY planning:
demand for land, land use, landscape/green space, urban comfort, public space, buildings

TRANSPORT refers to the physical and virtual movement of people, goods and data into, through and out of the city.
Associated aspects of ECOCITY planning:
slow modes / public transport, individual motorised transport, transport of goods

ENERGY & MATERIAL FLOWS refers to the movement or flow of energy and materials in space and through different urban and physical systems.
Associated aspects of ECOCITY planning:
energy, water, waste, building materials

SOCIO-ECONOMY refers to those human activities determining the social processes and economic life of the city.
Associated aspects of ECOCITY planning:
social issues, economy, costs

Figure 2.5
Overall ECOCITY goals structured according to elements of ECOCITY planning



Structuring the overall ECOCITY goals (see Section 2.1) according to the five elements of ECOCITY planning, shows that some goals are related to all ECOCITY planning elements, while others relate only to one or two of these planning elements.

2.4 ECOCITY objectives

The following sections present the objectives associated with the five elements of ECOCITY planning. The tables also include the overall ECOCITY goals which relate to each of the planning elements (see Figure 2.5). The text following each of the tables explains the objectives and their relevance. In addition, the 'Vision of an ECOCITY' graphic is reproduced beside each text, with the relevant features highlighted, to illustrate the link between the objectives and the vision presented in Section 2.2.

2.4.1 Objectives for (regional and urban) context

OVERALL ECOCITY GOALS	
> **maximise respect for natural and anthropogenic context:** landscape, nature, agriculture, urban tissue, genius loci, culture, infrastructure, mix of uses, local economy > **maximise mental well-being and community feeling:** health and recreation, cultural identity > **optimise interaction with municipal and regional material flows:** water, energy, food	
OBJECTIVES FOR …	
Natural environment	• strive for the protection of the surrounding landscape and its natural elements • make sustainable use of the surrounding landscape as a social and economic resource • plan in accordance with the climatic, topographical and geological setting
Built environment	• strive for a polycentric, compact and transit-oriented city structure • consider concentration and decentralisation for supply and disposal systems • promote use, re-use and revitalisation of the cultural heritage

Table 2.1
Overall ECOCITY goals for (regional and urban) context and objectives for related aspects of ECOCITY planning

Over the past 20 years the extent of built-up areas in many western and eastern European countries has increased by some 20% and far exceeds the rate of population growth in the EU over the same period (6%) [EEA, 2002]. This development is closely connected with habitat fragmentation caused by transport and other urban infrastructure and poses a major threat to biodiversity in large parts of Europe [EEA, 2003].

Against this background, new settlements and their infrastructure must be carefully planned (based on clearly defined socio-economic requirements to demonstrate the necessity for new developments) and thoroughly integrated into the regional and urban context.

Thus the planning for an ECOCITY quarter must consider adjacent areas as well as its integration into the city and the region on a wider scale. Selecting the right location and meeting the objectives for integration into the natural and built environment are two basic requirements for a high-quality development on the scale of the urban quarter.

Examples of important integration tasks are: providing connections for pedestrians and cyclists to existing networks; providing access and links to the public transport networks; creating social infrastructure that usefully supplements or extends existing facilities in adjacent city quarters; and connecting landscape elements in order to achieve green space and habitat networks.

Natural environment

On the regional scale, the natural environment provides the context for human settlements[8)]. The protection of the surrounding landscapes and their natural elements are therefore an essential objective

[8)] While on the global scale it provides the basis for human life per se.

for ECOCITY planning. The characteristics of the natural environment – ecosystems, habitats and species – differ from region to region and should be maintained and where necessary reinforced, while lasting detrimental and destructive impacts should be avoided. These objectives must be in balance with the requirement to use natural resources and assets in a sustainable way for economic and social purposes. For example, surrounding landscapes should, in part, serve as recreation areas connected to city quarters by attractive links. In this way they can make an important contribution to the quality of life and can offer alternatives to recreational activities further away from home. Diversified rural and urban agriculture allows regional and preferably also organic food production and helps to maintain cultural landscapes which have evolved historically from agricultural land use. Sustainable forestry and ecologically sensitive tourism can lead to added values based on local natural resources.

The natural environment of a settlement also comprises the climatic, topographical and geological setting. The climate must be considered, for example for air exchange systems on the urban scale, in order to achieve good bioclimatic conditions. Planning in accordance with the local topography might involve the smooth integration of pathways into the topography in order to provide comfortable walking and cycling. Built structures should also be visually integrated into the landscape and (depending on the climatic context) shady, north-facing slopes should be avoided, in order to promote buildings which receive sufficient solar radiation, are well-lit and contribute to energy saving. Geological aspects, such as soils and groundwater systems, play an important role in urban green spaces (e.g. choice of species for planting), rainwater management and building construction.

Built environment

In order to select an appropriate ECOCITY site, the potential of a particular location must be considered in relation to the following key issues:

- An attractive public transport system allowing maximum accessibility and promoting environmentally sound transportation patterns. The potential is generally considered to be high if the new development is situated either on an existing main axis of public transport infrastructure or near one which can be extended easily and economically
- Minimising use of new land to achieve a compact city structure. Therefore, well-situated brownfield locations (e.g. on former military, industrial, railway or harbour sites) and inner city developments (e.g. densification sites) are preferable. Consideration should also be given to whether the site is suitable for a high-density development with regard to the relationship with the densities of the surrounding areas

To achieve a city of short distances, new developments should also contribute to creating a polycentric city structure as a network of mixed-use city quarters. Choosing the right location does not in itself ensure high-density structures or the provision of attractive public transport on the site itself, but it does establish important preconditions for achieving these (see Section 2.4.2).

For the sustainable use of resources, a new balance of the concentration and decentralisation of supply and disposal systems (for energy, water or waste) may be necessary. Heating energy, for example, can be supplied very efficiently from centralised generation systems within the neighbourhood, as opposed to city-scale heating networks or small-scale heating systems for individual houses. Also, grey water treatment facilities for less polluted domestic wastewater can be created on the site, thus contributing to closing local water cycles and relieving more centralised waste water treatment plants.

Urban settlements should also fit into their historical context. Thus, ECOCITY planning should respect, draw on and even revitalise the relevant cultural heritage (related to regional climate, social conditions, political systems, religion and ethnicity as well as economic conditions and the age

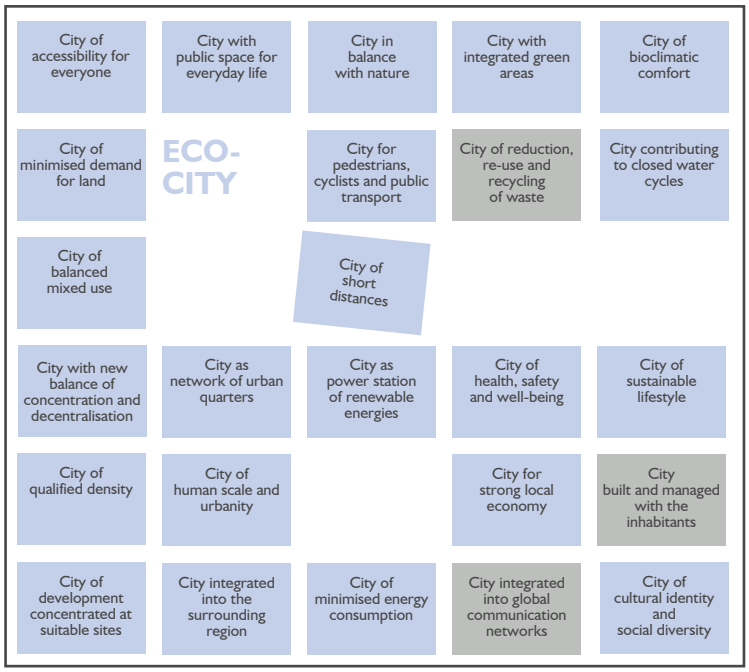
of existing settlements). For instance, the history of the local area can be used to inspire regional parameters for building forms and construction methods, the shape and proportion of public squares, plot configurations and the scale and even the design of streets. Such parameters help to maintain or create a recognisable identity for ECOCITY settlements which is based on regional assets.

2.4.2 Objectives for urban structure

Table 2.2
Overall ECOCITY goals for urban structure and objectives for related aspects of ECOCITY planning

OVERALL ECOCITY GOALS	
> **minimise demand for land (particularly for greenfield sites):** avoid urban sprawl > **minimise primary material and primary energy consumption:** energy-saving settlement structure, material-saving settlement structure > **minimise transport demand:** by optimising mix of use > **minimise impairment of the natural environment and human health** > **maximise mental well-being and community feeling:** urban comfort, liveability, mix of use, communication and opportunities for social contact, safe and barrier-free access, aesthetics, diversity, short distances, gradual development, sufficient space for working and living, etc	
OBJECTIVES FOR …	
Demand for land	• increase re-use of land and built structures to reduce demand for land and new buildings • develop structures of qualified high density
Land use	• organise a balance of residential, employment and educational uses as well as distribution, supply and recreational facilities • strive for fine-meshed, mixed-use structures at building, block or neighbourhood level
Public space	• provide attractive and liveable public spaces for everyday life • consider liveability, legibility and connectivity of public space patterns
Landscape / green spaces	• integrate natural elements and cycles into the urban tissue • create landscape patterns for high social usability
Urban comfort	• strive for high daily, seasonal and annual outdoor comfort • minimise noise and air pollution
Buildings	• maximise indoor comfort and resource conservation throughout the lifecycle of buildings • plan for flexible, communicative and accessible buildings

New settlements are still often dominated by monofunctional structures. These are associated with high transport demand, as accessibility is often based on car traffic, which leads to high energy consumption and related emissions. At the same time, residential space per capita increases as building densities decrease, exacerbating the effects on transport demand. Thus noise and air pollution, including exposure to particulate matter, remain a health hazard in urban environments [EEA, 2003]. Consequently, the quality of the urban environment and the avoidance of urban sprawl are major issues for sustainable urban planning in Europe.



Demand for land

An appropriate use of land as a resource is a basic requirement for ECOCITY planning. Brownfield sites and existing buildings, provided that they are appropriately located (see Section 2.4.1), should be re-used wherever possible, thus reducing demand for land and material consumption. Another priority is infill development, which means a densification within the existing city structures without extending outwards, for example by siting new buildings in gaps between existing structures.

A qualified high building density is an important tool for reducing demand for land. Instead of detached, single-family houses with large gardens, compact building structures, such as multi-storey r!esidential, commercial or mixed-use buildings, should be considered. The challenge for the architects is to create high-quality buildings with several floors, such as apartment buildings or terraced houses, while at the same time providing inhabitants with the spatial quality expected from a single-family home. However, when planning for high-density layouts, provision must also be made for good daylight conditions for dwellings and offices, the use of solar energy and sufficient open spaces. Balancing these demands leads to what is known as 'qualified high density'. Such developments provide the preconditions for economic public transport and community heating systems, the supply of daily goods and opportunities for social contact.

Land use

To ensure that people travel the shortest possible distances to fulfil the demands of everyday life, a balanced mix of land use in quarters, cities and regions is of great importance. Organising a mix of residential, employment and educational uses as well as the integration of distribution, supply and recreational facilities is therefore a core objective of ECOCITY planning. Today's economic structures in Western societies facilitate land-use mix because the tertiary sector (trades and services) is of growing significance. Many shops and offices can easily be mixed with dwellings. Certain trades (e.g. carpenters and plumbers) can appropriately be situated in the neighbourhood of residential buildings. In general, a maximum number and variety of jobs should be available within and near an ECOCITY quarter so that a large proportion of working people can benefit from short trips to and from their place of work. To implement this approach, planning must involve the provision of appropriate spaces and relevant building typologies. Targeted marketing and information provision by the developer and/or the municipality can help to attract appropriate businesses.

In addition to a balanced overall combination of uses, their spatial distribution is a major issue. Generally, the aim should be for fine-meshed, mixed-use structures at building, block or neighbourhood level. Shops for everyday requirements, primary schools and facilities for cultural and leisure activities should be situated within walking distance in or around the neighbourhood. An example of block-level mixed use is residential buildings, commercial buildings and a nursery school sited next to each other in one block. At the individual building level, use mix can mean retail facilities on the ground floor facing directly on to the street or public spaces, offices on the middle floors and dwellings on the upper floors.

Small-scale mixed use of this type contributes much more to the variety and vitality of the urban structure as well as to attractive public spaces than mixed use at the level of a quarter, where businesses are concentrated in a single location within residential surroundings.

Public space

Attractive public spaces for everyday life are a core element of ECOCITIES. The reduction of motorised traffic through ECOCITY planning facilitates the design of public spaces that are rich in quality and quantity and are not blighted by the visual and noise intrusion or the air pollution caused by traffic. The public spaces can be used as multi-functional places for recreation, playing and social contacts, events and commercial activities like farmers' markets. Urban green space provides aesthetic and microclimatic qualities (texture, colour, shade and wind protection). Squares and pedestrian arcades along major desire lines can be a highlight of ECOCITIES. Amenity is enhanced by water design with fountains, playgrounds with water features and channels of water running along streets, while well-designed and well-sited street furniture (e.g. benches, lights, information panels and waste bins) provides orientation, information and convenience. The willingness of private individuals or businesses to contribute to the design and maintenance of public space can be fostered by providing opportunities for people to identify with their ECOCITY. This can be one result of comprehensive community involvement. The liveability, legibility and connectivity of public space patterns should be maximised. This means designing urban spaces with active building frontages, such as residential entry gates as well as commercial and public facilities facing on to streets and squares. Public spaces should also be well-articulated, clearly identifiable and comprehensible as a hierarchical network of squares, streets and lanes. Connections to the open spaces of surrounding areas should also be clear. Public spaces should be subject to 'social supervision' from the windows of low- and medium-rise buildings facing on to them, to provide safety and security. Easy access should be ensured from everywhere and without barriers to pedestrian mobility (including mobility-impaired people).

Landscape and green spaces

An ECOCITY should be planned with careful consideration of natural elements like woodlands, trees, meadows and hedges, as well as water elements like lakes, streams and ponds. These natural elements and related cycles should become an essential element of the urban system. Based on a thorough analysis of the site, existing environmentally valuable structures should be maintained, for example by keeping larger green zones and basing street and building layouts around existing green spaces. Together with new green areas and corridors, these structures should fit together as an urban habitat network.

Generally, the volume of green outdoor areas, façades and roofs and their ecological quality should be maximised, while sealed surfaces should be minimised. In densely built areas this is even more important and can be achieved through the use, for example, of green terraces, vertical gardens and trees in streetscapes.

Besides taking into account the natural cycles, green areas in neighbourhoods should also be created for high social usability, providing a hierarchical structure with public parks, semi-public courtyards and private gardens. These should also accommodate sport and other leisure activities and link into the peri-urban green space to reduce the demand for leisure travel. Green terraces, communal and private gardens at ground floor level and courtyard allotments can offer alternatives to the suburban, single-family garden. A city farm for local food production can also contribute to helping children learn about nature.

Urban comfort

An urban climate which is balanced throughout the day and the seasons is essential for people's health and well-being and is therefore an important aspect for developing ECOCITIES. This requires air exchange corridors, building layouts that allow ventilation to courtyards and windows and a locally appropriate exposure of buildings and public spaces to sun and shade.

The vegetation of outdoor areas, roofs and façades as well as water elements further support a balanced bioclimate. Air pollution should be minimised, both by reducing emissions from traffic, industry and energy generation and by utilising the filtering and absorption capacity of trees and woodlands in green buffer zones or shelter belts.

Since a lot of people in urban areas suffer from noise intrusion, which can lead to severe health problems (e.g. stress-related disorders such as sleep disturbance or cardio-vascular diseases), noise pollution must be minimised. In an ECOCITY, people benefit from the reduced transport-related noise emissions (e.g. in car-free areas) as well as from immission-reducing measures such as insulation, tailored building layouts and ground modelling.

Buildings

The quality of buildings in ECOCITIES should be determined by requirements for high levels of indoor comfort and the conservation of resources in construction and building use. This includes low energy consumption, green roofs and façades, good noise protection and high-quality architecture to meet the potentially changing demands of the users. For the selection of building materials, all phases of the lifecycle should be considered, maximising the proportion of renewable and recycled (as well as recyclable) materials. Indoor comfort is created by using healthy materials and heating systems providing high thermal comfort and good indoor climates.

An additional objective is to plan for flexible, communicative and accessible buildings. Buildings should be adaptable, for example from commercial to residential or educational uses, and should also be changeable throughout the lives of their occupants. Thus a family apartment could become two apartments for parents and children or for elderly people. Residential buildings should also encourage social contact by integrating different generations and offering communal rooms, for example for parties and child care. All buildings in an ECOCITY must be accessible to the mobility-impaired (such as people with heavy luggage, prams or wheelchairs).

2.4.3 Objectives for transport

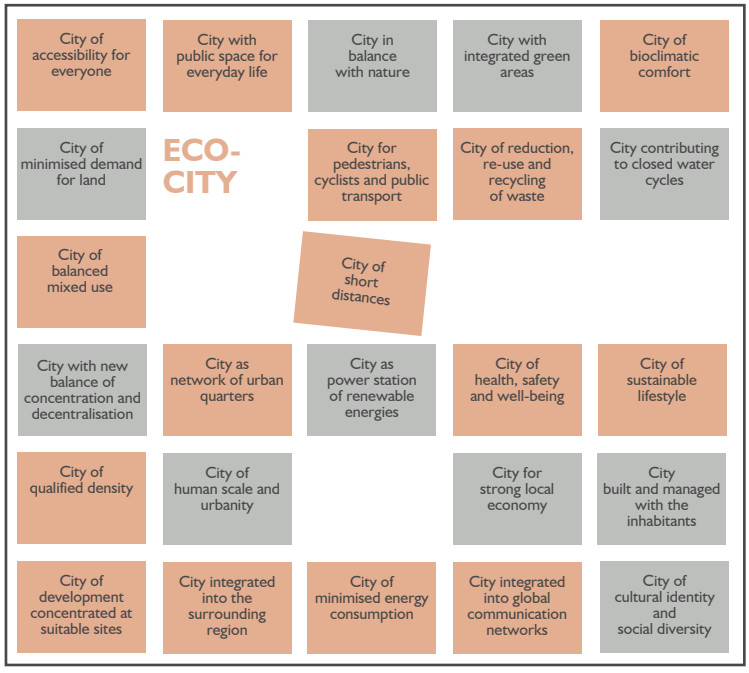
Transport is a major factor contributing to energy consumption and environmental problems (pollution, greenhouse gas emissions, noise and habitat destruction). In the EU in 2001 about one third of final energy consumption was related to road transport. An average EU citizen travels 35km per day in motor vehicles, 80% of this distance by private car. In the new member countries these figures are lower but they are increasing. If current trends continue, by 2010 motor vehicle kilometres will rise by 26% compared to 1998.

Apart from the ecological impact, several severe social and health problems are related to transportation. An unacceptably high number of people are still killed or injured in urban traffic accidents (two thirds of the 1.3 million traffic accidents in the EU in 2000 that led to injuries took place in urban areas). Noise is also a serious and growing problem in urban areas - 80% of it comes from road traffic. At least 100 million people living and working in European agglomerations or in the vicinity of transport infrastructure are exposed to road traffic noise levels above the WHO recommended level of 55 dB(A). Traffic also causes visual and psychological disturbance and is thus perceived as one of the key factors which compromises the quality of life in towns and cities.

OVERALL ECOCITY GOALS	
> **minimise transport demand** > **minimise primary material and primary energy consumption** > **satisfy basic needs and realise structures for human care:** mobility > **maximise mental well-being and community feeling:** accessibility to services, barrier-free accessibility to transport networks, etc. > **minimise impairment of the natural environment and human health:** e.g. through greenhouse gas emissions (environment) and through noise or accidents (human health)	
OBJECTIVES FOR …	
Slow modes / public transport	• minimise distances (in time and space) between activities to reduce travel demand • give priority to pedestrian and cycle paths as the main network for internal neighbourhood traffic • give priority to public transport as the most important element of a sustainable personal transport system • provide mobility management measures to support modal shift to environmentally compatible modes
Individual motorised travel	• reduce the volume and speed of individual motorised travel • support the reduction of motorised traffic through parking management
Transport of goods	• facilitate a neighbourhood logistics and delivery concept to minimise the need for individual load carrying by car • plan for efficient construction logistics

Table 2.3
Overall ECOCITY goals for transport and objectives for related aspects of ECOCITY planning

In a 1995 survey of EU urban citizens, 51% stated traffic as the main reason for complaining about their environment, with two further transport related issues – air quality and noise – being cited by 41% and 31% of respondents respectively [EC 2004]. Since the beginning of 2005, urban administrations have furthermore been under legal obligation to guarantee a certain level of air quality for their citizens (Air Quality Framework Directive 96/62/EC). Therefore it is an important goal for local governments to reduce both traffic-related energy consumption and impairment of the environment.



Slow modes / public transport

Travel demand is directly related to human activities and their location in time and space. Therefore the most effective way to influence this demand is to minimise distances between activities. If people can find jobs, shops, services and leisure opportunities

near their homes, they tend to travel less, thus reducing overall demand for person kilometres. A central settlement location and mixed land use greatly contribute to achieving this objective. In urban areas, it is often even faster and cheaper to use the environmentally friendly modes (walking, cycling or public transport) for short to medium distances, and less time needed for everyday travel further helps to increase people's quality of life.
An important issue is to give planning priority to pedestrians and cyclists. The aim is to maximise attractiveness and usability of walking and cycling as alternatives to motorised transport. The goal should be a dense, high-quality, supply-oriented infrastructure network for pedestrians and cyclists. It should offer direct access, as most pedestrians and cyclists have a limited tolerance for detours. Associated with this is continuity: corridors with barriers (such as steep level changes or railway tracks) can suppress use. A high proportion of slow modes also has social implications, as pedestrians and to a certain extent cyclists have the chance to meet other people, stop for a chat or talk to each other while travelling (in contrast to the encapsulated car driver).

One of the main objectives of ECOCITY is thus to ensure a high modal share of environmentally friendly transport modes. A basic requirement to reach this goal is also to give priority to public transport services. Priority here does not only mean operational regulations e.g. at junctions (to speed up trips by public transport compared to those by car), but also involves taking a positive approach towards public transport, both in the planning process and in the implementation phase. As good accessibility is a prerequisite for the competitiveness of public transport, such services should be easily available in space (short access to stops) and in time (short waiting times). Attractive public transport is also a function of a number of other factors, such as fare levels, vehicle types and information provision. One way of influencing the modal choices of those who make journeys is to make the preferred modes (e.g. public transport) more attractive than the less desirable ones (e.g. the private car). If, for example, public transport stops are easier to reach than parking spaces, it is more likely that public transport will be the preferred mode at least for some trips.

Mobility management measures can further support the modal shift to environmentally compatible modes. Examples of this are awareness-raising campaigns, internet platforms on travel options and mobility centres with comprehensive support for transportation requirements (e.g. mobility help desk, agency for arranging lifts, car-sharing garage, bicycle hire system and public transport ticket sales).

Individual motorised travel
In an ECOCITY, the pull-type approaches presented above (making other modes more attractive) are complemented by push-type approaches to make the use of the private car less attractive. Although these measures are generally less popular, the need for restrictive measures to reduce speed and volumes of traffic is more obvious in areas where people live, which in mixed-use ECOCITIES will be almost everywhere, as this will directly enhance quality of life. Noise reduction and increased safety are two of the main aims in this respect. Designing street networks to be unattractive to through traffic and prioritising other modes as described above will go some way towards achieving these aims, although each scheme needs to be considered individually concerning possible safety risks.

For ECOCITY neighbourhoods, a variety of concepts are available to reduce travel by private car. These involve a combination of key decisions on car parking, car access and even car ownership. Traffic calming has already become well-known in the last three decades, while car-free areas and areas of reduced car traffic are relatively new, but are increasingly being implemented and thus becoming

more and more accepted[9]. It is sometimes possible to move from one traffic concept to the next most sustainable one in incremental steps but, especially when planning new ECOCITY quarters, the car-free model should always be considered as the first option. Nevertheless, it is important to be aware that when car accessibility is reduced, the alternatives must be of maximum quality. Otherwise transport poverty and reduced accessibility can occur. In countries and regions where the car-free option is less familiar, smaller scale experimental projects can serve as a demonstration of the feasibility of these schemes.

[9] See also Chapter 3 in ECOCITY Book II.

Another means of reducing individual motorised travel is to implement parking management concepts. Providing transport infrastructure for the mixed-use and housing areas of ECOCITIES will include the supply of a certain amount of parking spaces for the inhabitants as well as for employees and visitors (e.g. for shopping, commuting and guaranteeing quick personal travel at all times of day and night). Of primary importance is that there should be fewer, ideally even many fewer, spaces than would be provided in conventional schemes, where the provision for other modes of transport is of lesser quality. They should also be concentrated in neighbourhood car parks rather than being provided on street or in association with individual homes. Finally, if the distance to the nearest public transport stop for most people is also shorter than the distance to the nearest parking space, one can expect the use of the private car to be reduced – assuming that public transport service levels and quality are high.

Transport of goods

Facilitating a neighbourhood logistics concept can help people to organise the transport of goods (shopping, deliveries) without using private cars. Such a concept thus reduces the dependency on individual motorised transport. It requires a co-ordinated goods delivery system for households, local shops and services. This can be realised in car-free areas, for example, through a neighbourhood service unit (in line with building-oriented facility management units), the task of which is to collect deliveries of parcels or shopping (food and non-food) and distribute them directly to front doors or safe pick-up points located near the dwellings. A service of this type can further contribute to converting car-free living, already practised by a large proportion of people from students to the environmentally aware, poor families and elderly people, into a comfortable lifestyle.

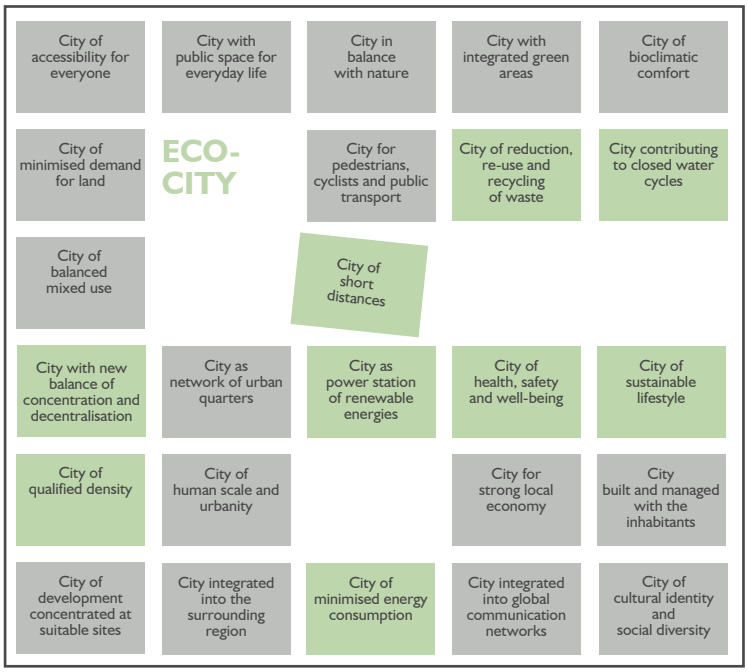
The delivery of goods to local shops and services in pedestrian areas, for example, also requires a logistics concept that prevents interference with the residents' and visitors' demand for a safe and quiet environment. Such a concept may consist of a combination of physical measures (e.g. network design to prevent access by vehicles above a certain size), restrictive measures (e.g. weight limits for goods vehicles, limited access times) and the joint organisation of deliveries from several distributors to several shops. However, care must be taken not to increase tonne kilometres elsewhere or to force inefficient use of vehicle capacities. Such distribution concepts rely on a certain scale of application to be successful.

Construction logistics should be planned with the goal of avoiding nuisance to and disturbance of the inhabitants of the site and surrounding areas, as well as minimising the actual flow of materials in space. The former must be especially considered for a larger site, as its construction will take several years and people may already be living in some parts of it. The issue of material flows depends to a large extent not just on the planning of processes on site (e.g. how much material is excavated and how much of it must be removed or can be re-used) but also on the choice of construction materials, for example. The larger the site, the greater both the need and the possibilities for rationalising construction traffic.

2.4.4 Objectives for energy and material flows

Table 2.4
Overall ECOCITY goals for energy and material flows and objectives for related aspects of ECOCITY planning

OVERALL ECOCITY GOALS	
> **minimise primary material and primary energy consumption** > **minimise impairment of the natural environment and human health** > **maximise mental well-being and community feeling:** e.g. indoor air quality, convenience of heating and ventilation system	
OBJECTIVES FOR …	
Energy	• optimise energy efficiency of the urban structure • minimise energy demand of buildings • maximise efficiency of energy supply • maximise share of renewable energy sources
Water	• minimise primary water consumption • minimise impairment of the natural water cycle
Waste	• minimise the volume of waste generated and of waste going to disposal
Building materials	• minimise primary building material consumption and maximise recyclability of materials • maximise the use of environmentally friendly and healthy building materials



Residential buildings and buildings for the tertiary sector (trades and services) account for more than 40% of final energy consumption in the EU [Directive 2002/91/EC], with space heating as the largest energy end-use. For this and other reasons the European Union emphasises the need to reduce the energy demand of buildings, as this constitutes an important part of the package of policies and measures required to comply with the Kyoto Protocol. The aim is to increase the energy efficiency of the urban structure, of individual buildings and of energy supply systems and to furthermore maximise the proportion of clean and renewable energy sources (which does not include nuclear power). Buildings have a major impact on long-term energy consumption and new buildings should therefore meet minimum energy performance requirements tailored to the local climate. In addition to this, improvements to the existing building stock, which is responsible for a large proportion of today's carbon emissions, must also be promoted.

The utilisation and flow of material resources (solid, liquid and gaseous) underpins economic and social development, but the ways in which they are used can create waste, emissions, effluents and resource shortages. One of the biggest challenges to sustainable development in Europe is a more responsible management of natural resources [European Commission COM/2001/264]. Breaking the links between economic growth, the use of resources and the generation of waste has been determined as a

headline objective. Sustainable management of material resources thus has to optimise the consumption of primary resources, avoid negative impacts of waste and pollutants and establish preconditions for the future use of secondary resources.

Energy

Optimising the energy efficiency of the urban structure is a very cost-effective way to save energy, but it must be considered at a very early stage of urban planning. This step includes striving for a compact building structure (e.g. apartment blocks or rows of terraced houses instead of individual buildings), while also arranging the buildings to optimise solar irradiation. This means buildings should face the sun, roofs should be suitable for active solar facilities such as photovoltaic panels and shading of façades should be prevented both by optimising the distances between buildings and by considering the position of trees. These measures also improve the quality of life and the well-being of the inhabitants by providing good sun and daylight conditions, but they must be adapted to local climates. High-density developments are also an important precondition for the economical application of community heating systems.

Space heating and cooling accounts for over half of the total energy demand of buildings in the EU. The most efficient passive energy saving measure for buildings, regardless of the climate, is to reduce energy demand by ensuring a high level of thermal insulation and air-tightness (combined with good ventilation opportunities and systems), as found in low-energy houses or so-called passive houses. This can be supported by a compact building design and a sensible arrangement of windows. A high ratio of windows on southern façades maximises solar gains, while the shading of windows reduces the energy demand for cooling. Further reductions in energy demand can be achieved through water-saving installations for hot water and by providing good conditions for indoor use of daylight. Additional investments for passive energy-saving measures are usually covered through lower operating costs within a few years. Besides energy savings, consumer satisfaction surveys have also confirmed that passive houses provide a comfortable indoor climate.

The most efficient energy supply systems on the urban scale are combined heat and power (CHP) or co-generation plants for heating and electricity, as well as community heating systems. At the building level, the quality of the HVAC (heating, ventilating and air-conditioning) equipment is of major importance. Efficient use of energy can be achieved with decentralised heating systems based, for example, on wood pellets or ground heat exchange, solar powered hot water and electricity production and sophisticated ventilation systems. For residential housing, mechanical ventilation with heat recovery is very efficient and leads to high indoor comfort. For public and office buildings, mechanical ventilation systems and natural ventilation using glazed areas for example with plants and water elements and meeting places, contribute both to saving energy and to the well-being of employees and visitors. The energy consumption for cooling can be reduced by advanced cooling systems for concrete components, for example, but conventional air-conditioning must be avoided because of associated low thermal comfort and high energy consumption.

Energy-optimised urban structures and buildings help to achieve a high share of renewable energy source use, which is a further aim in tackling climate change. For heating and hot water, the use of solar energy, wood, biomass and heat recovery is very efficient and the amortisation of investments is often achieved in a short period of time. For electricity production, renewable energies such as sun, wind and biomass, in combination with CHPs, can be the final step towards a low or even zero emission neighbourhood. An added value is the visibility of solar panels and photovoltaic cells, which contributes to a good personal or corporate image.

Water

The consumption of primary water can be reduced to less than half the current use. Very effective measures are low flush toilets and water-saving devices for kitchens and bathrooms. Rainwater collection and recycling is also a basic strategy, but the effect depends heavily on the local climate, purification technology and collection limits. Further water recycling technologies exist for grey water (all domestic waste water except faeces) and black water (faeces), but the cost-benefit ratio is dependent on the local natural water supply. An advanced water-saving concept should also include green space management, for example, choosing plants and trees which do not require large amounts of water, as well as rainwater retention, purification and infiltration features. These also help to avoid negative impacts on local water cycles. Further advantages of local rainwater and grey water management are contributions to urban comfort through attractive design and the possibility of experiencing the water cycle in playgrounds with water features, channels of water running along streets, reed beds, cascades etc.

Waste

To reduce the generation of domestic waste, a change in consumer buying habits is the most effective mechanism. This can only be partly influenced through urban planning but it can be encouraged by promoting sharing instead of ownership of rarely used items (e.g. DIY machinery, travel equipment, etc.). Waste going to disposal should be minimised. A necessary prerequisite is the provision of easily accessible and well-serviced areas for separate collection of glass, paper, plastics and metal. Local recycling possibilities should also be considered (e.g. composting of bio waste). During the planning phase special attention must be paid to strategies for excavated materials, since the annual quantity of this waste flow in volume drastically exceeds the flow of domestic waste in the EU. The aim is to remove as little excavated material from the construction site as possible and to re-use the soil as building material (e.g. noise reduction embankments, landscaping with small hills and refilling of unneeded basement spaces).

Building materials

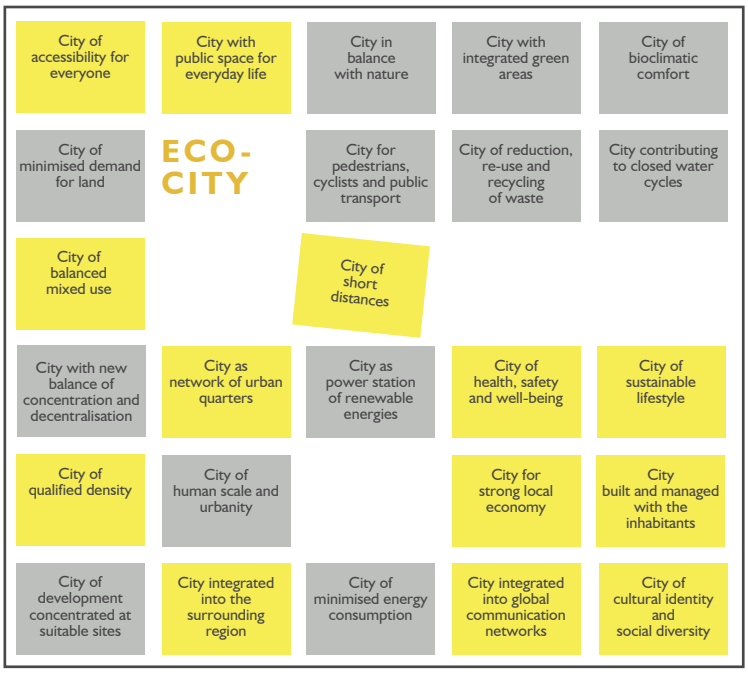
The mass flow of building materials in European economies is enormous and about 13 times higher than the mass flow of non-durable goods. The reduction in the demand for primary building materials is therefore an important starting point to decouple resource use from urban development. Effective measures on the urban scale are the re-use of existing buildings, compact building typologies (instead of detached houses) and the reduction of infrastructure for motorised transport. At the level of the individual building, reducing basement area, lightweight constructions (e.g. timber) and the use of recycled building materials (e.g. recycled concrete) are recommended. Positive side effects of these measures are less transport, less construction waste (at the end of the life cycle) and less cost. A further aspect to be considered while designing building components and selecting building materials is their recyclability. This is facilitated by materials with high durability, easy detachability (e.g. screws instead of glue), practicable reusability (multiple use in identical function) and practicable material recovery (use as secondary resource).

Besides recycling materials, other environmentally friendly and healthy building materials are recommended, such as natural and renewable materials (e.g. timber, clay and straw), local materials (e.g. local stone, brick and timber) and harmless materials (e.g. PVC-free installations and solvent-free paint). The use of local and regional materials also enables energy savings in goods transport and compatibility with local building traditions and it supports the local economy. Avoiding harmful substances improves people's indoor quality of life and contributes to reduced health care costs.

2.4.5 Objectives for socio-economy

OVERALL ECOCITY GOALS	
> **satisfy basic needs:** food, shelter, education, health care, jobs, etc. > **maximise mental well-being and community feeling:** general satisfaction, urban comfort, social mix, decentralisation, communication based on social inclusion and adequate natural and built environment > **realise structures for human care:** for children, the elderly, the ill etc., based on social policy and a well developed community life > **maximise awareness of sustainable development:** public and business > **realise a diversified, crisis-resistant and innovative local economy and strengthen sustainable industries and innovation** > **minimise total lifecycle costs (maximise productivity):** minimise maintenance and operating costs > **minimise impairment of environment and human health**	
OBJECTIVES FOR …	
Social issues	• promote social diversity and integration • provide social and other infrastructure with good accessibility
Economy	• maximise the appeal to businesses and enterprises • use the available labour resources
Costs	• strive for a long-term economic infrastructure • offer low-cost housing, workplaces and space for non-profit uses

Table 2.5
Overall ECOCITY goals for socioeconomy and objectives for related aspects of ECOCITY planning



Europe is famous for its cities and their important contribution to the social and cultural development of our society. Therefore socio-economic objectives are of twofold importance in developing an ECOCITY. By not paying attention to socio-economic requirements, the ECOCITY simply will not thrive, but by doing so we can link into an important European tradition and to the general goals of the EU.

A predominant requirement in the social sphere is to find a balance between different – and often contradictory – interests and objectives. The city is the place where democracy and living together with people of different cultural and social backgrounds is experienced most directly. If the peaceful collaboration of people from different parts of the world is to be more than an abstract metaphor for European integration, then our cities will be the place where this takes place. The social and economic soundness of the cities will contribute to the self-confidence of their inhabitants and administrative units in a constructive way. This will improve not only the quality of life of those living in these cities but ultimately also the innovativeness and competitiveness of the European economy. There is a broad consensus that this will be even more important in the future than

it is today, because of the ageing population which will, on average, be culturally more diverse. Sound socio-economic structures improve the vitality of the city and create and secure jobs in the service sector as well as in manufacturing.
In this way they contribute to the European goal of reducing unemployment levels. ECOCITY goals try to reflect the European tradition of urban living, while at the same time fostering lifestyles that conform to the general requirements of sustainability. These aims must be taken into account during the planning phases, but ongoing care is also required to nourish these processes.

Social issues
Social diversity is a reality in Europe. It is most directly experienced in cities and it is thus here where such diversity will predominantly be accepted or rejected. Therefore a functioning social mix on a very small scale is an important objective. This corresponds closely to a systems theory view that, for a system to deal with outside complexity, it must reflect and integrate this diversity internally as well.
Linked to this objective is the need to provide good social infrastructure in ECOCITY neighbourhoods or nearby. This requires schools, reasonable access to health services, places for the elderly to live, shopping facilities, places of worship as well as places for sport and other leisure activities. Such infrastructure improves integrative capacities and makes a quarter attractive to a broad range of social groups. A further instrument for fostering such a democratic and integrative culture in a city is to involve the (future) inhabitants and other stakeholders as early as possible in the planning and also to be prepared to change the plans as a result of this involvement.

Economy
The traditional European city is a place where people do not only live but also work and enjoy (part of) their leisure time. This variety of activities gives richness to the city, facilitates different social groups living together and provides workplaces. Mixed use and short distances in an ECOCITY mean that working life can be combined with family life much more easily than in cities with large mono-functional quarters. However, it must be clear that in the current market economy planning can only provide a framework for people and businesses to make the 'right' choices – therefore planning must be done very carefully and must link into the interests of the people. To achieve the right mix of uses in a city it is necessary to see not only the demands of the inhabitants but also those of companies and leisure institutions.
Therefore, as a second economic objective, provision must be made for appropriate infrastructure for business units. Businesses and, to an even greater extent, places where people spend their leisure time generate some noise and traffic. Companies need a certain level of infrastructure, for example roads for the delivery of goods, parking spaces, energy, water and telecommunications. But instead of avoiding potential conflicts and discussions by creating mono-functional areas for business, shopping and leisure facilities away from residential areas, it is necessary to communicate and find compromises between conflicting interests to create urban vitality. From a business point of view, the mono-structure is much easier to handle and more attractive in the short run. In the long run, mixed structures are more sustainable and profitable, not least because they can be adapted more flexibly to changing economic climates.

Costs
Money is the predominant resource in the economic sphere. To a certain extent spending less money means also using fewer resources, and most institutions have to economise their (financial) resource use these days. This also holds true for the ECOCITY goal of reducing (lifecycle) costs and offering a

long-term economic infrastructure. This is more or less a simple formulaic expression for a whole list of objectives. If the ECOCITY is too expensive it will not be built at all, or it will only attract one type of use (the one which pays the highest prices in the short run). Alternatively it will only attract a certain social group (middle/upper class people).

A common compromise made in urban areas by private individuals or businesses wishing to expand or relocate would not work in the ECOCITY: i.e. moving away from the more densely populated city centre to areas where property prices are lower. Lower prices (and thus often higher use of land per capita leading to lower densities) may attract large businesses which are not dependent on local customers and people for their living. But due to low population densities, there are rarely any small-scale businesses units which could provide for people's daily needs in such an area and this means an increase in traffic because people have to commute to work, shops and educational facilities.

Providing affordable housing and affordable commercial units is essential in achieving an interesting mix of uses and forms of tenure as well as a good social mix. Planning for high density generally supports this, since it generates a low percentage of land costs as part of the costs of individual houses and apartments. Nevertheless, construction costs should also be kept down as much as possible, while maintaining compatibility with ecological targets. The maintenance and gradual redevelopment of existing buildings on brownfield sites is often an opportunity for offering space for commercial and non-profit use, where tenants cannot afford high rents or investment in new buildings.

3 The process of planning an ECOCITY

This chapter presents the process of planning an ECOCITY. In order to fully understand the relevance and opportunities of the innovative ECOCITY planning approach, it is helpful to look first at the main characteristics of the conventional planning process.

These main characteristics include:

- sectoral fragmentation, where solutions for planning problems are sought in particular sectors, neglecting interrelationships (see Section 3.1.2);
- a top-down approach in decision-making and lack of participation (see Section 3.1.3);
- lack of evaluation and monitoring of results (see Section 3.1.4).

Confronted with the complexity that characterises the real processes of the construction of the city today, the conventional approach clearly displays its inadequacy. Within the current framework of environmental crises and economic globalisation, it is easy to understand how and why this inadequacy is increasingly noted by planning experts, politicians and citizens. People speak of the 'crisis of urbanism'.

The task at hand is thus to create new concepts, procedures, guidelines, techniques and tools that are adapted to current demands. These need to lay the foundations for a new urbanism based on the challenges of our times, especially those arising from the environmental crises. There is general agreement that the concept of sustainability provides a very adequate framework for this task (see Chapter 1). During the last few decades, a great deal of effort has gone into developing these new approaches (see also Section 2.2.1).

Local Agenda 21 is just one good example of the innovative proposals developed during recent years at the institutional level. However, many efforts to find new planning methods are also being made by local professionals, experts and businesses in their daily work and these are less easily categorised.

However, the efforts of theoretical reflection and institutional processes have not yet been matched by developments in the actual application of these ideas. Of course, the level of incorporation of these approaches varies greatly throughout Europe, as does the scope of implementation and practical experiences. In very general terms, it can be said that the development of sustainable urbanism in southern and eastern Europe has not progressed as far as in northern and western Europe. There has not yet been much experience or research comparing real projects from all over Europe on the basis of the requirements of sustainable urbanism and with the aim of finding common conclusions useful for widespread future application.

The ECOCITY project is thus a pioneering experience in pan-European planning and evaluation within the framework of sustainable urbanism. It represents the first effort in trying to integrate theory and practice on this scale in order to address the three main problems of conventional planning identified above.

3.1 Urban development as a cyclical process

One of the main reasons for the great complexity of constructing a city is the interrelationship of a large number of the cyclical processes. In fact, the main failure of the usual fragmentary approach to planning lies in its inability to account for this cyclical nature of urban phenomena in the solutions that are found. However, the concept of a cyclical process – one of the main principles of ecology as a science – is an integral part of the paradigm for a sustainable approach to planning. Considered from this point of view, all urban interventions develop according to the following cycle, regardless of the scale of planning (see Figure 3.1).

The lifecycle of urban development contains the following phases:

- *Initiative:* the need for a concrete intervention is identified (even in a shrinking city), e.g. the creation of a new settlement, the creation of a new infrastructure element or a facility, the renewal of a whole or part of a neighbourhood
- *Pre-planning:* general objectives and guidelines for the new intervention are established, e.g. overall dimensions, zones, target users, general deadlines and financing
- *Urban planning* begins according to established guidelines
- *Detailed planning and architectural design* begins once the final masterplan has been drawn, e.g. the assignment of different building projects and sectors to different planners and experts through diverse procedures (competition, direct external contracting, internal contracting etc.)
- *Implementation and construction* begins according to the established deadlines

As mentioned above, these are the general phases usually considered in conventional planning processes. The masterplan is one of the main planning products and the planning output is considered 'ideal' when the built intervention corresponds as closely as possible to the previously drawn proposal. This is seen as the main indicator of success in conventional planning.

But the cycle is not really closed after implementation. At least two other relevant and closely interrelated phases can be identified:

- *Maintenance:* the most important part of the cycle begins when the construction process is completed and the built settlement, infrastructure or urban element is given over to use – with all the changes and wear and tear associated with such use
- *Obsolescence:* this is the natural destiny of any urban intervention when the lifecycle is in an advanced state. When the processes of transformation and/or obsolescence reach a certain level, a new intervention becomes necessary and the cycle begins again, applied to a new urban reality formed by time

In the light of this cyclical perspective, it is easy to see how the main drawbacks of conventional planning actually contribute to current urban problems:

- The fragmented, non-integrative and non-iterative approach to planning has led to rigid and mono-functional solutions with very little capacity for adaptation
- The usual top-down approach makes it difficult to adapt the intervention to the real needs and wishes of target users and, at the same time, fails to take advantage of the wealth of knowledge citizens and stakeholders have about their urban habitat, again impairing the capacity for adaptation
- The usual absence of a systematic procedure for monitoring and evaluating the results inevitably means very valuable information is wasted that could contribute to the general advancement and innovation of planning tools and techniques and to the well-focused adaptation of existing structures

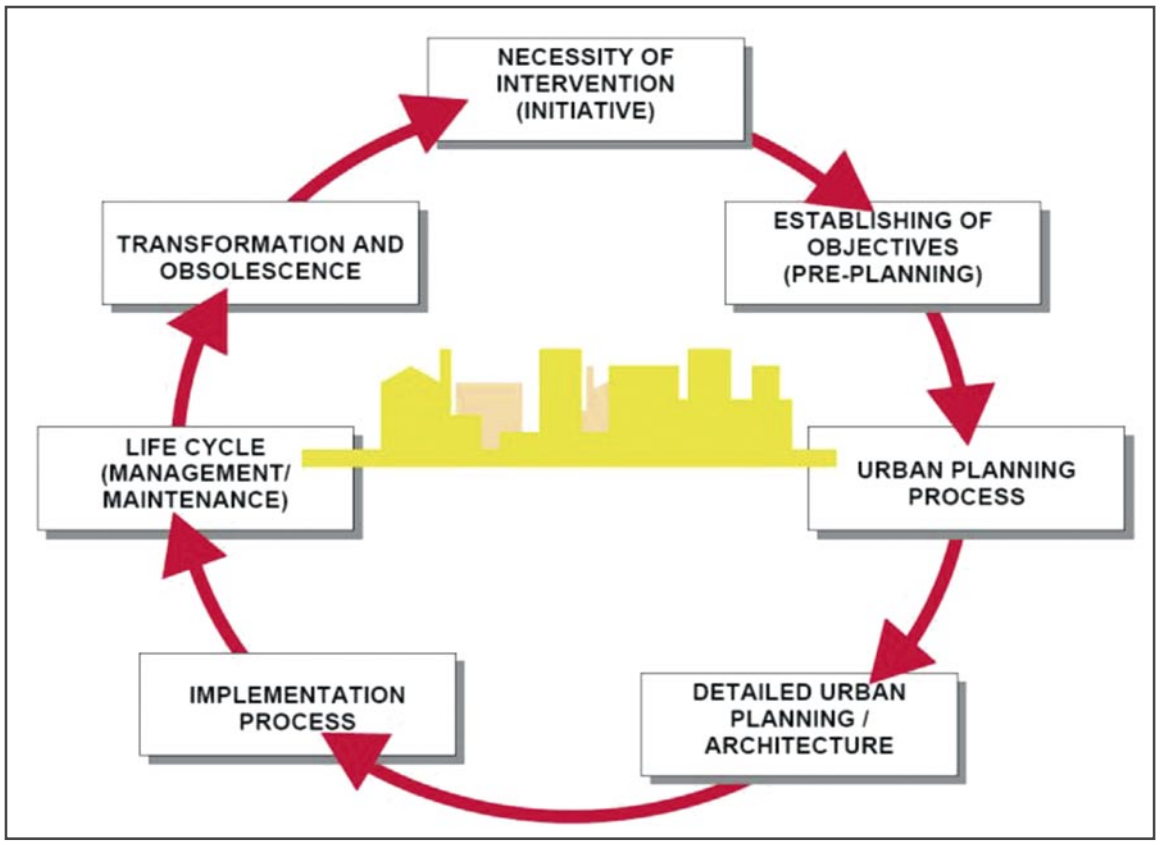


Figure 3.1: Urban intervention as a cyclical process

When working towards sustainable urbanism, these three drawbacks are the main areas on which efforts should be focused, while also respecting the general requirements for economic, environmental and social sustainability. In fact, the ECOCITY project is conceived around these areas, and its general contribution as a research project to the articulation of a new kind of planning process based on sustainability can be considered in these terms.

3.2 Creating an ECOCITY: the integrated planning approach

The idea of integrated planning really constitutes the core of sustainable urbanism. It is based on acknowledging the complexity of every urban process and trying to tackle this complexity by focusing mainly on the interrelationships among different fields and sectors, but without neglecting the necessity of appropriate, sector-specific solutions. The key issues of integrated planning are:

- A multidisciplinary approach
- Iterative (i.e. repeated and ongoing) processes of analysis
- Holistic integration of the results obtained through sectoral analysis

With the city as the main object of analysis, a very important aspect is to adopt a practical and accessible framework for its description. This requires a clear identification of elements of urban analysis which allows both straightforward linking of the planning objectives and criteria to these elements and the assignment of tasks to the different disciplines involved. In the ECOCITY project, the structure adopted for analysis and evaluation was based on the following elements: context, urban structure, transport, energy and material flows, and socio-economy (see Chapter 2). Other alternative structures, based for instance on the scale of approach (territorial, metropolitan or urban) might have a similar role in an integrated planning process. In ECOCITY planning, those sectors related to the metabolic and environmental functions of the city (transport, energy and material flows and socio-economic aspects),

which conventional planning considers as subsidiary to urban structure, are considered at the same level of importance. In every individual case, however, the system of analysis must be adapted to the specific local context and the type of project.

In the ECOCITY project, different planning objectives (see Chapter 2) as well as a set of measures and evaluation indicators related to these objectives (see Chapter 4 of Book II) have been developed as specific planning tools. This was done in such a way so that every aspect of the intervention can be individually identified and approached throughout the planning process without overlooking its connections to the whole. Drawing out the interrelationships also contributes to structuring the iterative processes of the planning cycle.

It is important to remember that this set of tools for analysis, re-integration and iteration can only bring maximum benefits if the approaches taken are multidisciplinary and the work is based on flexible teams in permanent contact with all the agents involved in the process. Thus when adapting these planning tools for a specific context, it is important to bear in mind that one of their most important functions is to make the process understandable to all the actors at all times – including and especially the citizens.

3.3 Creating an ECOCITY: participation

The principle of participation is considered to be an important aspect of sustainable planning and its benefits may be expressed in the following terms: the more the stakeholders affected by an urban process are involved in decision-making, the more knowledge will be accumulated and the easier it will be to avoid possible conflicts by identifying them and channelling them towards more constructive ends.

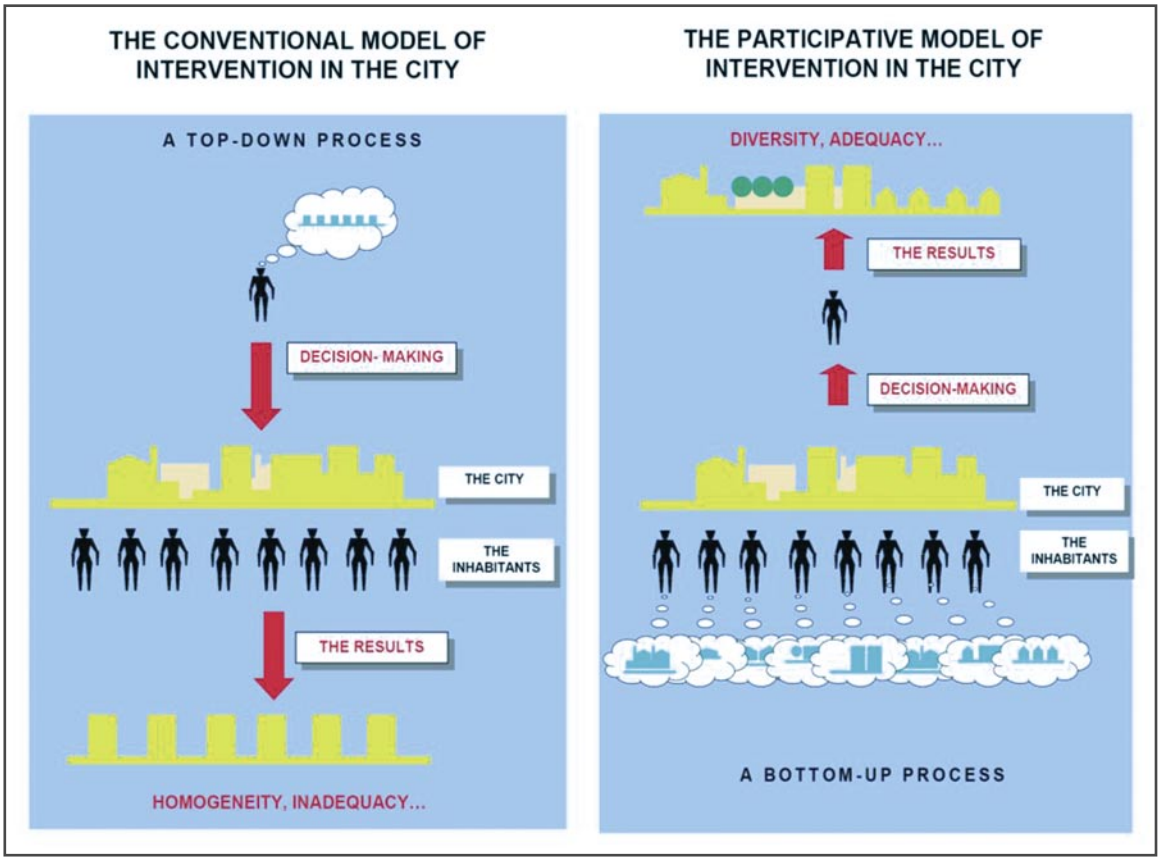


Figure 3.2
Models of intervention in the city Models of intervention in the city

There are two main arguments contained within this principle:

- The first refers to knowledge: the basic idea is that nobody knows more about their city than the citizens (and other stakeholders) themselves. According to this, the usual top-down planning approach constitutes an unnecessary waste of a valuable source of knowledge
- The second refers to conflict: the basic idea is that every stakeholder has interests, wishes and needs with respect to the city where they live and work. If these are not duly considered when making decisions for an urban intervention, it is very likely that conflict and dysfunction will arise at some point. The consequence is a waste of time and resources

Considering these arguments, sustainable planning as a bottom-up process is based on the involvement of all actors and stakeholders from the beginning and throughout the planning process (see Figure 3.2). Regarding the knowledge argument, the results of a participation process which incorporates the wealth of information held by the users will always be considerably richer and more diverse than any solution conceived in isolation by an expert or team of experts at the drawing board or the computer. Regarding the conflict argument, the effort of creating consensus among the different actors and stakeholders and incorporating the needs and wishes expressed by different users will generally be rewarded by greater commitment to the final results from everyone.

In any case, participation should not be reduced to one event, rather it should be an iterative process closely intertwined with all the planning phases. It is very important that integrated planning and evaluation tools are conceived in such a way that they contribute to making this iterative process easier for all stakeholders. All this requires the use of appropriate techniques and methodologies adapted to local circumstances and to the actual phasing of the project.

This is well illustrated by the ECOCITY project case studies (see Chapter 4). A number of different approaches have already been developed[10] but this is a field which is always in need of flexible adaptation and innovation.

[10] see also Book II, Chapter 4.

Generally speaking, though, participation in ECOCITY planning should include:

- *Pre-planning:* the establishment of general planning principles and guidelines according to the needs and wishes of citizens (possible tools: future workshops, European Awareness Scenario Workshops[11])
- *Urban planning:* iterative process which should include decision-making about definite uses, locations and characteristic urban elements (possible tools: planning workshops, Planning for Real)
- *Detailed planning:* continuation of the iterative process applied to specific elements of the project. For instance, users might be particularly involved in the detailed design of a community space of special value (possible tools: micro-planning workshop, architectural charrette);
- *Implementation:* control and monitoring of the work in progress in order to check that the results correspond to the agreed plan (based on the masterplan as a starting scenario, which has been checked and transformed during the iterative planning and participation phases) and to reduce the possible disruption caused by the construction process itself (possible tool: Neighbourhood Planning Office)
- *Operation/maintenance/monitoring:* flexible adaptation through the establishment of bodies both for self-management and for communication with and between the administrative bodies in charge. This should be done in such a way that the results of continuous evaluation and monitoring are fed back into the planning process, in accordance with the idea of the cycle (possible tool: Neighbourhood Planning Office)

[11] see also Book II, Chapter 4 for more detail.

3.4 Creating an ECOCITY: monitoring and evaluation

The most important phase of the cyclical process of urban development starts once the physical construction has ended. This is when planning hypotheses are validated – or not – and when new processes and phenomena, many of them unexpected, make their appearance. In order to address these processes in relation to the lifecycle of the built intervention, management and maintenance tasks are required, whether they have been planned or not. If these requirements were not sufficiently considered during the preliminary phases, conflicts can arise and these tasks will become more difficult to accomplish. Furthermore, if no mechanisms and procedures for monitoring and evaluation are planned, a wealth of useful multidisciplinary knowledge is lost.
When a healthy urban development process with embedded evaluation and feedback tools is working, transformations generally occur in the form of continuous adjustments to meet the real needs of the community and should thus contribute to the general improvement of the area in question. If, on the other hand, an urban process is conflict-laden, transformation and obsolescence generally lead to critical situations.In any case, sustainable planning involves incorporating monitoring and evaluation tools in two different phases:

- Monitoring and evaluation during the planning phase
  (i.e. before implementation; ex ante evaluation)
- Monitoring and evaluation of the built reality (ex post evaluation)

During the pre-implementation phase, continuous evaluation with the participation of all relevant stakeholders (see Section 3.1.3) is the essence of an iterative process. The idea is that this process is supported by an integrative analysis structure, which is adapted to the local context and facilitates the connection between objectives, measures and evaluation indicators. Qualitative and quantitative aspects are considered and the project is only completed when the proposed objectives (or new or adapted objectives agreed on during the process) have been met. This was the approach taken during the ECOCITY project in developing the evaluation scheme. The main goal was to develop a set of indicators for urban sustainability, appropriately and comprehensibly benchmarked, which are applicable in the evaluation of planning results in the very different contexts of the seven case studies. For this task, a total of 34 indicators associated with the five planning elements (urban structure, transport, energy and material flows, and socio-economy) were developed.
As reality often differs from the plans, it is very important to continue monitoring and evaluation once the project has been implemented. Empirical analysis is needed to check whether the preliminary project hypotheses were correct and, if necessary, appropriate adaptations and improvements must be made. The tools required for this ex post evaluation are quite different from those used for ex ante evaluation and must be based mainly on detailed field work and consultation techniques. Again, participation is a key issue in this respect. Only if stakeholders are involved in the ex post evaluation of a development in a permanent way (e.g. through the creation of local premises dedicated to the tasks of management, maintenance and continuous monitoring), will it be possible to ensure that the results of the necessary self-adaptation process do not go against the needs and wishes of the people living there.

4 Concepts for ECOCITY model settlements

The vision and the objectives for an ECOCITY formulated in chapter 2 are very ambitious. They set standards and describe a target state, towards which urban development should head. The concepts for the model settlements developed within the ECOCITY project meet these standards to different degrees but each have their specific strengths and show possible steps towards an ECOCITY. The model settlements were planned for Bad Ischl (Austria), Barcelona (Spain), Győr (Hungary), Tampere (Finland), Trnava (Slovakia), Tübingen (Germany) and Umbertide (Italy) and are introduced in the following sections.

4.1 ECOCITY Bad Ischl

4.1.1 General information

Bad Ischl is situated in central Austria and is also the centre of the region of Salzkammergut, which covers parts of the administrative provinces of Oberösterreich, Salzburg and Steiermark. The community of Bad Ischl consists of many settlement areas of different sizes. All parts of the town have existed since the first census in 1869. The number of inhabitants in 2001 was just over 14,000, after a gradual population increase since 1971.

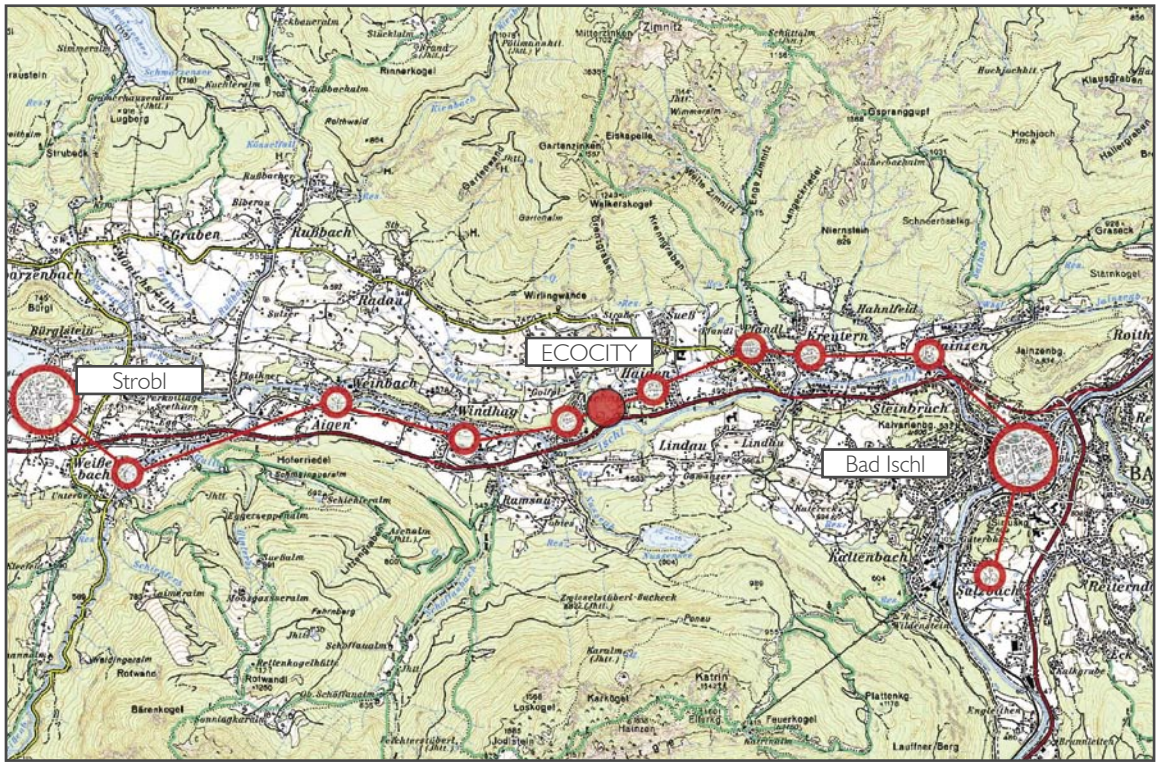


Figure 4.1.1: Linear urban development along a public transport axis

The Austrian part of the ECOCITY project intends to make a contribution to overcoming the general trend of (urban) sprawl through a vision for concentrated settlement development (especially in the area around small towns) and to thereby provide better conditions for public transport. This will be initiated by concentrating building around the planned light-rail stop in the ECOCITY area and, step by step, around all the other stops on the planned public transport route (thus also extending existing neighbourhoods). The project will focus on a balanced proportion of housing and workplaces to promote an equal distribution of passengers in both directions.

4.1.2 Project description

The site was selected to intensify the axial development between the centre of the town of Bad Ischl and the neighbouring communities of Strobl and St. Wolfgang – this is promoted by the situation in a valley. The demand and potential for public transport should be improved through the project. The project area comprises 24.6 hectares and is planned to attract about 2,100 new inhabitants (see also Table 4.1.1).

The planning area consists of the following elements (for descriptive figures see Table 4.1.1):

- Part 1: the ECOCITY subcentre (Robinson area) is the main component of the project; this quarter will provide infrastructure for the daily needs of the new inhabitants as well as for the existing under-supplied neighbourhoods.

In walking distance from the ECOCITY subcentre there are two additional small developments:

- Part 2: the ECOCITY light industrial estate (Aschau/Ramsau) is a small area which will be developed monofunctionally (but in co-ordination with the ECOCITY subcentre) through the addition of new small and medium-sized industrial enterprises to the few existing ones (the new businesses should preferably have an ecologically compatible focus).
- Part 3: in-fill development 'Neuner area' (Krenlehner Siedlung) is a small area which is to be developed to increase the density of a 'sprawl' settlement by adding a small, mainly residential area in higher density, low-rise types of building.

Table 4.1.1 Quantitative characteristics of the Bad Ischl ECOCITY development

Quantitative characteristics	Data			
Planning area	**Part 1**	**Part 2**	**Part 3**	**Total**
Number of inhabitants	1,970*)	0	130	2,100*)
Number of dwellings	790*)	0	50	840*)
Number of jobs	560*)	690	0	1,250*)
Total land area (project area)	166,755m²	62,570m²	16,950m²	246,275m²
Built-up area	82,915m²	53,595m²	11,165m²	147,675m²
Green area (only public)	53,435m²	2,635m²	2,470m²	58,540m²

*) excl. hotels and guest houses (280 units)

Urban structure

The ECOCITY quarter is planned around a mixed-use core, designed within a 300m radius around the central light rail stop. A qualified density (gross floor area ratio[12]) for the subcentre: 0.73) is achieved through multi-storey, residential and business buildings with the highest density around the rail stop. The maximum height of the buildings is harmonised with that found in the historic centre of Bad Ischl (three to four storeys) and decreases towards the edge to two-storey terraced houses.

[12] m² gross floor area per m² building area

A main central axis was created to provide quick access from the largely residential buildings along a network of paths crossing the axis to the facilities in the central area. The north-south orientation of the main axis allows the buildings to be positioned for optimal active and passive use of solar energy (solar architecture). It also facilitates a view of the mountain tops (the dominant landscape feature), as well as direct access to meadows and forests in the north and south.

Residential areas are located at a greater distance from the main inter-regional road bordering the site to the south (to minimise disturbance by noise and pollution). Instead, dwellings are situated near the integrated and surrounding green areas. Rows of three-to-four-storey buildings along the main street provide continuous shelter for pedestrians, provide space for different functions (mixed-use at building level), create an urban ambience and ensure a qualified density.

Figure 4.1.2:
Masterplan Bad Ischl

To integrate the settlement into the landscape, green areas, qualified as sensitive in the landscape analysis, are conserved as much as possible. They are perceived partly as green corridors connecting to the neighbouring settlements and partly, as in the case of the vegetation along the stream that crosses the planning area, as being integrated into the new structures.
The provision of shopping, employment and social facilities necessary for a balanced mixed use was planned according to the population potential and taking into account the existing facilities in the surrounding neighbourhoods and the rest of the community. The aim of this was, in particular, to avoid negative impacts on the town centre infrastructure. The spatial distribution of facilities is determined by the best scenarios for goods supply and accessibility by the users, adjusted to account for frequency of use:

- Facilities where there is high demand for delivery or collection of large quantities of goods or heavy items are located nearest to the main inter-regional road to provide short access distances for delivery traffic and keep lorries out of residential areas. At the same time they remain relatively close to the core of the ECOCITY to ensure short distances for internal distribution.
- The light industrial area occupies larger units which do not fit into the small building structure of the ECOCITY subcentre.
- Shops with demand for goods transport and good accessibility by the users are situated in central sites along the primary axis to achieve an even distribution of shortest distances for all inhabitants and to allow some bundling of deliveries.
- Cafés and restaurants, educational and cultural facilities, as well as commercial, social and medical services, are also located along the primary axis. Sheltered housing for senior citizens is situated in a quiet area near the centre but with green spaces nearby.
- Offices are located along the primary axis too, partly on the second floor (pedestrian area) and partly on the ground floor (northern part).

An idea developed for this project is for 'service points', where small-scale public service facilities are concentrated at prominent, easily identified, public locations (e.g. public transport stops). They include public toilets, public telephones, drinking fountains, information points (town maps, signposts for pedestrians, information panels or screens and public transport timetables etc.) and are also useful as meeting points.
Important leisure facilities are green spaces, which are provided in great variety:

- A public park: connection of public green spaces ('urban forest', greenery along the banks of the stream, bordering green corridors in the west and east) with grass for sunbathing by the stream, picnic places, adventure playgrounds for adolescents and separate, sheltered seating areas for senior citizens
- Greenery in streets and squares (tree-lined avenues, concept of characteristic tree species for different types of paths)
- Semi-public green spaces in the courtyards of residential buildings (with integrated children's playgrounds, different characteristic plants for different courtyards)
- Private gardens (adjacent to terraced houses and other low-rise, high-density buildings)
- Private green spaces incorporated into the building structure (loggias, balconies and roof gardens)

The residents should design and cultivate much of the residential green space for which they are responsible, to develop their awareness of a nature-oriented living environment. Overall, the green elements are complemented by water features, such as a small pond through which the stream flows, and fountains in the squares.

Figure 4.1.3:
Green Areas

A well-designed variety of patterns and building typologies creates a diversified and aesthetic environment. Public space is designed as a network of squares, streets of different character and green spaces for different uses. To promote variety in the shape of various building forms, colours and materials and thus to avoid long, monotonous streetscapes (especially in multi-storey areas), the plots along the streets in the centre of the ECOCITY will be divided into several sites, with buildings designed by different architects.

The River Ischl, running parallel to the main inter-regional road, provides the principal fresh air corridor that disperses and dilutes the pollution from traffic in the valley. The necessary protection of the ECOCITY development against noise from this road is achieved through existing hedges in combination with noise abatement walls and multi-storey parking as well as existing forested areas with fringe vegetation to be added.

Transport

Compared to 1992, the modal share of individual motorised transport in Bad Ischl in 2001 increased significantly (from 50% to 58.3%), while walking decreased (from 30% to 22.9%) - as did cycling (from 9.9% to 8.8%). Only in public transport was there a slight increase (from 9.5 to 9.9%), which may have been achieved by the implementation of a city bus route. The proportion of the working population which both lives and works in Bad Ischl is 72.2%; therefore the volume of commuters in Bad Ischl is relatively low.

To improve the percentage use of sustainable transport, an integrated system of public transport is planned. This system includes regional rail, superior local public transport, regional and local buses and

demand-responsive transport services. The superior local public transport (light rail or new technologies like cable liners or other people movers) will connect the ECOCITY with the town centre of Bad Ischl and the Wolfgangsee lake (in the village of Strobl). Until the realisation of this link (during the initial implementation phases) the ECOCITY will be connected to the centre of Bad Ischl and the rest of the region by a bus route. The demand-responsive transport services (fixed-route taxi) already connecting all areas will be improved.

Figure 4.1.4
Weather protection in the main street

The internal pathway system is free from barriers and private cars (access only for delivery and other services plus emergency). Moreover the pedestrian and cycle paths are integrated into the existing network in the surrounding settlements. For weather protection the main parts of the pedestrian network are planned as roofed passages (in the central area with shopping and service facilities), arcades (along the rest of the main axis) and roofed pavements.

Facilities are provided for bike parking in residential and commercial buildings (rooms on the ground floor) as well as boxes or bicycle stands in the squares.

A car-sharing system will also be offered to give people who want to live in the ECOCITY without their own car demand-oriented access to individual motorised transport. These vehicles (and those belonging to visitors) will be parked in garages on the edge of the area near the inter-regional road.

A local logistics yard, situated in the industrial estate, will function as a distribution point for goods transported to and from the ECOCITY and as a central hub for the internal transport system. It will include multipurpose shopping/transport trolleys as means of goods transportation for pedestrians within the ECOCITY and a PINbox facility where delivered goods are stored in a locked box to be picked up by the recipients at their own convenience. Larger goods will be delivered directly.

Energy supply and material flows

The ECOCITY site lies in a forested, mountainous region. Biomass is available from several saw mills located in the surrounding area as well as from other sources and is therefore an attractive option for heating and possibly electricity supply in the ECOCITY. Being located in an east-west-oriented valley, the site is well suited for the use of solar energy – only in December is the sunlight blocked out most of the time by the mountains. Several heat supply and heat delivery systems are possible for the ECOCITY. One option is a central biomass heating station with a district heating network with or without a natural gas peak load boiler. Another possibility is a central gas combined heat and power (CHP) station scaled for summer heat load, with additional biomass heating boilers for demand in winter time as well as decentralised systems for passive houses.

For material flows, two sets of measures are planned. First, sustainable use of water will be supported through decentralised rainwater management (including green roofs and rainwater storage tanks for non-drinking water purposes) and semi-permeable pathway surfaces and infiltration systems for the overflows (percolation fields, permeable drains and infiltration ponds). Secondly, to facilitate re-use of building materials a 'material accounting system' (building inventory) will be established with a database which lists the quantity and quality of the assembled building materials. The excavated soil will be re-used on site, e.g. for landscaping.

Socio-economy

For the economic infrastructure of the ECOCITY, sufficient floor area is provided to accommodate local supply facilities for the inhabitants, as well as a variety of offices and small companies (compatible with a residential area). Together these provide a number of jobs in balance with the human resources of the ECOCITY. The model settlement should also be an additional attraction for a new type of 'ecological' tourism in Bad Ischl and the region.

Social targets used as a guideline when planning the Bad Ischl ECOCITY include a balanced social mix (in terms of education, age, income, ethnicity and sex), correspondent to the local population picture and the new trends in society. These targets also incorporate gender and lifestyle-sensitive planning (promoting a sustainable lifestyle) as well as diversity in housing and spatial structures to create a lively local neighbourhood, with self-organisation of residents to take on joint tasks and social networks which promote communication. A number of different measures are used to achieve this. Housing and other facilities are provided for a variety of generations and social and ethnic groups (including an innovative and accessible social infrastructure). In addition, mixed forms of property ownership and tenancy are available (rental, hire-purchase agreement and owner-occupation, as well as 'Baugruppen' – groups of future building owners with specific lifestyle and housing concepts who develop and build their homes together).

Participation has been an important aspect of the ECOCITY. The participation process started with an information event on the project objectives, which was also intended to help find people interested in being involved in the planning process by participating in a planning workshop. However, this process could not continue due to political problems. The implementation and marketing strategy, developed in co-operation with local developers and real estate experts, includes activities to make the necessary plots available and to find future inhabitants. In a financing concept based on the preliminary estimate of infrastructure costs, a small contribution from the increased value of the plots was suggested, which would result in avoiding additional costs to the local authority budget for infrastructure. But implementation has also so far been restricted due to political problems and difficulties associated with the availability of the plots in private ownership.

4.1.3 Project outcomes – key elements

Key elements to achieve the status of an ECOCITY are:

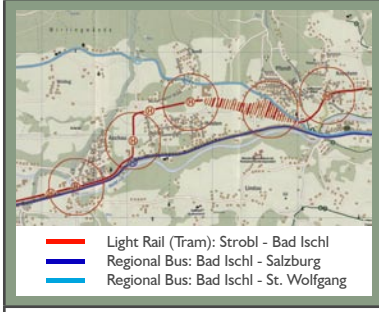
Key element 1	Key element 2	Key element 3
		
Public-transport-oriented location of a dense, mixed-use subcentre, integrated into an axial development	Pedestrian-oriented design of public space, providing a barrier-free network of pathways and squares, keeping car traffic on the edge of the settlement	Integration of conserved natural green areas and newly designed green courtyards within the settlement

Table 4.1.3
Comparison between sprawl conditions and ECOCITY

Sprawl		ECOCITY
152	Residential units	790
34,000 m²	Gross floor area of dwellings	79,260 m²
0 m²	Gross floor area of other facilities	42,300 m²
62 m²	Built-up area per inhabitant	32 m²
102 m²	Street area per inhabitant	25 m²
0-5 m²	Public green space per inhabitant	29 m²
304 m²	Private green space per inhabitant	38 m²

To demonstrate the possible positive results of ECOCITY planning, a comparison of some physical data is drawn between two scenarios for the site of the ECOCITY subcentre: the usual/existing sprawl pattern and the ECOCITY pattern.

4.2 ECOCITY Barcelona - Trinitat Nova

4.2.1 General information

This case study looks at a renewal project on the north-eastern outskirts of Barcelona, in a neighbourhood beside the Collserola mountain range and upstream of the Besós River. A total of 891 social housing units in decline are being demolished and replaced by 1,045 new ones in several phases. The process, initiated in 1995 through a participative community plan, has been driven by the initiative of the local people themselves, who encouraged the administrative bodies involved (city and regional government) to include innovative sustainability criteria in the project. After a two-year participative design process, the Masterplan for the renewal area of the eco-neighbourhood was approved in March 2002. During 2003, sectoral sustainability studies financed by the municipal district were undertaken for the fine adjustment of the subsequent phases in compliance with the ecological guidelines previously established. Under the title *Eco-Neighbourhood Trinitat Nova* these studies have been synthesised to form an integrated sustainability plan through the ECOCITY project. Today's challenges are to maintain adequate feedback throughout the remaining process, based on citizen participation and to extend the process to the rest of the district.

These are the main features of this case study in progress:

- participation, self-empowerment and neighbourhood initiative
- re-use of urban land (brownfield site) and improvement of the existing structures
- regeneration of consolidated urban tissue in a compact Mediterranean city framework
- centralising a formerly peripheral area through investment in public transport
- centre-periphery balance of urban resources

4.2.2 Project description

Trinitat Nova was one of the peripheral urban areas of social housing created in Barcelona during the 1950s to accommodate the new workers arriving in Catalonia from other regions of Spain. It was built without urban planning, with no provision of basic facilities and with poor construction techniques and materials. Most of the dwellings are extremely small. Additionally, serious construction pathologies appeared soon after building was completed. An extremely irregular topography and the urban isolation from the city were other critical problems affecting the urban and social structure of the neighbourhood.

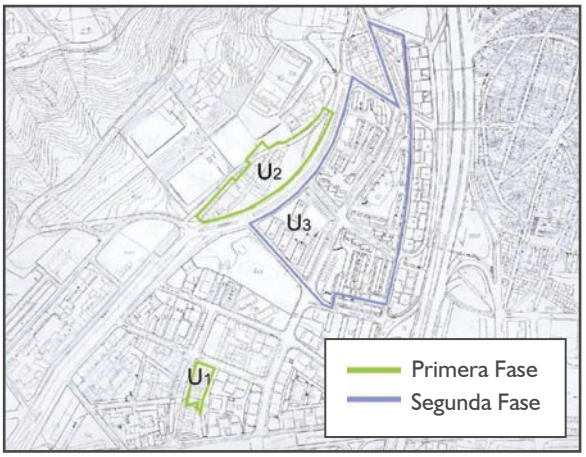


Figure 4.2.1
The three units and phases established by the Barcelona General Masterplan (February 1999)

In 1988, almost forty years after construction, the City of Barcelona made a detailed urban study of the state of the neighbourhood. A main conclusion of this study was that a great majority of the social housing units were irreparably affected by aluminosis and should be demolished and replaced with new ones. The conclusions of the study were incorporated into the Barcelona General Masterplan in 1999, defining three intervention units (U1, U2 and U3) (see Figure 4.2.1).

In 1999 the local and regional governments held an architectural competition for a design to renew the area. However, the residents, who were involved from 1995 in a process of community planning in order to improve the general situation of the area, protested against the winning proposal. Eventually, the results of the competition were cancelled. After that, the people themselves organised a European

Awareness Scenario Workshop, inviting residents, experts and authorities to take part. In this workshop the fundamental principles for the ecological urban renewal of the neighbourhood were defined and sustainability and participation were established as the basis for future development.
In 2000, these fundamental principles were translated into a document of analysis and guidelines, conceived as a working and discussion draft for the planning process. After a new competition it was decided to initiate a process of participation for drawing up a new Renewal Masterplan. In March 2002 this Masterplan was approved, but the local people called for an improvement to qualify the concept as a plan for an Eco-Neighbourhood. The necessary sectoral sustainability studies, mentioned in the previous section, were co-ordinated by Gea 21 and, after completion, were considered for the detailed steps of the next phase. The resulting masterplan for sustainability, with the title 'Eco-Neighbourhood Trinitat Nova', then became part of the ECOCITY project (see Figure 4.2.2)

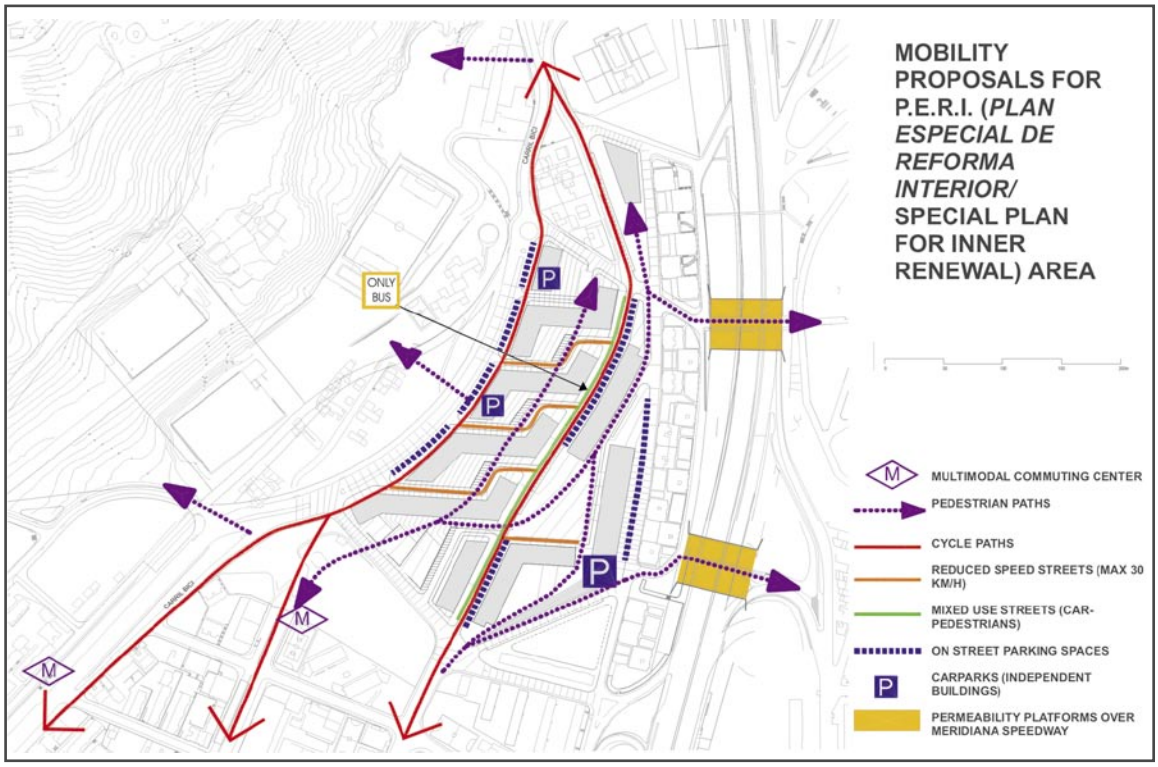
Urban structure
With respect to the urban context of the project, the main issues are the physical connection of the neighbourhood to adjacent neighbourhoods and to the general metropolitan setting and inclusion within the neighbourhood of general facilities servicing the entire city. The main landscape features to be taken into account are the proximity to the mountains, abundance of urban green space and views towards the mountains and the sea.
The complex topography of the site to some extent limits accessibility. Another major problem is the current level of motorised mobility in public spaces. To increase the *mix of uses,* motorised mobility needs to be reduced, opportunities for contact and communication need to be increased and easy access to basic facilities must be guaranteed. Providing shopping facilities for daily supplies along main streets and diversification of uses throughout the new development are proposed as means to achieve a good mix of uses. New four-to-six-storey housing units, with shopping and other facilities on the ground floor, are planned to create an optimal density akin to that which exists in the rest of the city.
In relation to public spaces, the structure of the new development seeks to create good bioclimatic conditions and quality of public spaces. The main criteria for this goal are: the design of streets, squares, courtyards and inter-block spaces as places for encounter and communication; creation of suitable bioclimatic conditions permitting the use of public spaces in all seasons; increasing city safety and security by favouring city life in public spaces; and integration of the natural processes and cycles within the urban tissue. With respect to the natural environment within the city, the corresponding sectoral studies propose the application of two specific indices to evaluate and enhance the permeability of soil and the amount of green space in the area. Another sectoral study proposes some specific modifications of the Masterplan's urban layout and built volumes to increase the quality of public spaces.

Transport
The general objectives are sustainable mobility and accessibility for the whole area. In addition to the already existing bus routes and underground station, a recently finished light rail route connects Trinitat Nova with the neighbourhoods situated north of the district. Extension of the existing underground line is also in progress. Higher densities and an improved mix of uses will contribute to creating a neighbourhood of short distances. A new cycle route in the area will connect with the existing and planned Barcelona cycle network. Designation of the whole neighbourhood as a traffic calming area will also increase the quality of public space and thus make walking and cycling more attractive. The whole area is contained within a 1,000 x 500m rectangle, so the longest walking distances are around ten minutes. Considering the difficult topography of the district, one fundamental factor is reducing barriers to accessibility in public spaces.

Figure 4.2.2:
Masterplan Barcelona

With regard to motorised mobility and parking, the main goals are to reduce harmful emissions and greenhouse gases produced and to reduce consumption and deterioration of public space by private vehicles and thus increase the quality of this space. Taking advantage of the existing steep topography, four semi-underground car parks on the periphery of Unit 3 are proposed in order to avoid car penetration into the heart of the neighbourhood and to eliminate surface-parking as much as possible (see Figure 4.2.3).

Figure 4.2.3



Energy and material flows

The main aims in this field are the reduction of energy demand and environmental impact produced by non-renewable energy consumption; improving efficiency in supply and reduction of maintenance costs in buildings and public spaces; and replacing non-renewable energy with renewable energy whenever possible (e.g. using solar energy for warm water and heating).

This housing project will be one of the first constructed according to the new regulations on solar energy use for Barcelona. The design of the buildings has already incorporated a wide range of passive features such as insulation.

This is especially important as a way to protect buildings against over-heating in the Mediterranean summer and to reduce heating needs in winter. The energy sectoral study considered different options for heat generation (thermal solar energy, co-generation and heat pumps) and distribution/supply (totally centralised system, partially centralised system with separated storage in buildings and totally independent systems), finally proposing a centralised co-generation system with collective management. A great majority of the energy proposals from the sectoral study will be incorporated into the final design.

In relation to water, the priorities are to increase efficiency in distribution and use; create urban conditions for infiltration and recollection of rainwater; promote water recycling and re-use; and contribute to the understanding of natural cycles through the introduction of water into the urban setting. Additionally, the old water distribution facilities have been converted into the 'House of Water', a new environmental interpretation centre focusing on the water cycle.

Regarding waste, the main objectives are a general reduction of urban waste and creation of optimal conditions for recycling and re-use, eliminating negative impacts on users' comfort, health and welfare.
As a regeneration project with an estimated volume of 180,000 cubic metres of demolition waste during three phases, one of the main problems to be coped with here is construction and demolition waste management. The main proposal from the sectoral studies is to implement a management plan for demolition and construction waste.

Socio-economy
The integration of social, economic and environmental strategies has been one of the main priorities. With 7,696 residents in 1996, Trinitat Nova had been losing population since 1978. 31% of the population was aged over 65 in 1996. Of the neighbourhood population, about 30% did not have education to primary level, which led to social exclusion. Additionally, younger residents with middle and higher education were leaving the neighbourhood, which further worsened the educational structure. Problems relating to health care and disease prevention were also significant among the young and adult population.
The main target group here is the residents themselves. An important aim of the project is to recover lost population, by attracting young people and families to a neighbourhood with an increased quality of life, better transport facilities and many new social and economic opportunities. The general transformation of the neighbourhood, with radical improvements in connectivity, facilities and urban quality, and the innovative ecological outlook of the whole operation will without a doubt be economic attractors contributing to the improvement of social conditions.
Nevertheless, a main concern of the Trinitat Nova project is to avoid gentrification, assuring the introduction of a younger population without excluding the existing, older one. The surplus of new housing units in the renewal area may be a good tool for this gradual transformation. Furthermore, the main objective of the community plan, through its educational and social dimensions, is to establish sound conditions for the creation of local jobs and opportunities. There is a well-defined strategy in this respect with many initiatives in progress.

4.2.3 Project outcomes – key elements
The agreed objectives are now being extended to the surrounding problem areas, with the replication of the process in the closest neighbourhoods. In certain aspects, Trinitat Nova has become a pilot project for the Barcelona sustainability policy (e.g. in relation to new municipal solar and waste recycling regulations). Several proposals studied for the Trinitat Nova project have been adopted by the municipality or the regional housing department as a reference for their future policies.
Examples are the soil permeability evaluation devices, domestic water recycling and orienting streets and buildings appropriately for the climatic conditions and energy saving aspects. The recently approved Neighbourhood Act, aimed at the renewal of urban settlements focusing on participation and sustainability, converges with most of the sustainability objectives developed through the Trinitat Nova ECOCITY project.
The most outstanding output is the participative and collaborative approach to seeking solutions to the complex problem of renovating social housing in old neighbourhoods, undertaken within a framework of integrated planning and ongoing feedback in participation workshops. The case is being studied by several international projects as a model for a new way of integrating social, economic and environmental issues in urban contexts.

Immediate prospects include:

- Reinforcing the idea of Eco-neighbourhood Trinitat Nova as a pilot project
- Reinforcing the articulation of the educational and social dimensions of the project, focusing especially on participation processes
- Extending the operation to the whole neighbourhood
- Integrating the results of the sectoral studies into the next project phases

Key element 1	Key element 2	Key element 3
Integration of social, economic and environmental strategies	**A sustainable mobility concept taking advantage of new centrality**	**Incorporation of sustainability concepts developed by the project into metropolitan policy**
An integrated planning process of urban renewal on a brownfield site, driven by the initiative of the residents. Ecological quality of the neighbourhood and innovation are considered economic attractors. Mix of use and introduction of new housing units are considered factors for increasing social diversity. The process in itself is considered an educational opportunity for the population involved. At the same time it is an extremely important experience of new governance and public-private-third-sector partnership.	Being a brownfield site, the area is served by the existing public transport network, which has been extended to include new light rail and metro stations. The mobility concept, which includes car-free areas, cycle lanes and centralised car parks, is possible thanks to a number of factors: the excellent public transport service and the proximity of the neighbourhood to the rest of the city, the middle-high density of the area and the general accessibility of services within the neighbourhood.	Aspects such as soil permeability evaluation indicators, domestic water recycling devices and criteria for the orientation of streets and buildings have been adopted as a reference for the new sustainability policies of municipal and regional government. The recently approved Neighbourhood Act converges with most of the sustainability objectives developed through the Trinitat Nova ECOCITY project.

4.3 ECOCITY Győr

4.3.1 General information

Győr is one of the five traditional regional centres in Hungary outside Budapest. The number of inhabitants is 130,000 in the city, totalling 200,000 together with the agglomerated villages. The city is one which has gained from the political and economic transition of the country. Due to its location in the corridor between Vienna and Budapest, its favourable surroundings, diversified economic structure and rich cultural heritage, it was the first city to recover from the depression of the economic and structural changes. These changes had important consequences for the city structure: the service functions of the central area have been growing; the conflicts between traffic demand and the protected city structure have become more severe; new shopping centres have been built, partly outside the built-up area; and new industrial developments have been located outside the city, while the hundred-year-old traditional industries have created increasing environmental problems.

The concept for the ECOCITY is a long-term development proposal for the re-use of a 100-hectare industrial area along the Moson-Danube River which borders the historic city centre. The concept provides the possibility of extending the centre, helping it to keep functioning and at the same time preserving the central area with a number of protected historical monuments. This re-use of the industrial areas in the city is a means to preserve the equilibrium of the city structure. As early as 1994, an idea for the development of a Water City emerged. Due to the strategic decision of the site's owner (Rába plc) in 2000 to gradually cease industrial activities here and to re-use the area, the planning process has recently speeded up.

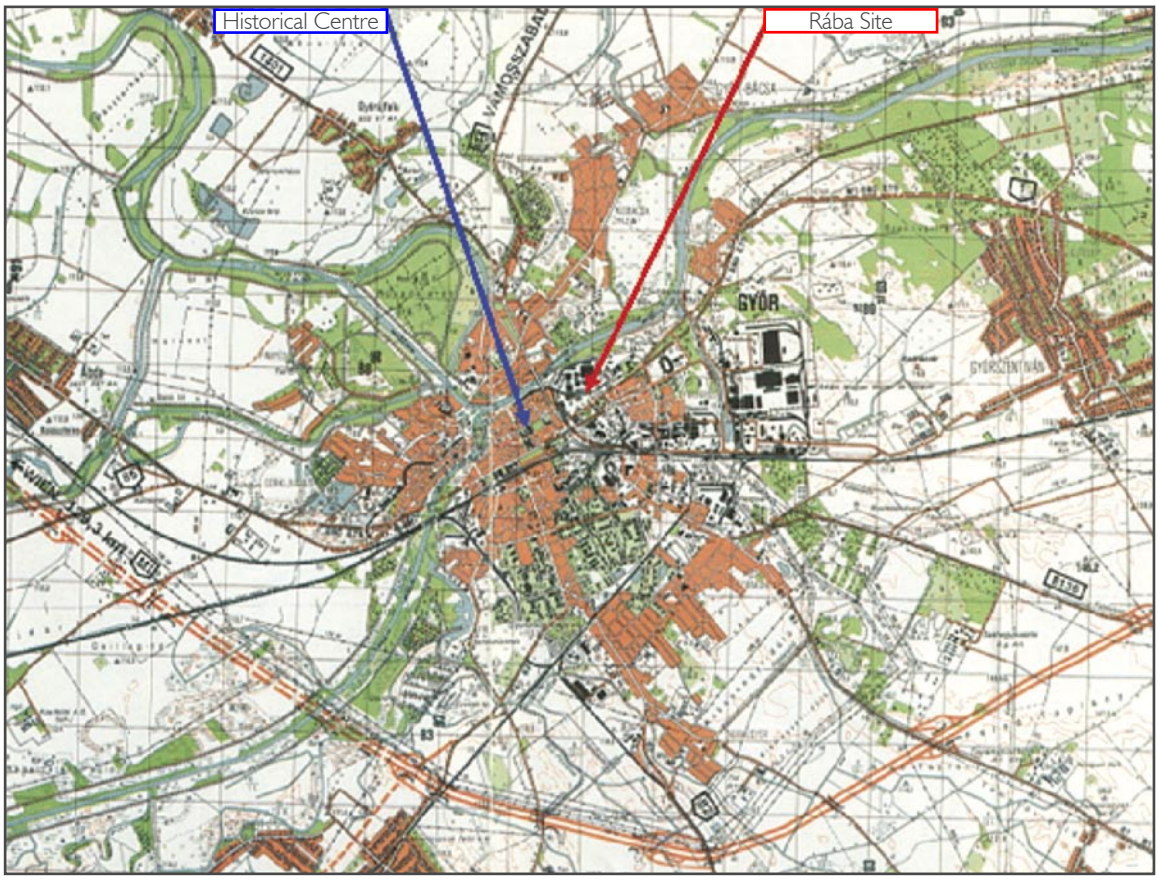


Figure 4.3.1
Location of the historical centre and the planning site

4.3.2 Project description

Urban structure

The urban structure of the area covered by the plan responds to the following aspects of the location:

- Its proximity to the green belt of the Danube
- The existing internal infrastructure due to former industrial activities
- Its location very close to the city centre
- The development of a shopping centre on its south-western border

Two investors have emerged so far. One will build the shopping centre on the south-west corner of the site. The preparation of the investment is in an advanced phase – detailed plans have been made and former office buildings as well as some warehouses have already been demolished. The other investor intends to develop a high density residential area with some 6,000 flats in 4-9-storey blocks, resulting in around 11,000 inhabitants. The plans also include facilities for about 5,000 jobs.

The location of the site is very favourable in terms of accessibility not only to the historical centre, but to the region as well. However, a main road runs between the site and the inner city. The site extends along the River Danube where, between the river and the residential area, a park is planned for recreational purposes. Some existing industrial buildings will be converted to other functions (e.g. canteen → library; power plant → museum; air-raid bunker → energy storage or museum). Some symbolic structures such as the water tower and the school will also be preserved.

At the quarter level, which is the whole newly built-up area, the neighbourhoods are organised around four or five city squares which will all be connected to the surrounding landscape and the water system by the planned 'green fingers'. On these main squares the college, the library and an administrative centre will be located. Each square has its own identity and the two squares on the city side will have wider public functions. Between the squares, an urban connection formed by the main system of avenues and boulevards fulfils the 'city of moving and meeting' function. This is where buses, bicycles and cars circulate, as pedestrians meet, move and walk along.

This basic urban structure provides cooling in summer, as the main winds pass along the 'green fingers' when they blow into the area. The 'fingers' constitute the connection running south to north to the water and give the area its character as a location for ecological housing. The residential sites are connected with each other via these green fingers which meander through the area. Pedestrians and cyclists can walk and ride along these green corridors and can reach the roads on the banks of the river easily.

Transport

A complete pedestrian, cycle and bus network has been developed. Multi-storey car parks for each block have been planned to accommodate 200-250 cars. On street parking will not be allowed except for visitors and short-term parking for services.

Footpaths and cycle paths provide the main transport network at the quarter level, providing the shortest routes to the main destinations. For example, people are likely to walk or cycle to the primary school, as it is nearby and safe to walk to. The neighbourhood layout with central courtyards, crescents and squares focuses on pedestrians and cyclists. As the pedestrian and cycling routes lead from houses to other functions and services, the structure will result in more walking and significantly more cycling than a standard layout designed for cars. The paths run both between and through the building blocks and the resulting openings provide good bioclimatic conditions at the same time. There are several main axes planned for cyclists. These routes are integrated into the cycle network of the city. Of the three possible main cycle lanes on the existing roads to the city centre, the shortest one will be fully developed. The profile will be (re)designed in such a way so that cyclists are prioritised and car speeds are reduced. Along the Danube, a cycle path will provide connections to the green spaces, the sports grounds and the city centre.

Figure 4.3.2:
Masterplan Győr

The population density is high enough for efficient and cost-effective public transport provision. A city bus route will operate to connect the historical city with the shopping centre in the south-west corner of the site. A new bus route (at first one and later two routes) will form an integral part of the public transport network. One of the routes will run to the west on the main arterial road, passing by the city centre and railway station and thus connecting the site with other residential districts. The other will go to the south-eastern industrial districts. Distances to public transport stops do not exceed 300m from anywhere within the area.

The main access to other parts of the city for cars is provided by a main avenue which serves as a collector road and which has a capacity of about 20,000 vehicles per day. By designing this and other urban roads in such a way that car traffic is urban-friendly, the road system will support sustainable mobility. The redesign will be undertaken in accordance with the principles of the 'drive slow – go faster' method. The characteristics of the avenues are: low driving speeds (about 40 km/h); narrow lanes with nevertheless high capacity due to special junction design; continuous flow of traffic due to absence of traffic lights; and mixed use of lanes where possible. Traffic safety in the area is not based on traffic lights but is achieved first and foremost through street design, which controls speeds and makes clear who has priority. The main collector road has a special layout with separated narrow lanes and a wide central reservation where there is enough space for a footpath or cycle path and even kiosks.

Other streets are designed so that driving speeds will not exceed 20 km/h. As speed is slow due to the narrow lanes, pedestrians and cyclists will have 'natural' priority, whereas cars are guests. Drivers and pedestrians will have eye contact. Thus the quarter is a safe place to cycle and walk and children can play in the streets.

Energy and material flows

During the design of the new quarter within the framework of the ECOCITY project the principal aim in relation to energy and material flows is the passive utilisation of solar energy.

Plans for the passive utilisation of solar energy at city quarter level include:

- Encouraging the utilisation of solar energy through different building methods
- Creating a road and pathway network which is designed so that the orientation and width of streets and paths and the planting structures implemented ensure that prevailing winds are interrupted to reduce the air-blast effect without blocking adequate ventilation of the quarter

Most of the time winds in the area blow from the north-west and somewhat less frequently from the south-east. This gives a unique opportunity to combine the cooling effect of the wind with the basic ecological structure. 'Green fingers' planted with trees running north-eastwards lead directly to the green banks of the Danube and stretch deep into the planning area.

Plans for the passive utilisation of solar energy at building level involve orientation of façades and glass surfaces, heat storage capacity and control of energy flows in the buildings.

Two options for heating and hot water supply are being considered:

- Alteration of the existing boiler house operated by the current site owner, Rába plc, to house two biomass furnaces (wood chips or pellets) with 7MW performance complemented by one gas heating plant with 3MW performance and a solar energy collector field with a 6,000m^2 surface area
- Use of waste heat from the nearby distillery

The 'green fingers' are used as rainwater collectors and they will serve as main conduits for the rainwater drainage system. The rainwater will soak the edges of the 'green fingers' and trees and other plants will grow there. At times of heavy rainfall the water will flow into the Danube and at times of high water a stop-valve prevents the Danube water from flowing into the area.

Socio-economy
The ECOCITY project also means designing a city or neighbourhood of which the human network is an implicit part. As Rába plc is one of the most important factories in the city – not just economically but also emotionally – notable elements of the Rába Museum will be preserved and displayed in the old bunker. A new city library will also be established. Furthermore, valuable monuments of the site (e.g. statues) will also be preserved.

The new quarter consists of about 10 urban neighbourhoods, each comprising a little under 500 dwellings. The neighbourhood is the smallest spatial and liveable unit in which public spaces and functions can be organised. Conditions should be such that the people will give their own meaning to the quarter and neighbourhoods, thus shaping their identity. Each neighbourhood is organised around a central courtyard or square in a unique way. Here, people will be attracted by service functions such as a nursery school, a mobility centre, a primary school, a bicycle shop, a neighbourhood medical centre or a social meeting space. Sheltered living for the disabled and other social provisions might also be grouped around the central square. In the quarter several forms of housing are available (in terms of physical and social features and types of ownership). It is a plural world for owner occupiers and tenants, single people and families, young first-time buyers and older 'empty nesters' and offers affordability for many purses.

4.3.3 Project outcomes – key elements

Key element 1	Key element 2	Key element 3
		
Urban renewal on a brownfield site	Sustainable mobility	Natural environment
Through the re-use of the industrial area along the Moson-Danube River, the plan provides the possibility of extending the neighbouring city centre, helping to maintain its central functions and to preserve a number of historical monuments. The site is located very close to the city centre providing favourable conditions for accessibility. The intention is to develop a residential area of qualified density with around 6,000 flats in 4-9-storey buildings. In offices, commercial facilities, etc. a total of 5,000 jobs will also be created.	A dense network for pedestrians and cyclists will be constructed; as pedestrian and cycling routes lead from dwellings to other functions and services, this structure will result in more walking and significantly more cycling than a standard layout designed for cars. Urban boulevards which are characterised by low driving speeds, narrow lanes with high capacity due to special junction design, continuous flow of traffic due to absence of traffic lights and mixed use of lanes where possible.	'Green fingers' planted with trees running north-eastwards lead directly to the green banks of the Danube and stretch deep into the planning area The site extends along the River Danube where, between the river and the residential area, a park for recreational purposes is planned.. Most of the time winds in the area blow from the north-west. This gives a unique opportunity to combine the cooling effect of the winds with the basic ecological structure of 'green fingers'.

4.4 ECOCITY Tampere - Vuores

4.4.1 General information

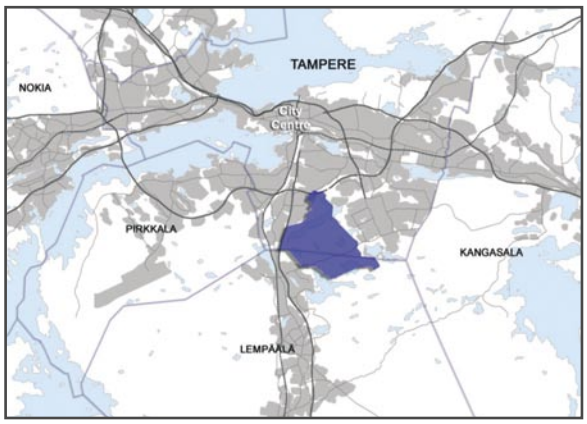


Figure 4.4.1
Location of the Vuores area

The Vuores case area is a typical 'greenfield' development in a woodland area to the south of the city of Tampere. Vuores is separated from Tampere by a lake and borders onto the district of Hervanta to the east. Altogether, the planning area comprises 472.6 hectares. It is planned to have 13,400 inhabitants and workplaces for 3,500 people (see Figure 4.1.1).

4.4.2 Project description

At the beginning of the project very generic concepts were developed for the Vuores area. These were derived from the criteria and indicators developed for the ECOCITY project. However, they were developed still further. Interlinked concepts were devised for six topics with the following goals:

- *Urban planning*: optimising the urban structure, its buildings, public spaces and traffic system; taking into account the microclimatic conditions in the area; preventing traffic noise and other harmful emissions
- *Transport:* optimising the street network; minimising car traffic; optimising public transport; providing space for walking and cycling; providing flexible parking systems; optimising mobility management
- *Energy:* optimising energy conservation and energy system performance; minimising heat loss; increasing awareness of energy use; reducing electricity use
- *Information technology:* provision of possibilities for various tele-activities
- *Conservation of the natural environment:* taking local landscape structure into account in land-use planning; maintaining biodiversity; control and ecological management of storm waters
- *Social issues:* taking social sustainability into account; organising citizen participation

The concepts were produced as cards. Each card contains an illustration of the concept, the measures to be taken according to it, objectives to be fulfilled by it and criteria and indicators with which it should comply.

Urban structure

In relation to its urban structure, the main principle for the area is a *close relationship with nature*. There are short distances to the green areas from every dwelling. The built structure is arranged on both sides along the main collector street, leaving the connection from the blocks of buildings to the surrounding green spaces basically free, without interference from traffic. The building density is also very low, especially on the fringes of the structure.

In developing a masterplan (see Figure 4.4.2) for Vuores the *distinctive natural environment* was appreciated from the very beginning. The features considered were the varied topography and shapes of the terrain, the valuable natural elements in the area, the water system (ridge as a watershed), the possibilities for recreational use of the forest and the existing holiday cottages. Consequently, the basic themes of the planning process were to preserve the natural environment and the character of the area as well as to take into account its microclimate.

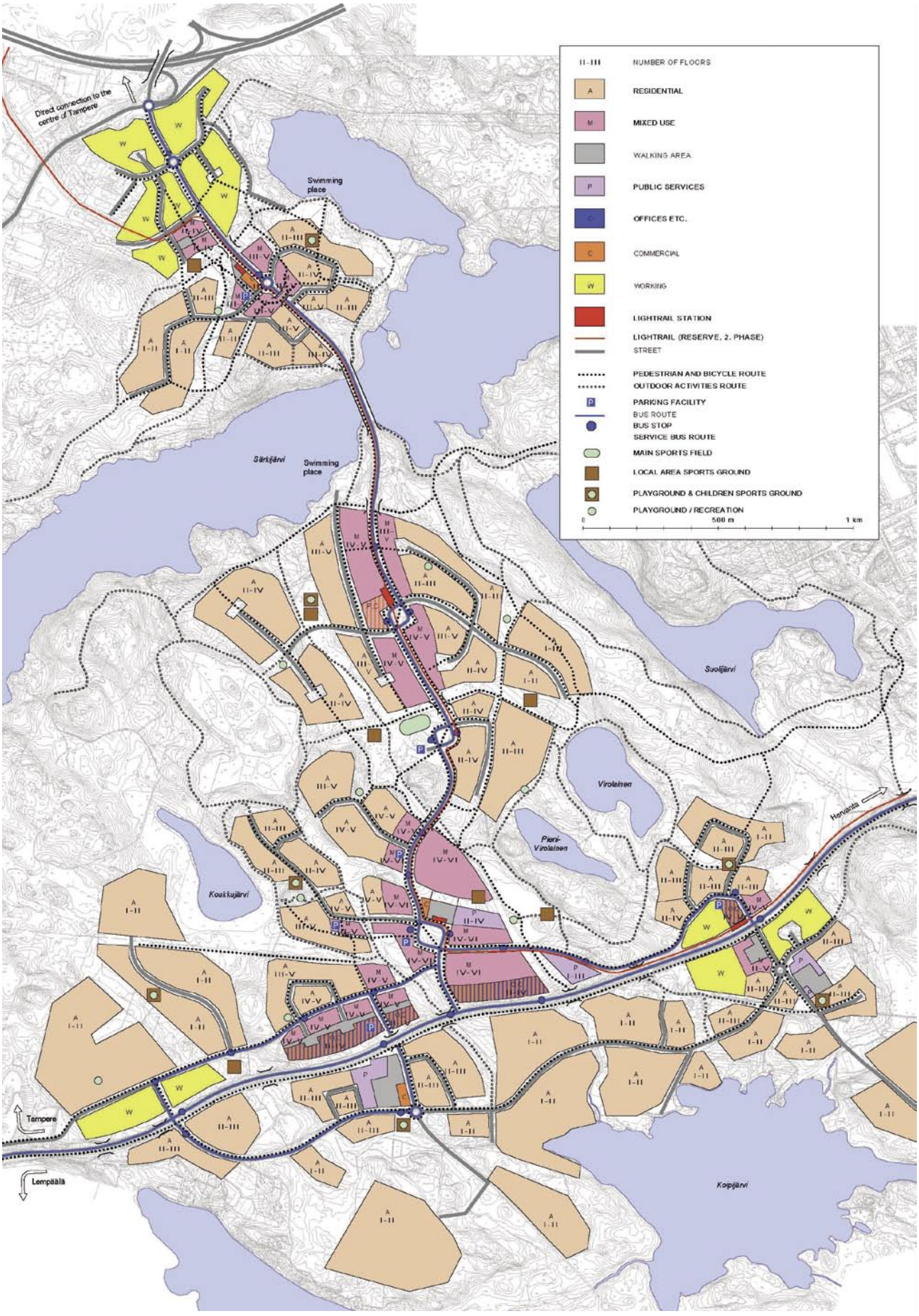


Figure 4.4.2:
Masterplan Vuores

Considering the necessary service structure for the population of the area, a *high mixture of uses* is planned, especially for the central parts. In this way the area is given a chance to develop its own independence, rather than becoming a dormitory suburb. The structure is also concentrated towards the main collector street to provide short walking and cycling distances for most people to everyday basic services and public transport.
The area has one *main centre* and *four sub-centres*. The basic services are concentrated in these centres. The centres are well served by public transport routes and contain workplaces as well. In addition, the main centre includes less frequently used but nevertheless important community services. A two-phase *architectural competition* for the main centre of the area was launched in autumn 2003 and came to an end in December 2004. The ECOCITY principles were one part of the competition guidelines. These principles will be applied more closely in the town planning and implementation phases. Urban public spaces have been mainly concentrated around the five centres and are also connected to the public transport network. Pedestrian and cycling routes link them to the nearby residential and mixed-use blocks as well as to the surrounding green spaces. There is a central sports area with various sports facilities and outdoor playing fields.
Because it was considered important to take the sensitive natural environment into account, the area has a rather scattered built structure. For the same reason its mean density (gross floor area ratio) has become very low, only 0.17 for the whole area. However, in the central zone the density is 0.35. A scattered structure with low density tends to create long walking and cycling distances and also makes it difficult to arrange economic and effective public transport systems which serve the whole area equally. There is also the danger that the street structure will lead to car-oriented transport. These drawbacks can be resisted in part by concentrating the building around the five centres and using traffic calming on the collector road for cars.

Transport
As a greenfield area Vuores does not yet have its own transport network. The only existing road is the Ruskontie road running along the southern boundary of the area. Besides this there are only a few forest tracks and paths. The traffic solution for Vuores is based on the new main route, Vuoreksen puistokatu street, which transverses the area from south to north and crosses over Lake Särkijärvi. In addition, there are perpendicular parallel routes on both sides of the Ruskontie road. Access roads are perpendicularly linked to these roads and designed as low-speed, dead-end streets with pedestrian priority. However, in order to ensure easy and fluid service traffic, the pedestrian routes connecting the street ends are also open to service vehicles.
The guidelines for traffic and road planning are focused on promoting walking, cycling and public transport. The walking and cycling routes are planned as separate from the car traffic and are to be executed in good quality. Public transport services are also planned to be of high quality, including having frequent services and fast routes especially to Tampere city centre, to maximise their use (see Figure 4.4.3).
The accessibility considerations in the Vuores area have led to the central role played by public transport in the transport system. It is intended to be based on a light rail system, which will run along Vuoreksen puistokatu street, directly to the centre of Tampere via the proposed bridge over Lake Särkijärvi. Before the realisation of this service, public transport will be bus-based. All the basic services will be situated within reasonable walking distance from the public transport stops.
A high-quality and comprehensive pedestrian and cycling network will be provided for Vuores. It is planned to be as safe as possible by using traffic calming and by crossing car lanes as little as possible. The pedestrian environment should be usable by all and the basic services in particular should be

easily accessible. The solutions will also be favourable to car-free families. Furthermore, an ample and comprehensive route network serving recreational activities will be provided. Special attention will be paid to cycle parking, especially in the central areas.
Through traffic by cars is allowed on the collector road, but it will be restrained by traffic calming and speed limits. The aim is thus to reduce the attractiveness of the area to through traffic. Cars using the access roads are required to respect the pedestrian priority regulations. Residential parking will be concentrated in facilities some way away from the dwellings, especially in the areas of blocks of flats. The aim of this is to promote the use of public transport. Car-free areas are not proposed in Vuores.
All streets are also designed for the use of necessary emergency and service transport. Products ordered from certain mail order or e-trading companies are planned to be distributed through a kiosk chain with long opening hours during evenings and weekends.
The problem of traffic noise is considered to be mostly solved by sufficient distances, the relative location of buildings, courtyards and gardens and suitable traffic and parking arrangements. Nevertheless, some physical noise abatement measures will have to be taken.

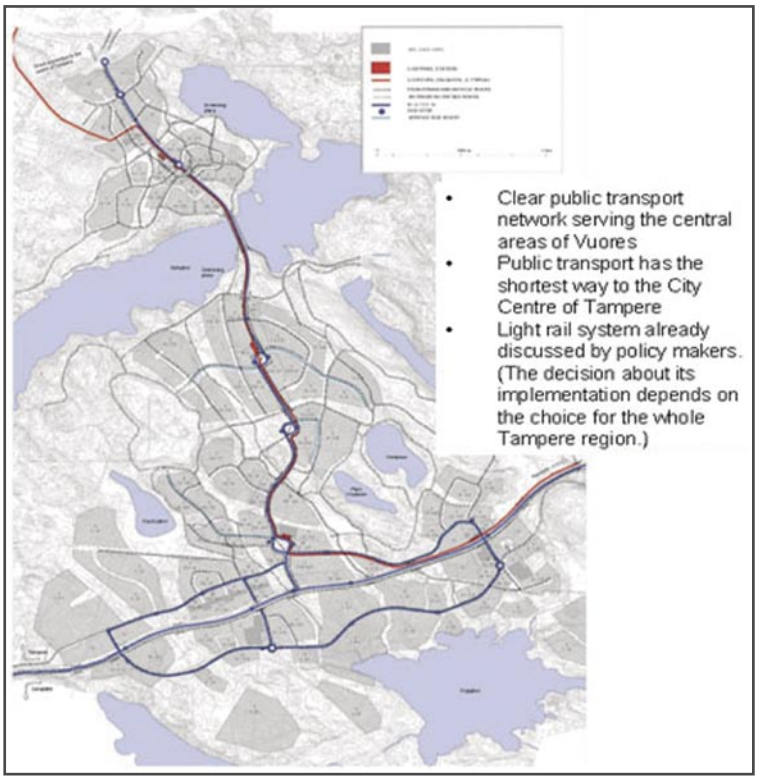


Figure 4.4.3
Public transport

Energy and material flows

For the energy supply, a regional district heating network fed by a combined heat and power (CHP) plant is used for heating the surrounding more densely built areas. The possibilities of utilising renewable energies in the area are rather limited and not profitable. Thus, considering the sustainability issues, extending and using the existing district heating network as the main heating energy supply system is the most reasonable alternative for Vuores. However, the plan is for it to be supplemented by ground-source heating systems and active solar systems to increase the amount of renewable energy used in the energy supply. Detached houses and farmhouses will partly also use biomass and electricity for their heating on an individual basis. Passive solar heating will also be utilised to some extent for heating. The appropriate combination and extent of different heating and heating supply systems will be determined on the basis of the results of ongoing research. A district ground-source cooling network is also being researched. The orientation of individual buildings for passive solar energy use must be decided. The Tampere City electricity works also utilises wind energy and is a shareholder in a wind farm. The increase of wind energy production directly in the Vuores area or nearby, though, is not economically feasible, due to poor wind conditions.
Energy saving is important, irrespective of the energy source of the building. The building stock will include both low-energy buildings and buildings which comply with the Finnish Building Code 2003. The energy conservation strategy is based on the reduction of heat loss through improved insulation levels, low-energy windows, air tightness, heat recovery and temperature control. Low temperature heating systems and heat recovery from ventilation are recommended. User-friendly temperature control strategies and visible energy consumption by metering are also aspects of the building design.

No demand for cooling is expected for the housing and offices and other buildings will only have a low cooling demand. Intelligent cooling systems are under investigation for these purposes.
The cost-effectiveness of improved thermal insulation, advanced windows and ventilation heat recovery is very high. The resulting increase in investment costs has been less than 3% compared to conventional building practice. Heating energy consumption can be reduced by 50-60% in a cost-effective way simply by reducing heat loss from the buildings. If solar technologies are introduced, heating energy consumption can be reduced by 70-80% compared to a typical Finnish detached house.

Building materials and soil movement

Opportunities for the sustainable use of building materials will be investigated but it is already clear that the use of wood in construction will be substantial. Because of the richly undulating and fragile terrain, much effort has been and will be made in designing the streets and siting the buildings so that soil movement is minimised. This objective, however, has led to rather winding road patterns in the area.

Water and waste management

The Vuores water management system will be a traditional one. Wastewater will be collected mainly by gravitational sewers and treated in a large sewage treatment plant near the centre of Tampere. The development of grey water systems has not so far been raised as a possibility in Vuores.
Because of concerns about the possible negative effects of storm water, its natural treatment and control has become an important issue in the planning of Vuores. Conventional storm water sewers are avoided and storm water is controlled and treated by detention, infiltration and wetland systems. The objective is to maintain the present hydrology of the area (see Figure 4.4.4).

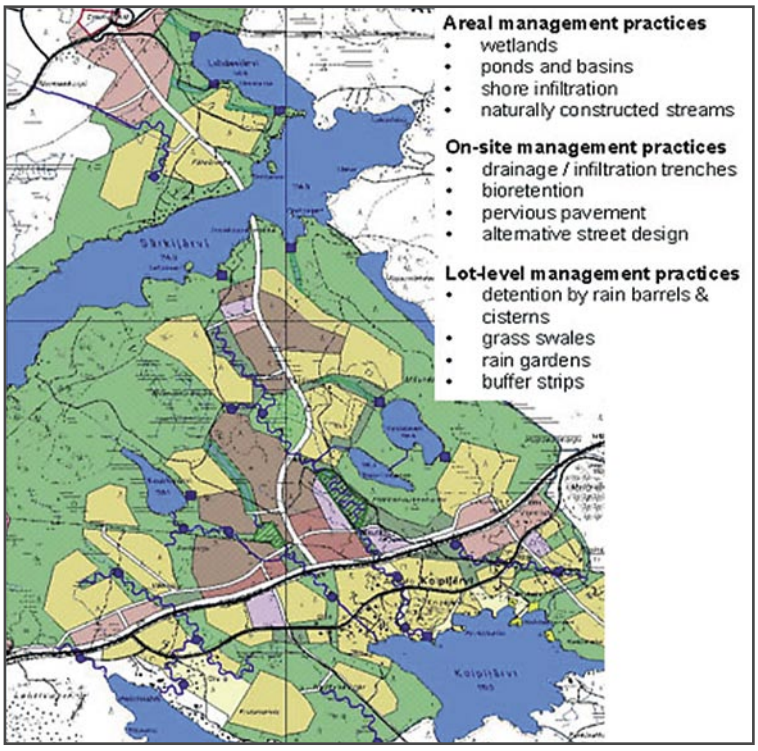


Figure 4.4.4
Stormwater management

Waste will be collected and effectively separated in order to minimise costs and emissions, to maximise recycling potential and to treat hazardous waste. Besides the sorting and collection of waste at the individual property level, there will be at least five drop-off collection points and one 'eco-centre' with waste sorting. Biogas from compostable waste will be utilised as an energy source.

Socio-economy

Participation has been based on the collaborative working group for Vuores, public meetings, interviews, inquiries and public surveys. In addition, the ECOCITY community committee was established in autumn 2001. Workshops for the inhabitants of Tampere have also been organised. Furthermore, the City of Tampere has organised several events with the investors and business sectors involved in the realisation of Vuores.

The essential aspect in the planning of Vuores has been the creation of the Vuores vision, describing the desired development of the area. The vision contains the 'Vuores Ideas' collected through several questionnaires, the results of workshops with local people and civil servants and material from the ECOCITY project. A framework for future participation in the Vuores development is under preparation. The city will also create new opportunities for participation via the internet.

The existing socio-economic structure of the area will be completely changed through its development. The aim is to establish plenty of high-quality public services and several private and commercial services. The central zone is intended to be the main shopping and service area of Vuores, but there will be public and private services in the sub-centres as well. There will also be several recreational and sports facilities. Public facilities will be planned for a variety of uses. An efficient ICT infrastructure will allow the use of electronic services and e-democracy as well as tele-working.

One of the aims in Vuores is to have a high social mix. Therefore housing in Vuores will be diverse in terms of ownership and types of dwellings, in order to offer different kinds of housing options. In addition, the different residential areas in Vuores will be developed to be as characteristic and distinctive from each other as possible.

Most of the ECOCITY concepts can be implemented by integrating them at the planning stage. However, the development of an effective public transportation system and the storm water management will probably need some special financing.

Most of the workplaces will be located in the service facilities and residential buildings in the five centres to promote mixed use. One work zone will be part of a larger business and industrial estate to the north of Vuores. The aim is to create jobs in a variety of sectors. There will even be possibilities for small-scale agricultural production and manufacturing businesses near to the residential areas. The possibilities of a link with existing research establishments and high technology enterprises in Hervanta will also be explored and there are also plans to create ecological workplaces. The aim is that many of those living in Vuores will also work there. The workplaces in Hervanta are also nearby and Vuores could perhaps offer jobs to the inhabitants of Hervanta and people in other neighbouring areas.

4.4.3 Project outcomes – key elements

Key elements of the Vuores ECOCITY area

Key element 1	Key element 2	Key element 3
Close contact with nature	Public transport	Community structure
One essential objective for planning in this area was the sensitive incorporation of the fragile natural environment. The basic elements considered were the varied topography and shape of the terrain, the valuable natural features of the area, its biodiversity, its microclimatic conditions and its existing water system. Consequently, the natural environment is omnipresent in the area. All the dwellings are within a short distance of the green areas. The natural environment penetrates the built structure with 'green fingers' and via a green belt which transects the area. One important issue is the protection of the area's natural water system	Public transport has a central role in the transport system. It will be based on an effective light rail system running through the whole area along its spinal road and serving all its functional centres. Before the realisation of the light rail, however, the public transport of the area will be based on buses using the same routes. A high-quality and comprehensive footpath and cycle network, with short distances to the stops, will support the use of public transport. Also all the everyday basic services will be close to the stops.	The built structure is concentrated around one main centre and four subcentres. These are situated within short walking distances from most of the dwellings. The centres contain a public square, everyday basic services and a large number of workplaces. In addition, the main centre includes less frequently used community services. Thus, there will be a rich mix of uses in these centres and good provision of public and commercial services, within reach of an efficient public transport service. The public squares in the centres are expected to foster a vibrant community life.

4.5. ECOCITY Trnava

4.5.1 General information

The ECOCITY Trnava case study deals with the ecological renewal of the urban centre of a medium-sized town with a valuable historic heritage and considerable development potential. Trnava is located on the fringes of the Danube lowlands, 50km north-east of Bratislava. Within the administrative structure of the Slovak Republic it plays the role of a regional capital. In terms of inhabitants, Trnava is the seventh largest city in Slovakia but the population size has been stagnating now for almost 15 years at around 70,000. Even in the future, no striking changes are likely in the city's demographic situation. However, it is expected that the new industrial capacities (PSA Peugeot-Citroën car factory) will help to stop the population decline in adjacent settlements and will cause an increase in migration towards Trnava.

Trnava enjoys a good location and is well connected to the road and rail network of Slovakia; nearby airports and ports are to be found in Bratislava. Inner-city trunk roads as well as excessive traffic volumes are common problems in many Slovak towns. The study for the ECOCITY Trnava emphasises sustainable urban development supported by appropriate transport infrastructure.

Similarly to almost all other Slovak towns, Trnava is supplied by energy (electricity and gas) from external sources. Specifically there is the nearby nuclear power plant, Jaslovské Bohunice, which supplies the city with heat. It will cease operation in 2006, which provides a good opportunity (and need) for the preparation of an alternative energy supply concept.

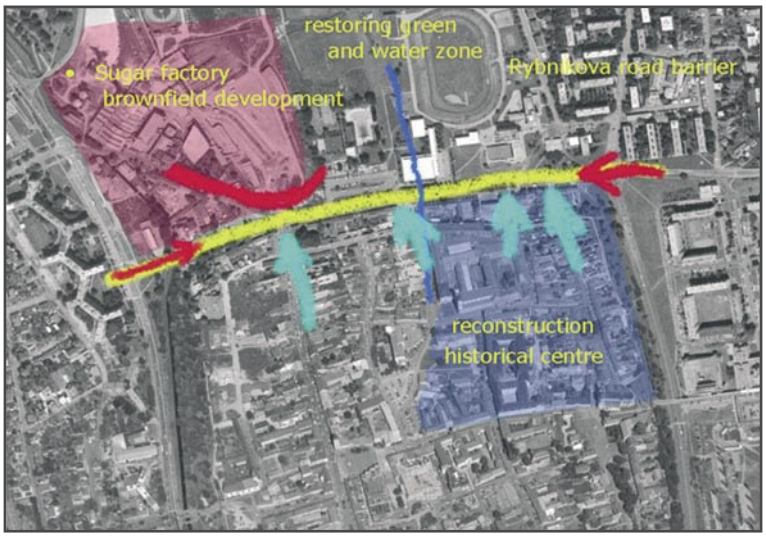


Figure 4.5.1
ECOCITY Trnava site analysis

4.5.2 Project description

This ECOCITY project examined the possibility of implementing the ECOCITY principles in three neighbouring urban areas with different types of structure and use: the northern part of the historic city core, the disused sugar factory with adjacent sites and the Rybníková traffic corridor (see Figure 4.5.1, site analysis). The approach used was to investigate the principles of sustainable urban development in the integration of transport and spatial planning. In the ECOCITY, public spaces (streets and squares) are the arena for interaction. Their quality can be evaluated according to three criteria groups: ecological, economic and socio-cultural. The 'comprehensive transport master plan' [Rakšányi, 2000] is an appropriate tool for this. It is characterised by the permanent, ongoing participation of area users in all phases: taking stock, exploration, analyses, evaluation of development intentions, goal assignment, scenario development, selection of the most suitable scenario, design draft (ECOCITY conception) with detailed sub-variants and implementation of the final design as the Local ECOCITY Master Plan (LEMP). Design of the physical structure and sustainable transport is combined with transport policy measures such as those presented in the EU Project LEDA[13].

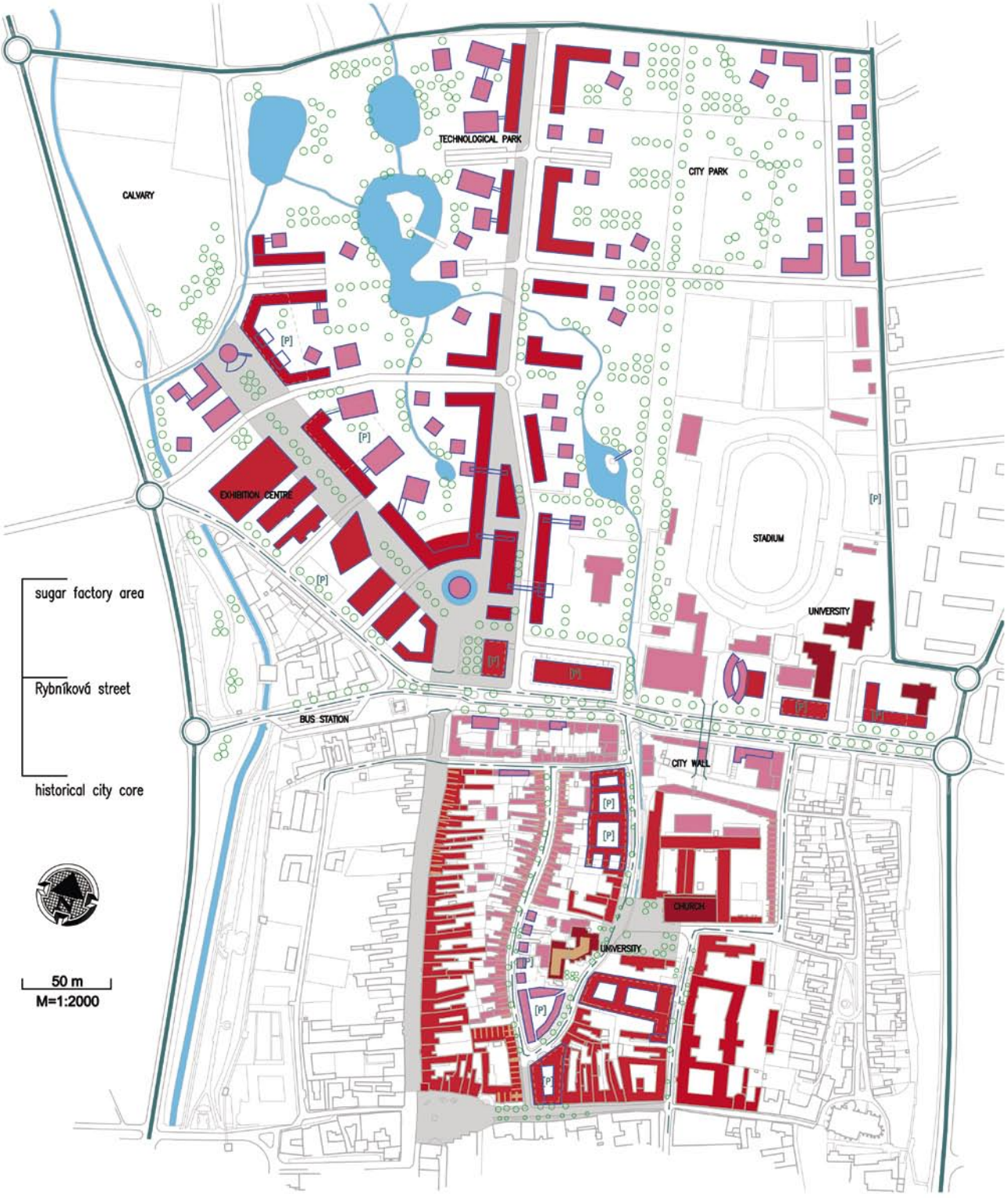
The Trnava 'ECOCITY in the Historic City' vision is based on the combination of three goals of sustainability: environmental quality, socio-cultural identity and economic effectiveness. The preservation of the historical heritage of Trnava was emphasised here. Specific to this project is the differentiated approach to individual areas, based on their quality and their current extent of preservation

[13] Legal and regulatory measures for sustainable transport in cities, *http://www.ils.nrw.de/netz/leda* (website in German)

of the natural and cultural assets of the area. For the model area, two relevant aspects that determine the character and the development of the ECOCITY Trnava model were selected: the direction of spatial development in relation to the urban gravity centre (concentration, de-concentration) and the approach to the cultural and historical heritage (reconstruction, restructuring).
The methodology resulted in four different scenarios. These scenarios enable different trajectories for the area's further development. Changes in traffic volumes in the ECOCITY scenarios are qualified by the change of functions in the transportation network of the whole city. The basic principle is speed reduction towards the city centre. For the transport sector the following sustainability characteristics were selected for the quality criteria: reduction of unfavourable transport functions and reducing overall traffic loads; design criteria appropriate to both vehicles and pedestrians; strengthening regional connections and links to neighbouring areas; improving public transport services; locating parking facilities to favour other modes; and providing city logistics.
The scenarios were discussed with citizens, local associations and independent experts. They were also discussed with the representatives of the town council and the mayor. After the completion of this participation process, the scenario was selected that restores and strengthens the city image through an appropriate degree of intensification of land use in some areas and an emphasis on the ecological principles of town development in the currently non-developed parts of the model area.
The whole design concept was inspired by the acceptance of the genius loci of both built and natural structures of the ECOCITY area. In drafting the scenarios new functions, hierarchies and categories of urban roads were tested. These have been proposed to contribute to the modernisation of the Slovak national standard 'Planning and design of urban and similar roads'.
The Trnava LEMP is a comprehensive documentation of urban structure and sectoral planning, resulting from parallel design and participation procedures and underpinned by an ECOCITY quality support procedure and quality criteria (see Figure 4.5.2).

Urban structure
The planned development in the central area fully respects the baroque urban structure of the historical city centre and preserves its compactness, texture and urban hierarchies. It also respects the character of the industrial development of the 19th century but proposes to demolish buildings without historical (or city image) value.
The scale of the planned development on the site of the old sugar factory has the character of an addendum to the historical structure, providing the components of urban fabric which are missing there. Optimisation of functions and the provision of functions with city-wide relevance in the new development ('city of short distances') were a main design principle. Mixed use is therefore a very important aspect of the plan and all major urban functions are integrated into it: housing, shops and services, schools, cultural and religious centres, administration, sports and recreation, public green spaces and water features.
Although in the historical centre there are no significant changes of urban functions, the sugar factory area loses its industrial character and its function is changed: an exhibition area, a technological park, a university campus, service facilities and housing are planned there. The new development around Rybníková street will have a distinctly mixed-used character.

Transport
The provision of a multifunctional structure is based on the principle of pedestrian accessibility and optimisation of commuting distances. Of further importance is an overall design of the city without barriers, which is accessible for all groups of people including the elderly, parents with children and the



Local Ecocity Masterplan

ECOCITY TRNAVA

LEGEND:

Urban structure
- existing structures
- proposed new structures
- recommended rebuildings
- possible addition of garrets (floors)

Height of buildings
- 1–2 floors
- 3 floors
- 4 floors
- 5–6 floors

Natural elements
- water
- trees

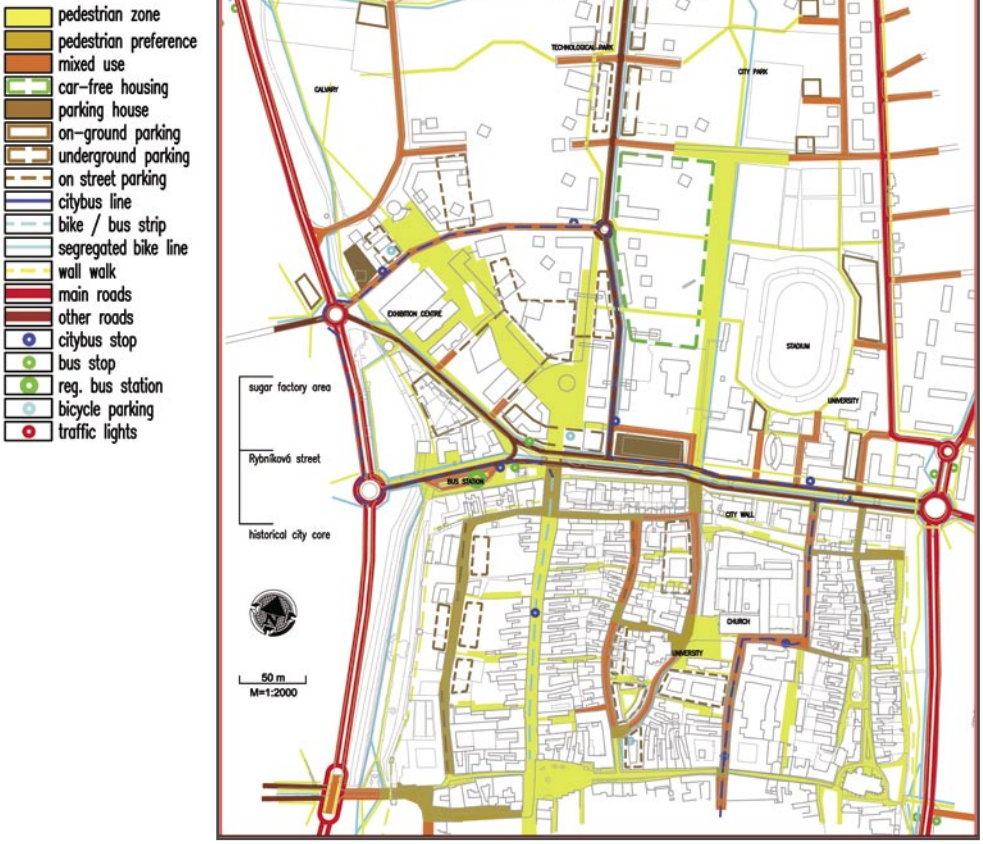
Transport
- main road
- traffic calming
- main pedestrian areas and paths
- underpass / overpass
- on-ground parking
- underground parking spaces

Figure 4.5.2:
Masterplan Trnava

disabled. Thus, for the transport system the requirements of the following participants and elements of the transport system lead the design (in the order stated): pedestrian traffic (pedestrian zones, 'woonerfs' or home zones[14], mixed-use areas, car-free zones, car-reduced zones and recreational pedestrian routes); bicycle traffic (segregated cycle paths, mixed-use streets, possibility to cross pedestrian areas and mixed-use lanes); public transport (city bus routes and stops, stops for other bus routes, regional bus station and multi-functional strips for buses and bikes); car traffic (main roads and other roads, mixed-used street areas, streets with calmed traffic, boulevards and crossings with traffic lights); and parking facilities (multi-storey car parks, carparks above and under ground, on-street parking and the possibility of secure bicycle parking). These parking facilities (in the form of large multi-storey car-parks) are located at strategically beneficial spots on the border of the area, with only limited underground parking facilities provided in the historical centre of the city (see Figure 4.5.3).

[14] a traffic calmed street or area, with a speed limit of 10 km/h and legal priority for pedestrians and cyclists

Figure 4.5.3
Transport plan



Special attention has been paid to traffic organisation by designing different areas: car-free or car-reduced zones and traffic-calmed streets. Speed reduction and traffic calming is guaranteed through the design of the road layout, especially on the Rybníková boulevard. This is achieved using elements recommended by previous research work undertaken at the Slovak University of Technology in Bratislava [STUBA; Bezák, 2004] – narrow lanes for cars, coloured and reflective separation lines, rumble strips on the road, rough paving, humps, longitudinal parking, etc. (see Figure 4.5.4).

Energy and material flows

The potential for energy saving in ECOCITY Trnava is enhanced through better thermal insulation and the use of alternative energy sources. Since there are no specific requirements for low energy houses/buildings in Slovak legislation and standards, the buildings were designed to fulfil the conventional values.

The ECOCITY will be supplied mainly through existing heat/energy networks and supplies (mainly central heating system, gas, oil and electricity). Due to the desire to keep a balance between existing supplies and new sources, renewable energy use represents only approximately 5%. In addition to solar energy (passive and active), heat pumps can be engaged, utilising waste heat from buildings and from the ground. Wood chips and wind power are also proposed to cover some of the energy demand, excluding the city core.

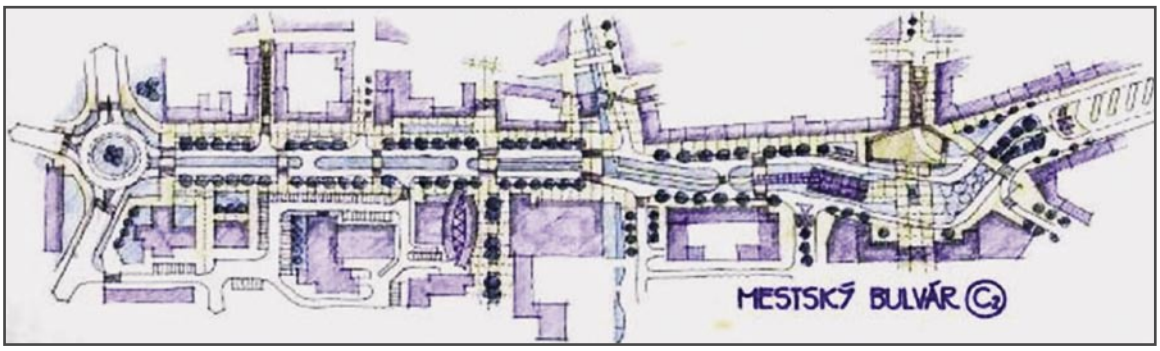


Figure 4.5.4
Traffic calmed boulevard

The possibilities for the application of ECOCITY energy principles in the historical part of the town are limited. Most of the buildings are on the national heritage list which means that the possibilities for improving their thermo-technical properties through additional insulation are minimal. Hence energy demand for heating remains very high in comparison to eco-building standards.
The introduction of natural components through urban 'bio-corridors' enables the integration of water and greenery into the city environment along the Trnavka stream and along Hornopotocna street. The basic water source for the new retention-ponds in the sugar-factory area will be the Trnavka. Rainwater from roofs and other sealed surfaces will be absorbed into the soil in planting areas, supporting the greenery. Recycling of used ('grey') water is proposed in the new buildings with the aid of local rainwater filters. It will be used where drinking-quality water is not required.

Socio-economy

In order to overcome the complex implementation problems of the ECOCITY, it will be necessary to involve all parties and for them to co-operate closely. The main stakeholders are the municipality, investors, citizens, landowners, entrepreneurs, developers, universities and the chambers of commerce. The creation of a public-private partnership could be a key for better co-operation between the above-mentioned partners. Consequently, it has the potential to solve many implementation problems. However, caution should be exercised. The practical implementation of the public-private partnerships is not easy, since hardly any such arrangements have yet been put into practice in Slovakia. It is thus necessary to gradually develop the culture of partnerships, especially between the municipality and the potential investors.
The concept of ECOCITY Trnava was created and discussed with the aim of benefiting the community of Trnava on different physical and psychological levels. These included the construction of new housing and urban renewal; the implementation of transport ideas such as the Rybníková boulevard, car-free areas and traffic calming; improved energy and waste concepts; and soil decontamination.
Two participation meetings were organised with focus groups (citizens from civic organisations, clubs, schools and representatives of NGOs) to inform them about the ECOCITY project and discuss how the citizens' values can be met in the project. Two further participation meetings were held with local councillors and civic administrators from the departments of environment, planning, transport and economic relations to discuss the inputs from the city strategy perspective as well as the strong and weak points of the ECOCITY scenarios. The ECOCITY Community Forum also commented on the scenarios during one of the participation meetings.

4.5.3 Project outcomes – key elements

In the design of ECOCITY Trnava, principles were used which aim to unify the central area of the city in the near future. Currently there are very different functions: the historic heart of the city, fields with under-utilised sport utilities, the university and the sugar factory (brownfield). These will all be connected by a road of regional importance (Rybníková), with the dimensions and character of a boulevard with social functions. The axes of water and greenery cross this road as well as some urban built elements.

Key element 1	Key element 2	Key element 3
Street as a connecting factor, not as a barrier	Reintroduction of water element into the public space	'Green' revitalisation of the historic city core
Rybníková street today is both a psychological and physical barrier with heavy transit transport, separating the historic city core and the new development areas of educational institutions, sports facilities and the sugar factory area to be redeveloped as a part of the ECOCITY project. Its proposed transformation into an urban street, or boulevard, with smooth but slow car transport (typically without lorries and transit traffic) creates conditions for street life, pedestrians and cyclists. Mixed use – services, shopping and culture – at ground level in buildings is provided near dwellings and workplaces to attract people.	Reintroducing and managing water in the public spaces and green areas prevents such negative impacts of urbanisation as soil contamination and local storm water floods. Water is retained in the urban area and used for landscape functions. The dysfunctional sedimentation basins of the old sugar factory will be transformed into three ponds to retain the rainwater. Combining greenery and linear water features creates bio-corridors connecting the city with its surroundings while the stream re-appearing in the medieval streets restores their historical image and improves their micro-climate.	The 'green' revitalisation of the historic city core not only emphasises the cultural values and conservation of the historical heritage, it also brings ecological values into the historic city fabric. This means more trees and green in the streets and courtyards, new parks, revitalisation of the stream, increased area of unsealed surfaces, more environmentally friendly buildings (also reconstructed ones) and last but not least calmed traffic with car reduction – to give the streets back to the people.

4.6. ECOCITY Tübingen - Derendingen

4.6.1 General information

The attractive university town of Tübingen is located in south-western Germany and faces a high demand for housing, especially to keep young families within the city and to offer housing for people who currently commute to Tübingen. An additional need for 6,000 dwellings by 2010 is predicted. At the same time, the settlement area in the region of Tübingen has grown enormously: by 137% from 1950 to 2000. Hence one of the main aims is to develop a strategy for resolving this conflict between the need for new settlement areas on the one hand and minimisation of land consumption and protection of surrounding environments on the other. Equally important is to define ecological requirements and demographic conditions for city expansion and to prevent urban sprawl by concentrating settlement areas around the existing railway lines and the stops of a planned new light rail service and close to the city centre.

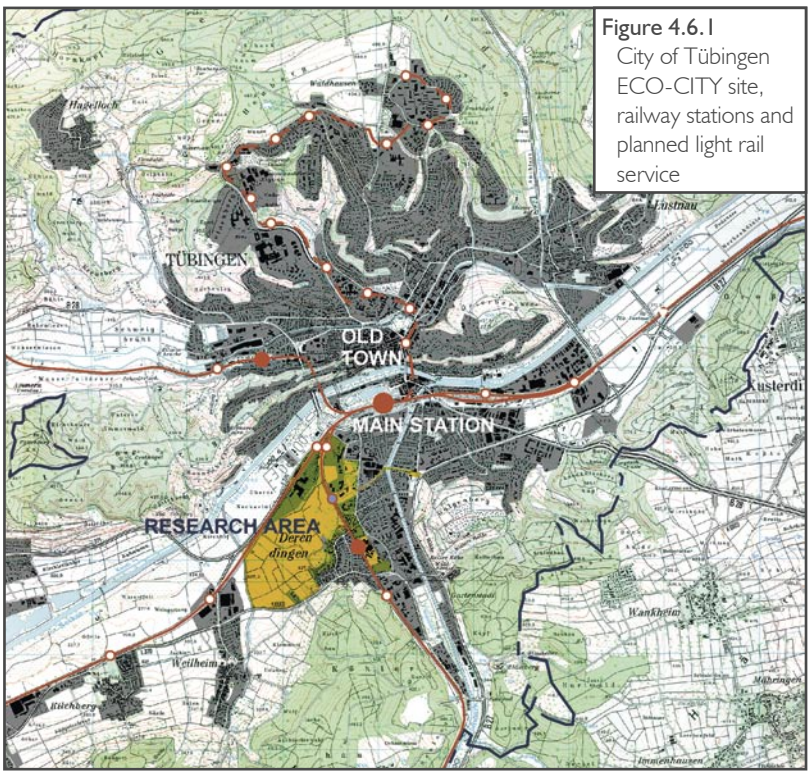


Figure 4.6.1
City of Tübingen ECO-CITY site, railway stations and planned light rail service

Additionally, the ECOCITY project should build on the experience gathered from the European best practice project, Tübingen-Südstadt, which won the European Urban and Regional Planning Award in 2002. The aim is to integrate the area's urban character, including mixed-use, high-density and car-reducing transport concepts, with transit-orientation and advanced landscape, water and energy concepts in order to create a new type of edge development.

4.6.2 Project description

A comprehensive citizen participation process began with a community planning conference before the design process commenced and resulted in vision plans and consensus points. This was the basis for the development of two scenarios with highly different approaches, which were discussed in a second workshop with local people and interest groups. This event identified extensive agreement between the general aims of the ECOCITY project and the wishes of the local citizens. It led to the final

Figure 4.6.2
Südstadt Development in Tübingen - Lorretto area

masterplan, which is conceived as an integrated overall concept with four implementation stages and modules which correspond to the diverse profiles of each part of the planning area. The ECOCITY site in Tübingen-Derendingen encompasses three different areas: a brownfield area, a densification area and a greenfield area.

Urban structure
The densification area of Mühlbachäcker in the north is linked to the central part of the greenfield and car-free Saiben area at the planned light rail stop by a dense and mixed-use building structure bridging the railway tracks. The courtyards to the south along an inner green zone connect the new quarter with the old village. A landscape sensitive housing scheme, oriented to maximise solar gains, completes the quarter at the western edge. The Saiben Village II extension in the south-western part of the ECOCITY site is linked to the old village centre of Derendingen. The brownfield development of the former Wurster and Dietz saw machine factory site next to a railway and light rail station is planned as a compact, high-density, mixed-use and commercial structure, with some existing buildings being maintained and the uncovering of a stream.

The Mühlbach stream represents an important landscape structure – a green spine connecting all the ECOCITY areas – and it will be diverted through the new Saiben quarter. The new western city edge, which contains traditional landscape elements such as orchard meadows and ecological infrastructure for water purification and infiltration, has been defined a city growth boundary, to prevent further expansion in the future. A city farm on the northern edge of the Saiben development should produce organic food in the adjacent green zone, which forms part of the star-shaped open-space structure of the entire city of Tübingen. The design of the public space has been developed especially for the demands of pedestrians and cyclists and is supported by water design. An attractive underpass crossing the railway, covered by a solar roof for weather protection, is located on an axis leading to the city centre and the Südstadt.

Urban climate issues have been considered and measures include keeping free the cold air exchange corridor north of Saiben Central and maintaining the green zone in the Mühlbachäcker area, which connects the western cold air source areas via the ECOCITY site with the city centre. These measures have been validated by an urban climate consultancy.
A sustainable water concept supporting attractive public spaces and taking account of the hydro-geological sensitivity of the greenfield area has been developed. The premise of this concept is to limit rainwater run-off to a level similar to that of an unsealed area, working towards a groundwater neutral city quarter. Therefore the amount of infiltration in the Saiben area should be increased by the infiltration of rainwater and purified grey water. These areas can also be used as attractive open spaces by the residents.

Transport
To minimise the use of motorised transport, the ECOCITY concept focused on public transport, cycling and walking facilities on the one hand and a sound mix of land use (housing, retail and services) on the other. The backbone of the transport concept for the planning areas is the development of a light rail line on the existing railway track, which is currently being planned as part of a region-

Figure 4.6.2:
Masterplan Tübingen

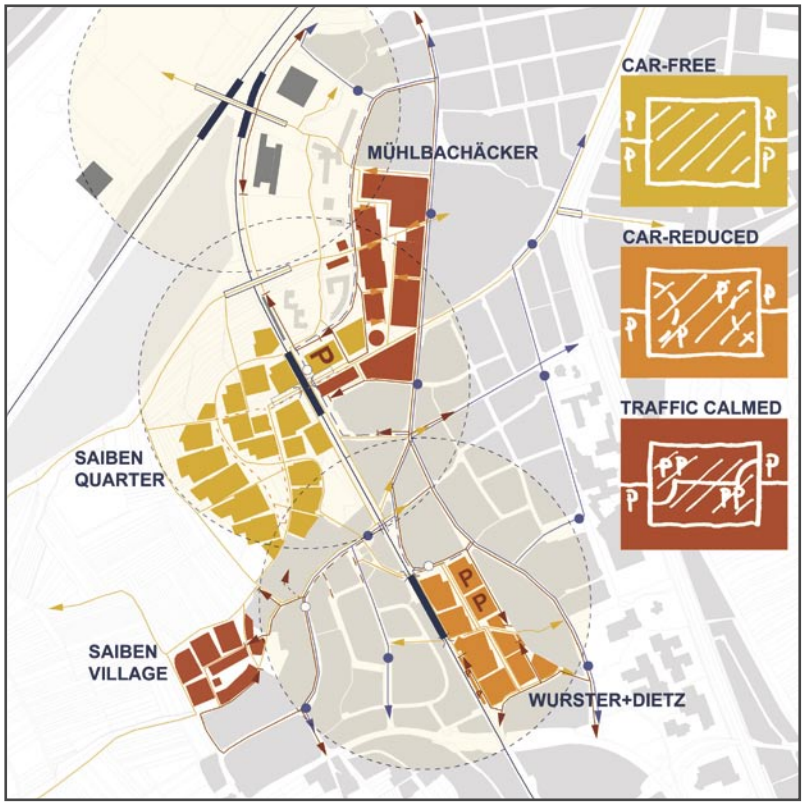


Figure 4.6.4
Transport classifications

wide network. However, to ensure successful implementation, the concept also makes provision for the public transport system being based around bus services.

Depending on the characteristics of the different planning areas and their location within the existing urban structure, the transport concepts applied range from traffic calming to car-reduction and car-free solutions. The disadvantage of the difficult access to the Saiben area via the railway tracks, for example, is turned into an advantage by planning for a car-free area and thus avoiding expensive infrastructure for access and circulation of ordinary motorised traffic. The main elements of a car-free neighbourhood are the minimisation of car-ownership by residents, a reduced supply of parking places and their location at a distance from the residential units which is similar to the distance from public transport stops. This infrastructure is supported by a range of different mobility services (delivery services, car club, good public transport information, reduced-cost season tickets, etc.). Teleworking is another measure of mobility management. Commuter trips are replaced by telecommunications that link the home workplace with the office network. An area office for teleworkers is planned in the Saiben Village II.

Car-reduced neighbourhoods offer slightly more parking spaces and the possibility to drive in and through the area, supported by a somewhat reduced service concept, while traffic calming concepts focus on speed reduction and more attractive streetscapes without restrictions on car ownership or parking spaces. In terms of sustainable development, a car-free transport environment generally offers most advantages, including occupying less land, minimised noise and air pollution and reduced distances travelled by car. Furthermore, this also facilitates higher quality urban and green space, enhanced function of roads as public spaces and safer transport. These criteria define a liveable environment, which today is still more often found outside the cities than within them, especially if the costs of housing are also considered. Urban quarters with reduced car traffic or none at all offer an adequate alternative to suburbanisation in the form of cost-effective housing in liveable environments.

Energy and material flows

An energy masterplan corresponding to the very advanced Swiss legal framework with adjusted energy concepts for high-efficiency or a high percentage of renewable energies was developed. This features an optimised urban structure bringing together south-facing buildings and energy-saving compactness, a high building standard, including a passive-house development at the edge of the Saiben area, and a high level of efficiency for systems such as mechanical ventilation and natural ventilation. The remaining energy demand will be covered by supply concepts with large proportions of renewable energies. The first priority for the Wurster and Dietz site is a district heating network based on wood chips. For the central part of the Saiben quarter a supply concept is proposed based on wood pellets and bio-oil generated directly in the Saiben landscape area or from sunflowers grown in the region. The proposed

building typologies show a high potential for the use of active solar energy, such as photovoltaic panels and thermal solar systems, in all areas.

Socio-economy

Striving for mixed-use concepts was a major goal in the socio-economic field. For each part of the area a special socio-economic profile has been developed. This profile follows from an analysis of the strengths and opportunities provided by the different areas. For example, as an attractor for the Saiben quarter an international school is proposed, located next to the planned light rail stop. Such an institution links to the strong academic background of Tübingen and would make the area more attractive to visiting researchers. A good accessibility of social infrastructure is ensured partly through proposed new facilities and partly by linking the new development with existing infrastructure in order to maximise the use of existing facilities. Differentiated profiles have been developed for the individual areas for mixed use with different qualities, meshes and ratios of use, including several residential housing typologies and facilities for elderly people, mixed tenure as well as special options for commercial uses.

Figure 4.6.5
ECOCITY vision Tübingen-Derendingen

4.6.3 Project outcomes - key elements

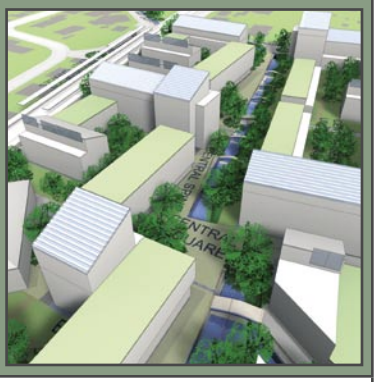
The location features a mixture of brownfield, inner city and greenfield development which allows the best accessibility of infrastructures for the daily urban activity patterns. The urban structure lends itself to a qualified density concept that combines very high density, high-quality public spaces, supported by water design, with fine-meshed mixed-use concepts and large amounts of green space and water treatment areas despite the high density. Thus urban comfort is expected to be high. The integrated planning process was characterised by a very early, complex and interactive integration of many disciplines and partners supported by a planning strategy including the development of comprehensive scenarios.

The transport concepts for the different areas maximise the opportunities offered by each one (e.g. existing infrastructure, existing and planned public transport services) to reduce motorised traffic and the associated negative impacts such as pollution, noise, risk of accidents, occupation of land and impact on the quality of public spaces. At the same time, accessibility is ensured by the provision of adequate spaces and networks for pedestrians and cyclists and the provision of delivery services and pick-up points (local logistics).

The built infrastructure for transport is supported and enhanced by a concept for mobility management to help ensure that people actually choose sustainable travel options in preference to their cars by making the former more attractive and accessible.

The urban structure is very energy-efficient regarding solar gains and compactness, The requirements of German building regulations are actually exceeded, with a large number of passive and 'three-

litre houses'. Furthermore, the supply strategy features district heating based on renewable energies, including innovative technologies. The greenhouse gas emissions are calculated to be low, with an improvement of one third compared to conventional settlements.
The environmental impact of the building materials is expected to be reduced by maintaining existing buildings and promoting the use of timber construction, healthy and life-cycle-optimised materials. Soil movement is minimised and the rainwater and wastewater management adheres to European best practice standards in this field.
The planned socio-economic structure of the area ensures great diversity. Different types of buildings allow for different prices and ownership and tenancy models. This makes an interesting and stimulating social mix possible and the high density means housing can be affordable. For financial reasons, the use of existing infrastructure was given priority over the construction of new infrastructure elements. There are a few special elements which justify the expenditure, as they also contribute to wider parts of the city. Even at the planning stage the ECOCITY is not seen as a separate settlement but as an integral part of the whole city, while still having its own identity. Mixed use serves two purposes: the commercial units often provide infrastructure for housing and small businesses, in particular, are much better off in a fine-meshed area than in an industrial estate.
Four implementation stages with defined population densities for the planning areas have been developed in relation to the expected socio-economic development of the city of Tübingen. The plan is to start with the Wurster and Dietz site with an urban planning competition in 2005 based on the ECOCITY guidelines.

Key element 1	Key element 2	Key element 3
Light rail stop, Saiben	New city edge, Saiben	Qualified density Wurster & Dietz
		
Public transport stop with attractive access to car-free area, mobility centre and concentrated building layouts. Attractive underpass under railway tracks on two levels, with solar roof for weather protection, water design and attached commercial properties. Mobility centre with light rail stop, car-sharing, bicycle parking and repair shop, solar roof and filling station for electric car fleet, community parking, neighbourhood logistics centre and retail outlets. Car-free area with urban block structure bridging the railway tracks. High density, mixed-use, including an international school as an attractor and a city farm.	Defined city growth boundary to prevent future extensions. Area contains ecological infrastructure. Landscape-oriented courtyards with passive-houses and service access for city logistics. City edge with traditional landscape elements such as orchard meadows, ecological infrastructure for water purification and infiltration and green zones for the residents such as playgrounds and garden plots.	Brownfield development with qualified high density and mixed use next to a tramstop/trainstation. High density, maintenance of existing buildings, high quality of public spaces supported by water design on the uncovered stream, fine-meshed mixed use and a car-reduction concept including centralised parking and a central inner spine with only temporary motor traffic. Solar orientation of urban blocks and district heating as well as extensive green and water treatment areas.

4.7 ECOCITY Umbertide

4.7.1 General information

The city of Umbertide is situated in the middle of the Alta Valle del Tevere, north of the Umbria Valley, and has a population of about 15,000. It lies on the River Tevere, 30km from Perugia to the south and 25km from Città di Castello to the north. The evolution of Umbertide started with the foundation of the ancient settlement of Pitulum above the river fort in the 3rd century BC. Through the 18th and 19th centuries, a hillside development evolved together with a planned settlement in the valley below. The railway of 1930 ensured further growth in the valley, followed by the first industrial structure with a 'workers' village' near the river.

Italy's transport policy of recent decades has focused on highway mobility and a fast national rail network to connect its major cities, thus weakening and marginalising local train communication. The railway services in and around Umbertide have subsequently declined and must be restored and extended to support sustainable means of transport for both passengers and goods. With the construction of the E45 highway (Perugia-Cesena), local industry recently relocated to be closer to more suitable infrastructure – thus making available a suitable location for a sustainable, residential development.

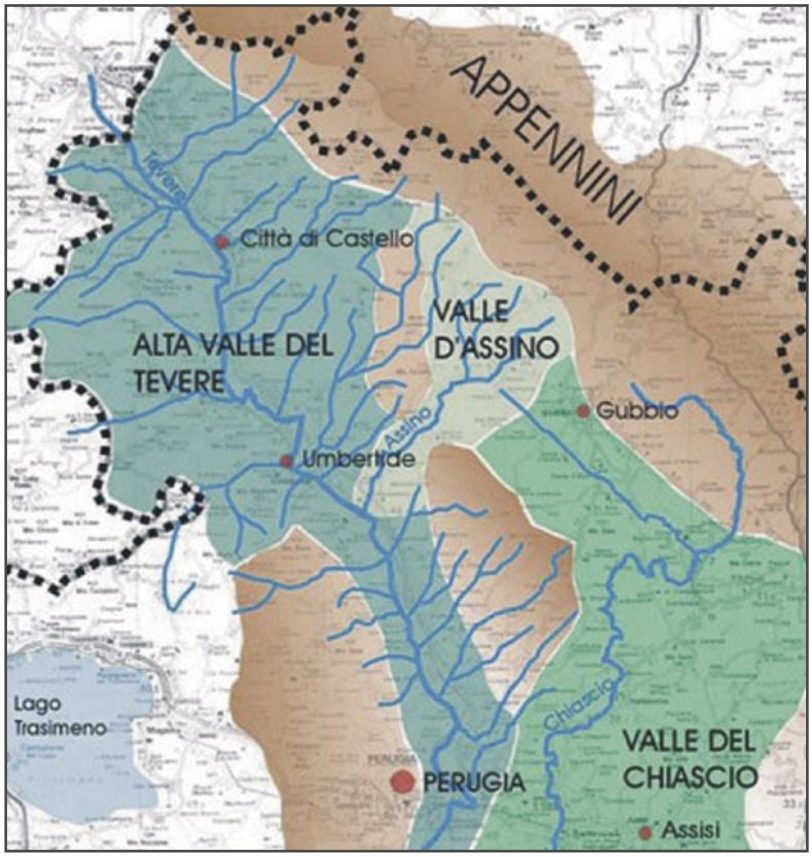


Figure 4.7.1
Umbrian orographic system

The sustainable structure of any urban or rural development needs a specific local economy to characterise and support it. The traditional cultivation of olive trees, wine, cereals and most importantly tobacco has formed the core of the local economy and its prosperity. Industry in Umbertide chiefly comprises small and medium-sized enterprises. These were established with the profits from agriculture and are oriented towards the production of specialised components, often linked to the cultivation, processing, distribution and storage of food. According to the 'Renewable Energies Campaign' promoted since the 1990s by the Umbertide municipality, the agricultural and industrial sectors have good potential for biomass and bio-energy production.

4.7.2 Project description

The general objectives and principles that have been applied in Umbertide are intended to prevent urban sprawl through a compact settlement that grows in an evolutionary urban process. The existing urban texture and building typologies are inspiring new urban planning which is climatically responsive. Furthermore the existing conventional transport structure is to be converted for alternative mobility within the 'urban comfort design' and integrated into a new sustainable regional and city light rail infrastructure.

The Italian ECOCITY partners, together with architects, planners and regional railway representatives, the Municipality of Umbertide and its community committee, organised several participatory workshops in order to select the main sustainability indicators. Through a community planning process (which included the citizens), the most important guidelines for the Umbertide ECOCITY project were also selected. The 35 workshop participants expressed their general consensus to the 'city as power station of renewable energies' followed by a progressive 'city for pedestrians, cyclists and public transport', a 'city of bioclimatic comfort' and a 'city of cultural identity and social diversity'. Their subsequent strategic choices were bioclimatic urban and building measures, biomass district heating, mixed land use and light rail implementation for passengers and goods.

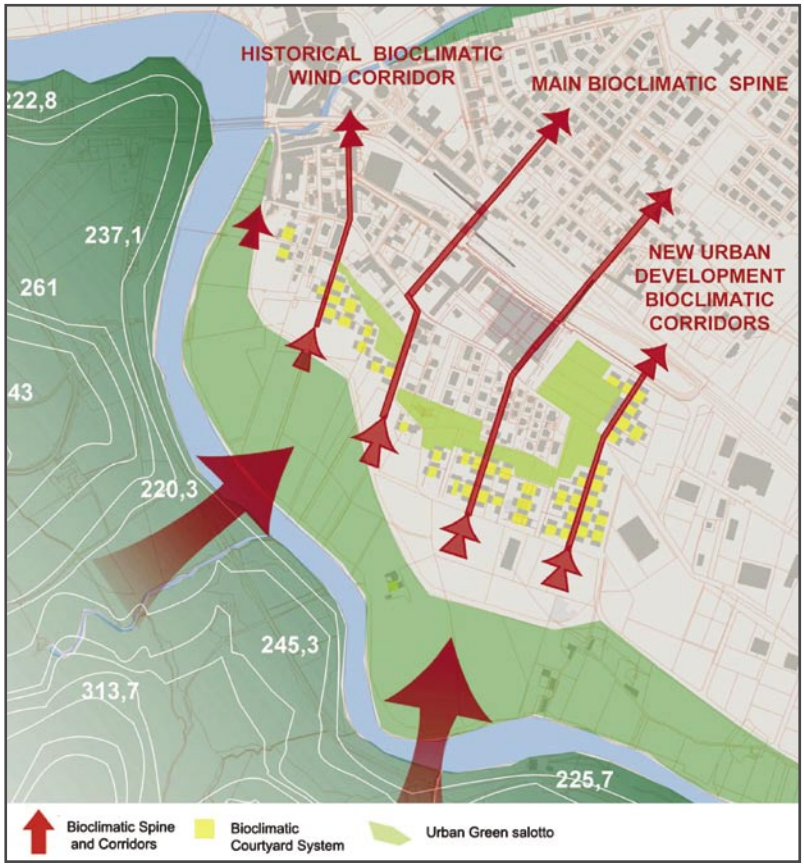


Figure 4.7.2
Microclimate and urban settlement

Urban structure

The landscape and the hydrological network is integrated into the urban project according to the same rules as both the historic and more recent rural elements, with water storage and irrigation in a closed cycle, natural green structures, canals and small lakes. Green areas, water and wind fill the city spaces, forming a continuous private and public network for the residents, from a natural green *salotto* (an outdoor living room) to more architecturally built-up squares and streets.

The site does not provide the most suitable microclimatic conditions so the ECOCITY project worked hard to gain maximum possible levels of comfort in the existing microclimate. The objective of well-being for the citizens results in the need to transform the area through a series of urban measures in order to achieve bioclimatic benefits, the mitigation of emissions and the control of air circulation and noise.

These aspects together make up 'urban comfort' and are defined as the principal motivation for urban design and for the new sustainable transport structure.

The first objective was to create the backbone of the urban structure in the form of the ventilation-oriented main axis, coming from the hillside across the river. This is in accordance with the existing city's structural orientation. Consequently, the principal bioclimatic spine tunnels the wind from the river park, from the south to the railway station and into the 9th-century city centre. The historical bioclimatic spine tunnels the wind from new urban area A to the ancient Borgo Minore. The other two remaining wind corridors run from area B through the existing roads of the 'workers' village' (the Molino), the former tobacco factory site and the modern city (see Figure 4.7.3).

The design of the urban texture comprises a system of buildings around a common external *corte* (courtyard) derived from the ancient Roman *domus* (typical Roman townhouse). There are three different building typologies: apartments, detached houses and terraced houses. Differences in the systems of construction, such as technological components, heights, density etc., depend on the specific microclimatic requirements of the location.

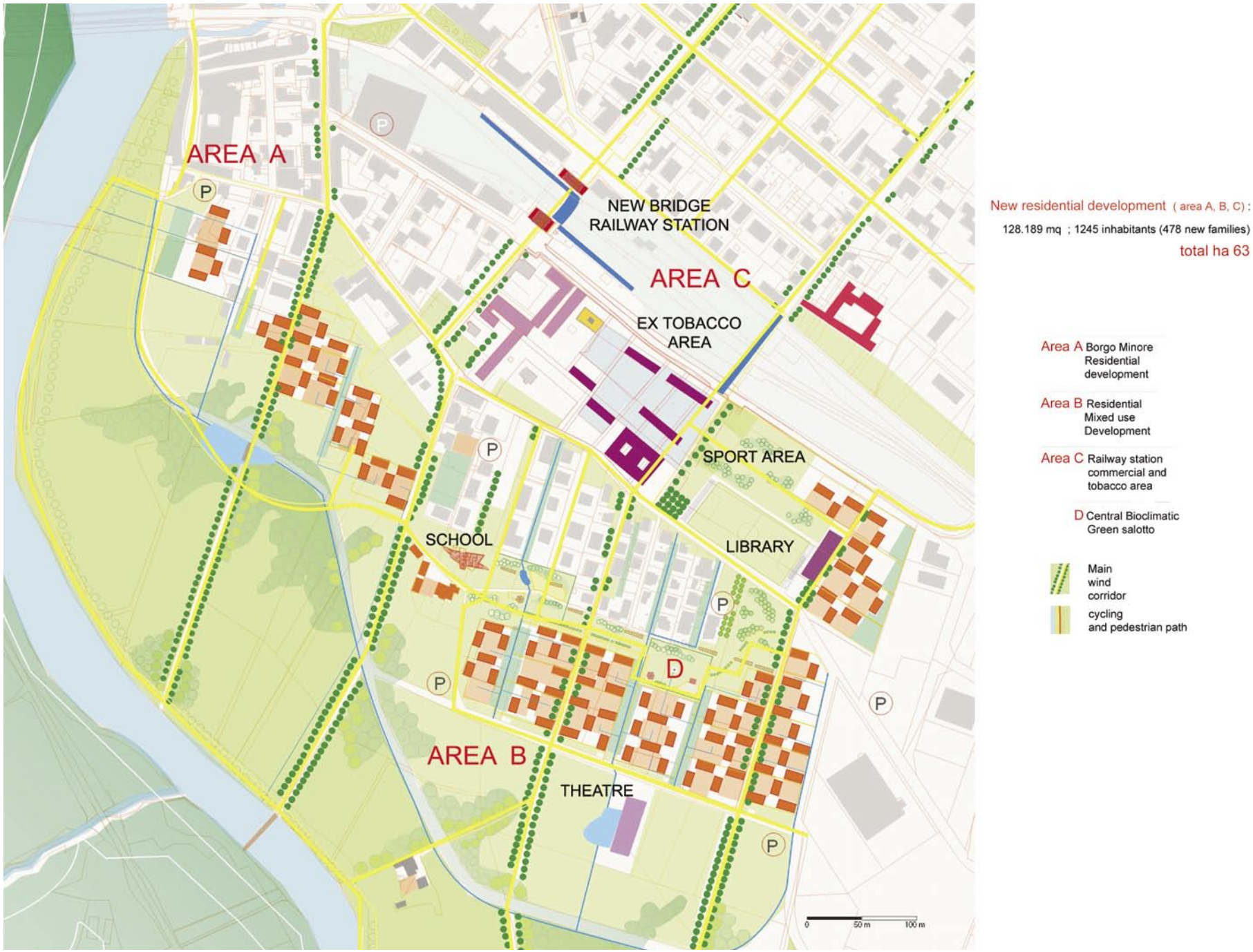


Figure 4.7.3:
Masterplan Umbertide

The new urban residential plan, integrated into the river park, respects the characteristics of the existing city with regard to density levels. Existing heights of buildings, numbers of flats, building typologies and district compactness are used as reference points for the continuing city evolution process. Furthermore, the interrelationships and boundaries between buildings, together with the geometrical shape and size of open spaces, has been optimised by using FLUENT software ('fluid-dynamic calculation simulation'). This allows levels of urban comfort and relative density to be regulated.

Business and public services will be mixed with residential functions. The first two are situated primarily on the ground floors of the buildings. They are centred around the principal points of the main bioclimatic axis, along the urban green *salotto*, the *atrium* buildings (see explanation below) or in the multifunctional open and covered areas of the renovated former tobacco factory.

The shape of the city and the landscape was originally formed by the geometry of the ancient Roman *centuriatio* (regular-meshed network of drainage and irrigation canals). The modern urban structure is also planned in accordance with the water system, relating to the collection, distribution and drainage of water. The River Tevere curves and meets the River Reggia, forming a critical flood point. Therefore the River Basin Authority prescribed urban extension limits.

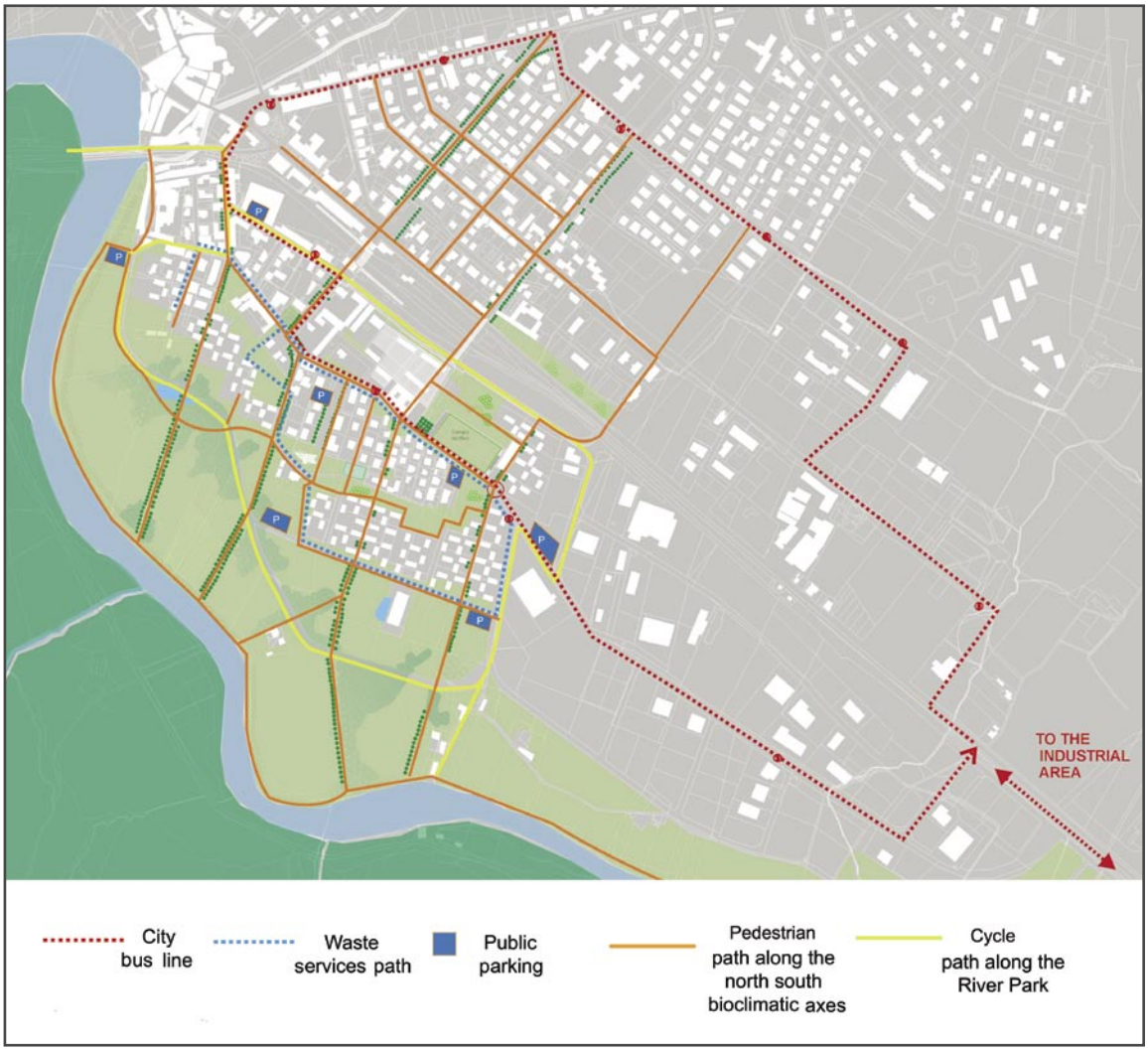


Figure 4.7.4
Umbertide: new mobility structure

From the urban grain the analysis continues to building typology, concentrating on the Italian *casa corte* (house with a central courtyard) as a local interpretation of the Roman *domus*. This type of structure articulates its buildings around two fundamental systems. The first is the *atrium*, a more architectural and defined space serving as a basin for rainwater storage. The second is the *peristilium*, a larger and more open space used as a vegetable garden. These systems not only represent the most appropriate response to more compact urban development in the high-density city, but also represent a more efficient bioclimatic mechanism. Even though the initial typology has been transformed during the past century into the 'middle class villa' and finally the 'upper class villa', the original concept and its fundamental characteristics are still intact.

Transport

The primary objective and principle for transport is the almost complete absence of cars. Unlike conventional urban planning, structured along roads for cars, the Umbertide ECOCITY project is organised according to bioclimatic wind tunnel axes, which are also used as footpaths and cycle paths and harmonised with the architecture of public, semi-public and private open spaces.

In collaboration with the railway company and the people of Umbertide, a plan was produced for the redesign of the existing, inefficient rail network to provide a new, efficient light railway, interconnected with the national rail network. In addition, a new railway station will be built in Umbertide.

In order to change the current modal split (80% of Umbertide citizens travel in private cars), a three-stage project was proposed, allowing a gradual transition to a 'long-term scenario'. By the final stage, private car use would be reduced to about 10% and journeys would instead be made by train (50%), other public transport (20%) and by bicycle or on foot (20%).

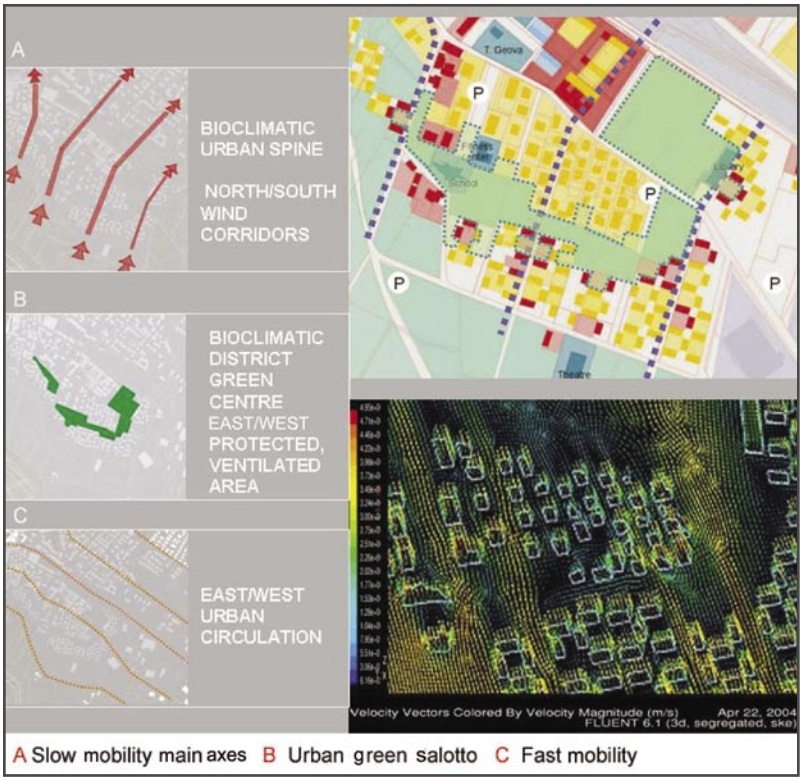


Figure 4.7.5
Mobility structure coherent with wind flows (ventilation)

Together with bioclimatic comfort, alternative mobility has become a prominent feature of the project. Different types of mobility can be identified, such as fast and slow modes, and there are other important divisions such as 'single-minded spaces' (spaces, such as large roads, that people pass through with a common purpose) or 'open-minded spaces' (spaces that are used for different purposes and that are not dominated by speed). The articulation of the fast, 'single-minded spaces' is organised along an external ring road, where bioclimatic efficiency is less important. The 'open-minded spaces' are made up of the alternation of the private and semi-public courtyards, the public square and the mixed-use locations as well as the 'urban green salotto' where comfort and aesthetic quality have been optimised. Here, far more attention was paid to details of construction, materials and bioclimatic efficiency (glare, orientation, sun protection, wind benefits etc.). They are organised along the north-south bioclimatic spine and the wind corridors between the buildings.

Energy and material flows

Umbertide has a Mediterranean temperate climate with rainy winters and hot summers. During the summer months, light breezes from the south, east and west enter the city from the surrounding hills, providing the buildings with natural air conditioning. During the remaining seasonal periods the prevalent wind direction veers between north and west.

The strategic choices made by the people of Umbertide in relation to energy direct the ECOCITY masterplan towards passive solar housing, high energy efficiency and the use of renewable energies. The most important priorities are: first, urban district heating and secondly, cooling features (including natural ones) for urban spaces and buildings.

The sustainable solar housing energy target was set in accordance with the Italian 'Casa Clima' certification concept. The proposed building typologies use a three-chimney scheme (two for air entry, and a convective loop system and one for air expulsion) which improves indoor comfort through natural ventilation, passive solar heating and cooling systems, optimising energy and bioclimatic efficiency. The remaining energy demand will be covered by a district heating network using the existing agricultural biomass produced and converted into wood pellets by local enterprises. The energy saving achieved is 75% and the CO_2 emission reduction is 73% compared to existing Italian building standards.

Figure 4.7.6
New building typologies

The demolition rubble, excavation material from the roads and gravel from the rivers will be used for landscaping, to construct playgrounds and as recycled materials for new buildings.
The water system follows the ancient urban grain: the small ponds, the canals and the rivers in the park represent the remnants of this natural water network. In the new residential settlement, the water cycle starts from rainwater collection in each central well and then flows into the private 'edible garden', along the pedestrian and cycle paths and enters the houses. It finally concludes with grey water and wastewater treatment and management in a closed cycle.

Socio-economy
Umbertide was originally a city of small and medium-sized industry surrounded by specialised agriculture. However, the relocation of some of this industry and the potential revitalisation and implementation of the railway produced a demand for housing and commercial space in the project area. The acquisition of the remaining building structures and property has awoken interest in creating an artisan commercial and mixed-used urban node along the railway and the main footpaths connecting the new district and the existing old city.
The railway station will become the central node of commercial and mobility interchange and will lead to new land use and enhanced building value. The ECOCITY project could increase the number of people available for employment in the planning area.
The conversion of the existing railway network into an efficient light rail line will create a new city centre. The new multifunctional 'bridge station' – with a carpark, two glass elevators, shops, an information centre and footpaths and cycle paths running from one part to the other – will function as a social and economic infrastructure between the entire city and the new quarter.
The 271,890 m^2 of the river park with the revitalised, rural organic farms, the existing 'workers' theatre' on the lake, a cultural centre and library and the playing field provide an attractive social and leisure infrastructure.
In accordance with the land-use and commercial, mixed-used structures of the northern part of the city, the new urban district locates its mixed-use commercial, services and communal facilities in the 'atrium courtyards' of the residential building blocks along the main bioclimatic spines. Furthermore, the primary school, the gym, the children's playground, the cafés, tea rooms, pizzerias and community centres will be situated along the controlled urban comfort area of the urban green 'salotto' as a connecting centre between the existing 'workers' village' and the new urban development.

4.7.3 Project outcomes – key elements

Key element 1	Key element 2	Key element 3
Holistic city organism	History, microclimate, urban and building typologies	Car-free area
The ECOCITY project represents a good opportunity for an 'ecological dialogue' between experts, local administrators and citizens. Attention to bioclimatic and transport issues increased collective awareness and some strategic choices could be made in a more innovative way. The innovative objective is an integrated approach to climatic and urban transport for a comprehensive, holistic city. The focus on urban comfort as a new planning culture concept will mean major changes to the urban planning discipline.	The site analysis originates from the 'studies for the city'. These studies recognise the city and surrounding area as a long-lived, holistic organism which is in a constant process of evolution, in relation to use, technology and form. The logical continuation of this philosophy, known as 'bio architecture' and 'urban ecology', forms the basis for the project. Hence, history, microclimate and urban grain and building typology are the main matrices for the ECOCITY-design. An innovation of the project is the FLUENT (fluid-dynamic calculation simulation) system applied for the first time to urban and building open spaces.	Unlike conventional urban planning (structured along roads for cars) the ECOCITY project is organised according to bioclimatic wind tunnel axes, which are also used as footpaths and cycle paths. Alternative mobility is the real core of the project; in fact it provides the main axis of the urban structure design for both pedestrian and cycling circulation and the architecture of public, semi-public and private open spaces. Alternative mobility becomes the fundamental framework, divided into fast and slow modes and including interrelationship aspects.

5 Results of the ECOCITY project: what did we learn?

This chapter presents the main conclusions of the ECOCITY project. The focus is on the assessment of the ECOCITY site concepts, as well as sectoral conclusions drawn by the different disciplines involved. In addition, obstacles and success factors for sustainable urban development will be discussed. They are based on the experiences of the ECOCITY partners during the planning of the site concepts.

5.1 ECOCITIES as a better place to live – visions and challenges

The idea of creating an ECOCITY is fascinating, yet also very complex. On the one hand, the ECOCITY vision (see Chapter 2), which served as a basis for planning the model settlements, contains appealing and very important concepts, such as maximising people's quality of life and living in harmony with the environment. On the other hand, the vision and the plans, by their very nature, contain some elements which to some may appear utopian. This makes it hard to predict whether and to what extent the plans will be implemented, although an implementation-oriented perspective was an explicit ECOCITY requirement. Nevertheless, such visionary ideas and concepts for greater sustainability (in urban development and elsewhere) are needed to provide inspiration and direction for the development of human society. As such, they play an important role in ensuring the healthy, diverse and balanced natural environment that is needed for the long-term survival and thriving of humankind.

The interesting variety of the ECOCITY model settlements in terms of their character, size and setting (see Table 5.1), as well as their situation in different climatic contexts (Scandinavian, Central European and Mediterranean), showed that putting the ECOCITY vision into practice does not depend on a particular location.

Table 5.1
Key characteristics of the seven ECOCITY model settlements

	Bad Ischl	Barcelona	Győr	Tampere	Trnava	Tübingen	Umbertide
Character of the site	Greenfield	Urban regeneration	Brownfield	Greenfield	Renewal of old town, brownfield	Greenfield and brownfield, urban densification	Greenfield and brownfield
Current inhabitants	10	2,200	0	30	2,500	4,000	900
Future inhabitants	2,100	1,790	11,650	13,400	3,000	3,300	1,350
Size of the community	14,000	1,500,000	130,000	200,000	70,000	85,000	15,000
Initiative for the project	Planners from outside	Inhabitants	Municipality	Municipality	No information available	Local planner with municipality	Planner from outside with municipality
Timing of planning	Initiated for ECOCITY project	Already begun before start of ECOCITY project	Already begun before start of ECOCITY project	Already begun before start of ECOCITY project	Initiated for ECOCITY project	Initiated for ECOCITY project	Initiated for ECOCITY project

With the exception of Bad Ischl, all of the sites were zoned for development and would eventually have been planned for, even in those cases where actual planning only began with the ECOCITY project. Thus, the contribution of the ECOCITY project was not so much initiating a planning process as significantly influencing this process by challenging accepted standards and providing fresh perspectives and inspiration for different solutions. In some cities, the ECOCITY ideas were directly integrated into the official municipal planning processes, while in others alternative plans were drawn up, which sparked new discussions and led to changes in the long run. Furthermore, several municipalities used the ECOCITY criteria as a basis for urban planning competitions and/or development guidelines and it is already foreseeable that some concepts will serve as reference or model cases at the local and regional level (e.g. Barcelona).

Overall, the ECOCITY project challenged the approaches to urban planning and development in all the municipalities involved, even in those cases where the ECOCITY site concept might not be implemented to its full extent. This challenge to established ideas was usually carried from the initiators to other key players, although everyone involved in the process at some point had to reflect on their usual approaches. Table 5.2 provides an overview of the main areas in which the ECOCITY approach stimulated rethinking or restructuring of existing processes, opinions and planning conditions.

Although all seven municipalities involved signed a declaration of intent to implement the ECOCITY concept once the planning had been concluded, their actual commitment varied, ranging from taking control of the ECOCITY site planning process to not getting involved in the project at all. There are also national differences regarding regulations concerning (sustainable) urban development. They vary, for example, with respect to the energy efficiency of new housing, the demand for the provision of private car parking facilities and the types of subsidies available to the public and private sectors for certain measures that aim to increase sustainability (such as public transport investment or innovative home heating systems). Where such requirements and options are more advanced, the aim was to ensure that the ECOCITY label was not used for a project which simply fulfilled the national norms, but only for those which achieve more than is already required by law. In the context of less advanced standards and requirements, the project was seen as an opportunity to show how ECOCITY standards can be reached within a planning culture that traditionally focuses on other values.

Table 5.2
ECOCITY challenges to local urban planning and development

Municipality	ECOCITY challenged…
Bad Ischl	• local policy makers and authorities to position themselves with regard to urban sprawl • the site owners
Barcelona	• the local planning system (⟶ spin-off effects for other local projects) • the original plans and the tendency to 'greenwash' conventional projects
Győr	• the local developers • the site owners
Tampere	• the planners and the jury in the urban planning competition • local policy makers and the administration
Trnava	• the municipal planning capacity • the local and regional budgets for urban planning • the site owner of the brownfield site
Tübingen	• the political decision makers (⟶ decisions on densification and greenfield consumption) • citizens and other stakeholders in participation workshops (⟶ consensus finding)
Umbertide	• planners, experts and policy makers • the local culture of urban planning

5.2 The ex ante assessment of the ECOCITY site concepts

5.2.1 Pre-implementation evaluation

The assessment of concepts for sustainable urban development in the framework of the ECOCITY project was an experiment. More usually, an evaluation is based on information about the implementation process and the behaviour of residents and users of a site e.g. the actual use of public transport and private cars, the functionality of the urban concept or job creation in the ECOCITY. However, in this project such aspects could not be evaluated, as the development activities concluded with the completion of the site concepts. Instead, the evaluation was a first step towards developing a practical tool for a quality assurance system, such as an 'eco-audit', that can be applied during the planning stages. The assessment focused on the planning process and the ECOCITY concepts and thus provides orientation on how far the ECOCITY objectives (see Chapter 2) have been achieved. The results are useful to point out strengths and weaknesses of a concept, to select the preferred scheme from different options and to derive tasks for consecutive planning stages.

By necessity, concept evaluations during the planning phase must be based partly on assumptions (e.g. in the case of the modal split). These are in turn usually based on comparable cases (e.g. a sustainable settlement in another region) or existing trends (e.g. the average use of private cars in the community or region in question). However, other issues, such as community involvement, can already be evaluated on both the concept and the realisation level at the end of the planning phase.

5.2.2 Evaluation tools

CRITERIA and indicators	
URBAN STRUCTURE	**ENERGY/MATERIAL FLOWS**
Building density Location of settlement Mix of uses Public spaces Landscaped area Urban comfort Integrated planning	Energy efficiency Energy demand Greenhouse gas emissions Building materials Soil movement Water management
TRANSPORT	**SOCIO-ECONOMY**
Infrastructure provision Modal split and CO_2 Accessibility User friendliness Quietness Provision of parking spaces	Community involvement Social infrastructure and mix Economic infrastructure Labour-related issues (employment) Profitability (costs)

Table 5.3
The core criteria and indicators for the ECOCITY evaluation scheme

The core criteria and indicators for the ECOCITY evaluation scheme were selected for the ex ante evaluation to provide direction regarding sustainable urban development (see Table 5.3) according to the main ECOCITY objectives (see Chapter 2). Further information on how these indicators were assessed can be found in the ECOCITY Book II.

The ECOCITY experience showed that some indicators (such as building density or community involvement) were easier to evaluate than others (such as modal split or profitability – again see ECOCITY Book II for more information on these issues). However, ongoing evaluation right from the start of a project is important, as it helps to develop overall planning objectives and priorities

depending on the regional context. In addition, it allows regional improvements to be identified later on. Furthermore, periodic evaluation and monitoring during the planning process is a precondition for the establishment of a quality assurance system like the European Eco-Management and Audit Scheme (EMAS). However, to allow such an ongoing evaluation of the entire planning process and implementation, the ECOCITY evaluation scheme would have to be adapted to apply to all relevant stages of a project. As the current scheme was designed for evaluation at the end of the planning phase, this would require an adjustment of the current indicators as well as the development of new ones.

Further development of the indicators will need to review their significance, calibrate the benchmarks that were chosen and find ways of rationalising the collection and analysis of data. The following measures could help to attain this goal:

- Define clearly from the beginning the specific data needed for each indicator to reduce the need for gathering data after planning is completed
- Reduce the number of indicators (but without leaving out important aspects of sustainable urban development)
- Make the indicators more robust by reviewing the benchmarks

5.2.3 Results of the evaluation

A crucial problem for the evaluation of the ECOCITY project was information gathering with regard to the concepts and the planning processes. Due to the fact that there was no independent institution to carry out the evaluation ('outside evaluation'), this had to be done by the ECOCITY partners themselves ('internal evaluation'). Involved in this process were, among others, public planners and administrators, participation experts, urban planners, architects, citizens, research institutes and universities. Furthermore, since the evaluation scheme could only be developed *during* the course of the project, the exact data requirement for the evaluation was not known before the end of the planning stage. This presented additional difficulties for the collection of some data. As a consequence, the data provided was somewhat heterogeneous and partially incomplete.

[15] More information on the evaluation process can be found in ECOCITY Book II - How to make it happen' and in the ECOCITY project deliverable 12 on the project website.

Detailing the outcome of the ECOCITY evaluation process for every indicator and explaining the implications of these results would go beyond the remit of this book[15]. Hence, for reasons of simplicity, only the main strengths and weaknesses of the individual concepts are summarised at this point (Table 5.4[16]), without striving for an in-depth discussion or a comparative evaluation. These strengths and weaknesses need to be seen against the background of the individual site concepts and planning processes. Therefore, the number of points highlighted does not necessarily indicate the general quality of a project as, first of all, the respective points differ in their relative importance and, secondly, the possibility cannot be precluded that certain strengths or weaknesses were not detected due to lack of information.

[16] Table 5.4 is based on the input from the sectoral evaluation groups. It covers the fields of urban planning, transport, energy, material flows and socio-economy.

	Strengths	Weaknesses
Bad Ischl	• high ratio of solar-oriented buildings • new sub-centre with exceptionally high density (⟶ decentralised concentration) • good provision for non-motorised modes of mobility • use of a centralised carpark as a noise barrier against highway traffic • high level of thermal insulation • heating energy produced from renewables • detailed concept for local building materials, soil excavation and water management • short distances and infrastructure to supply daily needs and more	• too 'visionary' (⟶ can create implementation problems) • based on planning team's proposal for a new light rail line (⟶ good idea, but implementation is uncertain) • poor community involvement undermined the holistic planning approach • the ECOCITY area differs enormously from the surrounding built area
Barcelona	• holistic planning approach with extensive community involvement • urban renewal project with high density and good access to the local infrastructure • preservation of existing green structures • high level of ecologically sound urban comfort • well-developed social concept (local community remains intact) • improvement of the existing urban structure • detailed plan for demolition, re-use and recycling of existing buildings • innovative concept for water management: analysis and optimisation of existing water cycle; green area management; grey water recycling; visitor centre	• location is not very suitable for cycling (⟶ topography; infrastructure) • local pre-ECOCITY participation process requires standard levels of car-parking provision
Győr	• brownfield project in attractive location (⟶ close to the city centre, green spaces and the river) • building density above average • efficient use of road infrastructure • mixed-use area as extension of the city centre	• too much provision for car parking, even in car-free areas • poor concept for building materials, soil excavation and water management • missing hierarchies with regard to streets and public spaces
Tampere	• short distances to green spaces • preservation of bio-diversity and integration of nature into the urban concept (⟶ 'garden city') • consideration of climatic conditions (⟶ cold air pools, areas of shade, wind protection) • good public service concept • architectural competition • light rail system already discussed by policy makers • centralised co-generation system • good level of thermal insulation • broad public discussion of the project • analysis and protection of natural water cycle	• too implementation-focused (⟶ quality problems) • poor location of the settlement (too far away from the existing city) resulting in e.g. urban sprawl and traffic problems • low density ⟶ urban sprawl • poor quality of community involvement • too much infrastructure for individual car traffic and insufficient public transport accessibility

Table 5.4
Strengths and weaknesses of the individual site concepts and planning processes (Pt. 1)

	Strengths	Weaknesses
Trnava	• favourable location in the historic city centre / brownfield development close to the city centre with the intention to build new green zones • two main pedestrian axes which are related to the existing structures • good existing share of public transport to build on • adaptation and re-use of existing (factory) buildings and (water treatment) plants • revitalisation of streams taking into account historic water management systems	• sugar factory area: character of the new settlement structure rather unstructured and dispersed with partial low densities • low ratio of solar-oriented buildings • too much car-parking provision
Tübingen	• holistic planning approach including extensive participation • mixture of brownfield, greenfield and partial urban renewal close to the city centre • combination of high density with high-quality landscaping, public spaces and water design • reduction of energy consumption through an energy-efficient urban structure and the use of renewable energy systems • settlement location and an ambitious mobility concept support car-free life-styles • detailed concept for building materials, soil excavation and water management (innovative: grey water purification in densely populated area)	• partly reliant on a light rail line planned for the region (⟶ good idea, but implementation is uncertain)
Umbertide	• mixture of brownfield, greenfield and partial urban renewal close to the city centre and the railway station • ambitious renewable energy system (heating energy) • application of advanced planning tools for urban comfort resulted in green corridors and bioclimatic building typologies • clear hierarchy of public spaces • goal of car-free area ambitious in local context • natural cooling system • comprehensive community involvement • takes into account the natural water cycle and historic water management systems	• method of implementation of car-free concept in stages is not clear • only medium density due to wide green areas and wind corridors

Table 5.4
Strengths and weaknesses of the individual site concepts and planning processes (Pt. 2)

5.3 Sectoral conclusions

The following sections present the main conclusions of the ECOCITY project from the perspective of the leading disciplines involved in the planning process as well as the evaluation of the site concepts. Many confirm the original working hypotheses, some were results of the research. These conclusions constitute the basis of the 'Guidelines'[17]. The focus is on urban planning, transport, energy, material flows and socio-economy.

5.3.1 Urban planning

[17] See also Chapter 3 of Book II.

The first step towards an ECOCITY neighbourhood is the selection of a suitable location. The site in question should have a high potential for having an appropriate social, cultural and economic infrastructure and workplaces nearby. The guiding theme for urban planners in this context is accessibility. This means that shops for daily needs, schools, nursery schools, services, jobs, leisure activities, etc. must either be located within the site itself or in the direct surroundings and that, ideally,

the site should fit within a polycentric urban structure. If the inhabitants need to commute or travel, they should be able to rely on environmentally-friendly transport modes. A special focus should be on rail transport, which normally corresponds to an urban development that is oriented along axes.
Another guiding theme for ECOCITY planners is the responsible use of land in order to prevent urban sprawl. The ECOCITY project came to the conclusion that the selection of the site must take account of internal city developments, as well as the existing or planned public transport infrastructure. Generally, well-located, brownfield projects and inner city development must be given priority. However, greenfield projects may be justified if the demand for new housing cannot be satisfied within the city area and if it is combined with high-quality cycle routes, a high-quality public transport system and clearly defined ecological and social objectives.

Dense and compact housing structures are an important tool in creating an ECOCITY, as they reduce land consumption, lead to shorter walking distances, facilitate good public transport provision, are a precondition for economically feasible district heating systems, promote social interaction and reduce the cost of infrastructure provision. As achievable densities are dependent on use, location, social and cultural factors and climate conditions, the ECOCITY case studies exhibit a range of densities, most of which can be labelled 'high density' in the local context. Hence the recommendation is to strive for an adjusted building density which takes the local settings into account. The objective is to find an ecologically, economically and socially acceptable density level – a so-called 'qualified density' – which combines building layouts with an energy-efficient urban structure, an adequate amount of landscaped areas and sustainable technologies (e.g. the use of solar energy).

Another core issue of sustainable urban development is to create settlement structures which are suitable for a mix of different uses. This means bringing living and working together again and planning for a great variety of functions, including the cultural and economic infrastructure, in order to avoid the disadvantages of a segregated city. In the case of the ECOCITY project, functionally diverse structures played a major role in almost all the case studies. The ECOCITY case studies feature different sizes of mixed-use areas with a range of ratios for residential and other uses. Furthermore, they include fine-meshed structures with mixed use on the floor, building[18] or block level.
With regard to green areas within the ECOCITIES, it was possible to achieve good results even in densely built settlements. In addition to areas with natural vegetation, the creation of areas of water, the planting of trees along streets, as well as the greening of roofs, terraces and façades were used as tools to bring nature back into the town. The majority of the site concepts also ensured proximity and accessibility of larger green areas for social activities (e.g. sports or recreation), which helps to reduce transport demand. However, these goals are more difficult to achieve in city centres and historical cores. Due to the hot climate, the ECOCITY concepts in southern Europe favoured urban forms which were more compact and had greater contrasts between built-up and outdoor green areas. In the northern countries, on the other hand, there is a higher degree of greenery infiltration into the housing areas. New approaches in this field were the reconstruction of landscape in brownfield areas and the integration of urban agriculture into the ECOCITY concepts.

[18] Mixed use on the building level refers to combinations such as shops or other commercial uses on the ground floor, offices on the middle floors and residential housing on the upper floors..

The public spaces of the ECOCITY concepts were of a very high quality compared to conventional projects which do not consider these elements as crucial. The ECOCITY planners recommend striving for public spaces with a high amenity value (e.g. supported by water features) and great variety (e.g. in size, use and spatial sequences). Community involvement during the planning phase and ex post evaluations are important issues to ensure public acceptance and attractive solutions. Depending on

the geographical location of the sites, the ECOCITY projects took into account elements such as wind protection and exposure to the sun in winter as well as sun protection and natural ventilation in summer, to provide maximum urban comfort.

5.3.2 Transport

Transport provision for an ECOCITY neighbourhood is very much related to the transportation system and the transport culture which already exists in the town and region. At a neighbourhood level especially, the majority of journeys people make will go out of, into or through the area rather than being trips within it. This should be less true in an ECOCITY, due to a better mix of uses and provision for daily needs. Nevertheless, most travellers will depend on transport services and infrastructure which cannot be influenced directly during the planning process of the ECOCITY. Therefore, it is very important that the transport concept for an ECOCITY builds on the strength of the existing services and facilities, while simultaneously attempting to improve the shortfalls. By doing this, it can also provide stimulation for the city or the region as a whole.

As far as the site planning of the seven ECOCITY cases is concerned, the concepts for the transportation of people and goods were partly centred on rail-based public transport and partly on improved bus facilities. They included proposals for car-free and car-reduced living, but also conventional provision for individual motorised transport, coupled with attractive facilities for non-motorised modes. In some cases, neighbourhood logistics concepts for local collections and deliveries were also considered. Improved provision of information on transport options and combined offers, for example for car-sharing clubs and public transport season tickets, were proposed in some schemes.

At the same time it became very clear that each new concept, such as car-free housing or better facilities for cyclists, must be adapted to local conditions and cannot simply be implemented without considering them. In all cases, the ECOCITY transport concepts represent an improvement on the conventional scenarios typical for the area. However, since these differ widely, the absolute levels of sustainability achieved are also very different. From an ECOCITY perspective, the focus on provision for the private car was still too strong in some cases.

Both the planning and the evaluation processes furthermore showed that in an international context the terminology used both for different transport concepts and also for the actual infrastructure and services differs quite widely. The term 'car-free', for example, is associated by some planners with an area which allows no access to cars, while others describe it as a development that actively supports lifestyles which are less reliant on car use and ownership. In addition, it was found that there are very few tested methodologies for the ex ante evaluation of the sustainability aspects of transport schemes. Those that do exist are based on assumptions that are very much related to the context in which these tools have been developed. Hence, it was difficult to adapt them to the specific planning process of an ECOCITY in general and the different ECOCITY sites in particular.

Along with a lack of commonly accepted methodologies came the problem of a lack of benchmarks. There are many national and international guidelines on CO_2 and noise emissions, but it is almost impossible to find benchmarks for 'sustainable levels' of parking provision, bicycle infrastructure or bus services. One reason for this lack is partly that the sustainability of a transport system depends on how it is used, which is influenced by more factors than the provision of infrastructure.

5.3.3 Energy

The concepts for the seven ECOCITY sites provide improvements to the local energy infrastructure. If implemented they will help to reduce energy demand and consumption in the ECOCITY areas. However, most of the concepts rely on new energy supply systems and an upgrading of the existing

systems was rarely taken into consideration. This is a reasonable approach if the existing systems do not support renewable energy solutions, but it should be kept in mind that new systems may be expensive and therefore not economically sustainable.

A weak point with regard to some projects was the lack of integration of energy-related aspects into the different planning and design phases. As a result, the energy supply chains are sometimes quite weak. The outcome of the ECOCITY project emphasises the fact that a sustainable energy infrastructure requires an optimisation[19] of the urban structure, for example with regard to population density or building orientation.

Small-scale co-production systems (co-generated heat and power) based on renewable energy sources (wood residuals, wood chips and sawdust) were not included in any of the site concepts, except for Bad Ischl. In addition, high costs are a problem with regard to electricity produced by photovoltaic means or wind power, which requires additional back-up systems for periods without sunshine or wind. In these cases, back-up electricity is usually provided by the national electricity grid and this originates predominantly from non-renewable energy sources (nuclear power, oil, gas and coal). The use of renewable energy sources seems to be dependent on governmental or other subsidies, which highlights the importance of renewable energy initiatives. Conversely, however, this dependency calls into question whether sustainable energy supply systems would be built without subsidies or legal requirements.

[19] In the context of sustainable development, optimisation should be understood as an ongoing process and not as a static concept. Furthermore, optimal solutions are contextual, which means they take the local situation into account.

5.3.4 Material flows

The issue of material flows has to be integrated right from the start into the development of an ECOCITY. The reason for this is the fact that key decisions taken at an early stage of the planning process (e.g. the location or dimension of the project) have a decisive influence on the need for materials and the generation of waste products, both of which should be optimised to attain a high level of sustainability. Once the basic project parameters are set, a more detailed estimate of major material flows follows (e.g. building materials[20], construction waste including excavated soil, as well as drinking water and wastewater).

The results of the ECOCITY project highlight the importance of the local context with regard to water management (e.g. the availability of water and climate conditions). Only if adequate information about the regional water demand, the natural water cycle (including ground water), as well as grey and black water systems is available, can effective and sustainable solutions be developed. In order to reduce the demand for drinking water, the seven site concepts focus on measures such as rainwater collection, water-saving installations, grey water systems and green area management. The prevention of water pollution was also high on the agenda of the planning processes.

Excavated soil is one of the most important material flows in urban development. Therefore the seven ECOCITY concepts include quantitative information about excavated and refilled areas. In addition, intended measures for the re-use of soil are listed (refilling, concrete aggregates, noise barriers, playgrounds and landscaping). Some planners revised the provision of basement areas, which reduced the amount of excavated soil and building materials in general. In the case of the ECOCITY project, all site concepts include measures to reduce demand for new building materials. Thus, the concepts envisage the following measures: re-use or recycling of existing buildings on the site, development of compact settlement structures, reduction of basement areas, reduction of driving surfaces (e.g. roads and parking areas), use of lightweight construction and re-use of excavated soil (gravel and stone). Furthermore, the concepts emphasise the use of eco-friendly building materials (renewable materials, recycled materials and local/regional materials).

[20] It is important to note that the primary energy demand of construction materials is not an important indicator for the total energy consumption of buildings, as most of the energy demand from urban households is for heating, air conditioning and personal transport.

5.3.5 Socio-economy

From the social perspective, sustainable development requires the satisfaction of people's basic needs (such as food, shelter, access to education and the labour market, cultural activities and entertainment), as well as care for people in need, promotion of mental well-being and community feeling, and good governance (e.g. democracy, community involvement and aiming for consensus). With regard to the economic sector, sustainable development requires a diversified and crisis-resistant local economy with a high level of productivity and innovation. The latter presumes a high quality of education, research and development, as well as economically viable small and medium-sized enterprises. As in other fields, awareness of issues related to sustainable development is also a crucial factor in the socio-economic sphere.

With regard to community involvement, major differences were found between the seven planning processes. As far as the content of the concepts is concerned, all the case studies claim that their social infrastructure and social mix is above the local average and they accept the need to establish settlement structures which are suitable for mixed use. Likewise, the creation of local jobs has been on the agenda for all the projects. Concerning the profitability of the ECOCITIES, there was unanimity among the partners that it was difficult to provide concrete figures.

The results of the project underline the fact that, as with any other city or part of a city, the ECOCITY has to be a compromise between different values and interests. It should not be left to professional and academic experts to find a good compromise, as the result is most likely to be a technocratic solution, which is implemented in a top-down manner. In the end, it is the inhabitants who have to live there and it is they who have to feel comfortable. This demands a certain degree of humility on the part of urban planners and other sectoral experts. Their task is to provide information and develop alternatives, which will then allow current or future inhabitants to discuss and make decisions about the project. In most cases this approach will lead to a modification of the suggested plan. The final decisions must be taken on the political level, thus, policy makers should also participate in the process and discussions right from the start.

From a socio-economic point of view, the different technical and socio-economic criteria are not an end in themselves. There are usually good reasons for their implementation, but only if they are understood and accepted by policy makers and the public will they lead to the desired results. On the other hand, if the importance of sustainable development cannot be communicated properly and there is no public support for a certain approach or solution, then there is no chance of a successful realisation and the outcome will not be an ECOCITY.

Another crucial point which is often neglected is economic considerations connected to urban sustainable development. Like community involvement, financial aspects and the creation of new jobs are a reality check for the project. This highlights the difference between utopian visions and urban planning which aims for the realisation of a project. However, due to the complex interrelationship between urban and economic developments, as well as rapid economic changes, it is not possible to find a durable mix of uses. Instead a high capacity for change is essential. Furthermore, what seems to be an excellent mix or a future-proof economic sector today may turn out to be a dead-end street tomorrow. Therefore, economic and social structures in an ECOCITY must be flexible and comprise the potential for change.

5.4 Obstacles and success factors for urban sustainable development

During the planning phase of the seven site concepts, the ECOCITY partners faced a number of obstacles which delayed or hindered the development of the envisioned ECOCITY. At the same time, they also encountered several factors which affected the ECOCITY planning process positively. The principal obstacles and success factors are further elaborated in the following sections. It is important to note that in all cases obstacles and success factors were experienced simultaneously. The resulting combination and the possible dominance of one over the other depended on the individual circumstances of the particular plan.

It should also be noted that legal requirements were explicitly not classified in this context. In general, they can be both obstacles and success factors for urban sustainable development. The existence of conventional building regulations (e.g. demands for the provision of parking spaces) may aggravate the implementation of ECOCITY ideas (e.g. car-free areas and lifestyles). National laws, such as building and land-use legislation, are a powerful tool of environmental and social policy. If they are wisely applied, they can help to enhance the level of sustainability. However, since these requirements differed so widely between the different sites, a general summary of their effect could not be made.

5.4.1 Obstacles for urban sustainable development

The ECOCITY concept is a new paradigm in the field of urban planning. As it challenges traditional planning principles and questions conventional behaviour it is often met with scepticism or even resistance. Thus it is interesting to take a closer look at the obstacles to urban sustainable development which were experienced during the site-planning phase of the ECOCITY project. It should be noted that these may be relevant in the creation of new urban quarters as well as in adapting existing quarters (except where otherwise stated):

- The idea of and need for sustainable development and the values connected to it are not sufficiently discussed as far as the wider public is concerned. Therefore ECOCITY projects are confronted with a lack of understanding from policy makers, planners and citizens alike.
- There is often suspicion from policy makers and planners towards the ECOCITY concept, as urban sustainable development is closely connected to alternative ways of decision-making (e.g. community involvement), the implementation of new technologies (e.g. pilot projects for grey water treatment or energy generation) and new organisational solutions (e.g. multiple use). This means a loss of influence for traditional actors and often leads to the fear of additional costs.
- An important precondition for the realisation of an ECOCITY is the availability of land or at least the cooperation of the landowners with the project. Another requirement is that the areas under consideration are situated in such a way that they comply with the principle of efficient and economic land use and that they can easily be connected to good quality public transport networks. These demands cannot always be fully met.
- Urban sustainable development is based on a holistic way of thinking and acting. This integrative approach is often inhibited by fragmented administrative structures, political rivalries and a disregard for citizen expertise[21]. Thus an ECOCITY project can fail due to a lack of commitment to cooperation or the inability to understand the issues or the role of other parties involved. Holistic planning is demanding and labour-intensive and thus not popular among all actors.

[21] For further information concerning the concept of ‚citizen expertise' see Saaristo (2000).

- The ECOCITY idea can only be put into practice if policy makers, planners and investors accept the paradigm of sustainable development and are willing to promote and, if necessary, even defend it. At worst, the ECOCITY becomes an issue of party political disputes, which can result in a loss of governmental and non-governmental support.
- Even though an ECOCITY is generally planned as a large entity which is intended to be implemented on a much smaller scale, as a well-organised cluster of small projects, with a large group of investors extending right down to individual home-owners, there can be local resistance to what is perceived to be one major project.
- The initial investment costs for urban sustainable development are higher compared to conventional projects, and break-even points will only be reached in the medium or long term (through low running costs due to efficient operation with reduced need for maintenance). This may scare off potential investors, although the life-cost balance is clearly in favour of ECOCITY concepts. Other benefits of an ECOCITY, such as lower emissions or a better quality of living, are non-calculable items and hence often disregarded by economic and financing experts.
- The ECOCITY is no self-sufficient island of bliss, which means that it needs to be embedded in existing structures (e.g. roads, water supply and sewage systems and food production chains). Consequently, some results of urban sustainable development may be blurred or even neutralised, while other factors are outside the sphere of influence of urban planners.
- The ECOCITY concept can also fail due to a lack of commitment on the part of the citizens. The fear of additional costs or a loss of wealth and comfort may bring the project to an end. In some cases it is not clear who the future inhabitants of an area will be. On the other hand, it is possible that the demands of the inhabitants concerning the ECOCITY are too high or too conflicting to be realised, which may discredit the project and leave it without support.
- Many benefits of urban sustainable development will only be recognisable in the medium or long term, while on a short-term basis similar ecological costs are generated as in the case of conventional approaches (e.g. land use, building materials and additional energy use). This is difficult to communicate on the political level, with its strong focus on short-term success.
- There is a danger that policy makers misuse the label of urban sustainable development, to reduce criticism of disputed projects in ecologically sensitive areas, but without having any real commitment to the idea.

5.4.2 Success factors for urban sustainable development

Apart from obstacles to urban sustainable development, there are also a number of factors which can help to promote ECOCITY ideas. But just as encountering obstacles does not automatically result in failure, the presence of one or several of the following factors cannot offer a guarantee of success, as this depends on the specific local situation. Nevertheless, certain factors appear to play an essential role, as they can frequently be found in connection with successful and innovative projects in this field:

- Successful urban sustainable development is often characterised by the commitment of one or more key actors, who may be individuals (e.g. a politician, an activist, a civil servant or an entrepreneur) and/or other parties (e.g. a municipality, a community organisation, a political party or a company). Without their vision, commitment and ambitious thinking the projects in question would not develop in the same way.
- Community building and involvement is a typical feature of successful projects. In this context it is important that citizens and planners identify with the municipality and that an innovative climate is created. The free flow of information and a high level of trust among governmental and non-governmental actors as well as between these two groups are essential.

- Planning processes are particularly successful in cases where win-win-win coalitions are built. This means that all the participants involved (planners, policy makers, the local administration, land-owners, investors, citizens, etc.) can benefit from their involvement – and perceive this to be the case.
- Overall political support for sustainable development as well as for new and unconventional methods and approaches turned out to be another success factor. The ability to form alliances and to agree on compromises is not only a basis for parliamentary democracies but also for the realisation of an ECOCITY.
- The development of different scenarios is a good tool to highlight alternatives as aids in consensus-finding and decision-making.
- It is easier to realise ECOCITY projects in communities which are aware of environmental problems and which have existing environmental laws and regulations. Such communities already have a high demand for a safe and healthy environment. Equally, the participatory aspect of ECOCITY planning is easier to put into practice if successful community involvement processes in the field of urban development have already been experienced in the past (building on existing social capital[22]).
- Successful projects are often located in surroundings or an environment which is considered worthy of protection by the actors involved. In order to maintain a high quality of life and to avoid a higher burden for the biosphere than is absolutely necessary, more efforts than usual are made to achieve ECOCITY goals.
- It is easier to develop ECOCITY projects if the municipality owns the site. However, this presupposes support for urban sustainable development from the municipal administration as well as local policy makers.
- The successful realisation of an ECOCITY project can increase the attractiveness as well as the reputation of a municipality. In the field of tourism or the economy these are important marketing factors.

[22] In the case of urban sustainable development, social capital can be both an important precondition and a valuable result of a holistic and successful planning approach.

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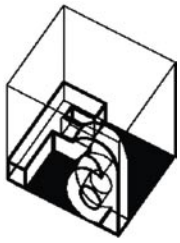

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Belts of car-oriented sprawl are still growing around our towns and cities. They occupy large areas of land, cause growth in traffic volumes and result in the increased consumption of limited fossil fuels, which causes pollution that harms the environment as well as human health.

In contrast to this development and in accordance with many EU policies, an ECOCITY - as defined in this book - is composed of compact, pedestrian-oriented, mixed-use quarters, which are integrated into a polycentric, public-transport-oriented urban system. Featuring attractively designed public spaces with integrated green areas and objects of cultural heritage, an ECOCITY is an attractive place to live and work. Such sustainable, resource-efficient and liveable settlements offer many benefits for the health, safety and well-being of their inhabitants. This in turn increases people's identification with 'their' ECOCITY.

The EU-funded project 'ECOCITY - Urban Development towards Appropriate Structures for Sustainable Transport' was conceived to contribute to the implementation of such patterns by designing model settlements for specific sites in seven European municipalities. The principles of this process and the concepts for the seven sites are described in this book. The results are urban quarters, which provide

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