Energy, Environment and Sustainable Development

Ecocity

URBAN DEVELOPMENT TOWARDS APPROPRIATE STRUCTURES FOR SUSTAINABLE TRANSPORT

Summary

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Background

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. The EU-funded **ECOCITY project** looked at the sustainable development of just such urban areas with a strong ecological perspective. 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 – 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 emissions). It also compromises the effects of many measures aimed at promoting sustainable transport modes (Gaffron et al 2005: p.7).

The structure of sprawl and the resulting problems are described in more detail in a Communication from the EU-Commission: *The siting of employment, retail and leisure centres outside urban areas, for instance around motorway junctions, undermines the economic viability of the city centre as a commercial district, encourages car use and excludes citizens who do not have access to a car from these jobs and services.* (Commission of the European Communities 2004, p. 26)

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).

These issues lay at the core of the project ECOCITY, which 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 desirable future development of the community as a whole. The overall objective was to plan sustainable urban neighbourhoods with an emphasis on the requirements for an environmentally compatible transport system. Sustainable solutions for other relevant sectors – energy, material flows, socio-economy – were also to be designed to generate an urban environment promoting sustainable lifestyles – implying higher quality of life and reduced consumption of resources.

The solutions were to be in accordance with *"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…"* described in the Communication from the Commission 'Towards a thematic strategy on the urban environment' (Commission of the European Communities 2004, p. 30) and in other EU policy documents on this topic.

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 objective of the Key Action 'City of Tomorrow and Cultural Heritage' (under which the ECOCITY project was realised) "*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 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].

Sources:

Publishable Final Report, Vienna 2005

Planning Urban Structures for Sustainable Transport, Philine Gaffron, Uwe Schubert, Franz Skala, Tina Wagner in Land-use and Transport Planning: European Perspectives on Integrated Policies, Ed: Marshall & Banister, Elsevier: Oxford 2007

[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/).

The importance of urban patterns for transport

Newman and Kenworthy provided in their studies many arguments underscoring the importance of designing urban patterns which are favourable for sustainable transport. They compared *annual travel demand* and the resulting *transportation energy use per capita* (which is a key indicator for sustainability) for cities with different land-use patterns and found large differences between compact European and Asian cities on the one hand and disperse American cities (where the key figures were 2 - 3 times higher) on the other hand, showing a correlation of density with the degree of car dependence. There is a rather long list of constraints acting upon automobile-dependent cities in the areas of economic efficiency (costs), environmental responsibility (impacts), social equity (access) and human liveability (loss in quality of life), which defines a need for action. One of the main (impending) constraints seems to be the availability of oil - several studies show, that the time of increasing oil production is almost over and a decline is about to begin (Campbell, 1991). The currently common approach of dealing with these constraints through incremental, largely technological adaptations appears to be insufficient – the increased energy efficiency of cars for example is counteracted by increasing travel distances and heavier vehicles while attempting to increase social equity by promoting car-ownership increases environmental impacts. Thus more fundamental long-term changes in the urban system and urban patterns will be necessary (e.g. to decrease travel distances, thus reducing costs, impacts, losses in quality of life and the dependence on cars)[2]. The goal should be to provide facilities and services in close proximity to where people live, preferably within walking distance or a short journey by bicycle or public transport because *it is not possible to solve sustainability in cities without addressing automobile dependence* (Newman et al. 1999: 42-47, 334-335). There is a particular urgency to instigate such strategic and long-term approaches as soon as possible - especially for new developments - because the long lifespan of (newly) built structures perpetuates their effects for a long time.

In planning for land-use and transport, it is important to differentiate between means and ends to produce solutions which are appropriate to the purpose. Transport, for example, is generally a means while *accessibility* and *mobility* - as defined in the project (see Box 1) - are the end (just as insulation and heating installations would be means where warm rooms are the end).

In the ECOCITY project, mobility and accessibility were seen to describe the same state of affairs from different points of view:

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 (rather than covering long travel distances at high speeds to reach the same number of destinations).

Good accessibility – as a characteristic of urban structures – is understood as the provision of destinations that are close to origins in space and in time, complemented by the availability of high-quality, environmentally compatible transport links (direct, barrier-free pedestrian and cycle routes and attractive public transport routes).

BOX 1: Definitions of *mobility* and *accessibility* as used in the ECOCITY project

Thus there is only an indirect demand for cars and roads, while the direct demand is for the accessibility of destinations. This demand should be met through the most appropriate and efficient means. The priority for a truly sustainable city would thus be a combination of urban patterns of proximity (short distances) and attractive networks of pedestrian and cycle paths.

[2] The mutual dependence between land-use and transport and the advantage of complementary measures in both sectors to maximise synergies towards a 'more sustainable' outcome, is also addressed in the introductory chapter to this book.

In the ECOCITY project, the overall aim was to keep sight of the ends and design the most sustainable means to meet them. Model settlements (urban quarters) were designed for specific sites in the seven municipalities involved to intensify the implementation of agreed principles and to demonstrate the feasibility and desirability of future urban living compatible with sustainability requirements. While the chosen municipalities differ in size, the focus lay on small to medium-sized towns and cities, which is where the majority of people in Europe is still living. Where favoured by the location, the option of linking smaller urban centres by high quality public transport and concentrating further development along the transport axis was considered. Additionally to the different sizes the diversity in climate zones, site location and urban contexts (greenfields, brownfields,...) contributed to showing the possibility of sustainable solutions under different circumstances.

The vision of an ECOCITY

Considering the long lifespan of built structures, settlement patterns for the future (ECOCITIES) need to be **sustainable** in the original sense, in order not to jeopardise the basis of existence for future generations. This includes **ensuring the availability of the resources land, energy and materials** as well as the **preservation of the natural environment** – thus impairment of the environment and resource use have to be minimised. But settlement patterns fit for the future also need to provide **a high quality of life for the present generation** – in other words, the liveability of ECOCITIES should be maximised

To illustrate the vision of an ECOCITY, the features of a community, which would fulfil these goals, were brought together in Figure 1. Agreeing on such a vision of the final aim is helpful when discussing and agreeing on the steps and measures that need to be taken along the way. It can also help in promoting overall awareness of the idea of an ECOCITY. The building blocks of this vision are not ranked in any particular order of importance, as all are required to reach the goal while their relative contribution varies from case to case.

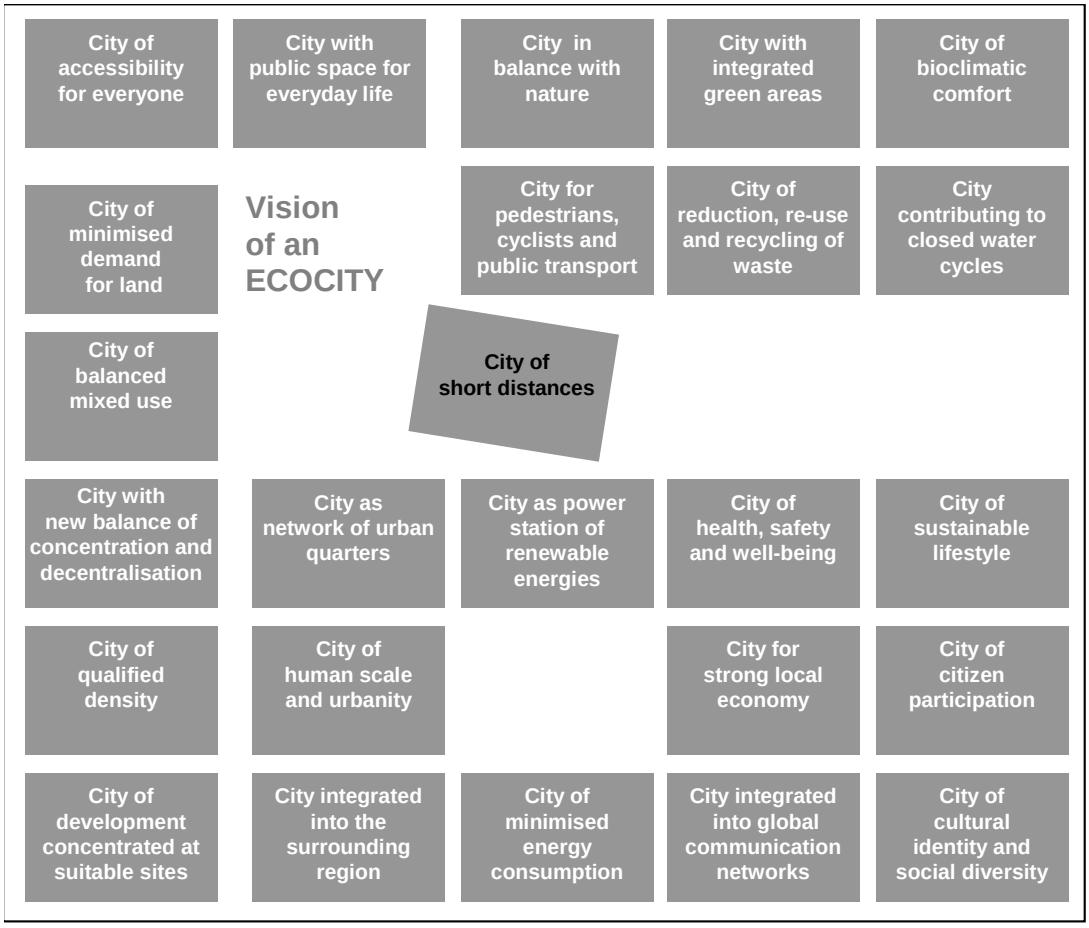

Figure 1: The vision of an ECOCITY

Due to the close interrelations of transport with other sectors, especially the urban structure, minimising transport demand is a key element in fulfilling the vision: it contributes to minimising material and energy consumption (for motorised means of transportation) as well as to minimising the impairment of the natural environment and also the impairment of people's health and safety (caused by transport, predominantly car-traffic). This in turn increases human well-being. The **city of short distances** – the appropriate urban structure for minimising transport demand – is thus a central feature of the ECOCITY vision. It is a main requirement for maximising the **accessibility** of various destinations and thus maximising **mobility** for everyone (see definitions in Box 1).

The most important characteristics of ECOCITY patterns can thus be summarised as follows:

> *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 and mainly composed of **solar-oriented** buildings. In combination with attractively designed public spaces, that integrate 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.*

Benefits of an ECOCITY

Along with agreeing on the vision of an ECOCITY, it is important to realise the benefits an ECOCITY can bring on a number of different levels. These can provide arguments in decision making and help to keep the momentum going during the development, as this can be a very complex process, which involves many actors: the public sector (municipalities, regional planning bodies), the private sector (private businesses, including developers, urban planners and architects), the residents (people living in the direct neighbourhood of the planned ECOCITY as well as its future inhabitants) as well as the (natural) environment as the most important "counterpart". All these actors can gain from an ECOCITY: the benefits range from personal convenience to global sustainability. To get support for realising an ECOCITY, the challenge is to convince the relevant actors *a priori* of the benefits to be expected. Table 1 outlines the most important benefits that can be derived from creating appropriate patterns for sustainable transport such as Transit Oriented Development (one of the main aims of the ECOCITY project).

Benefits for ⇨ from ⇩	the public sector	the private sector	residents	the (natural) environment
Appropriate patterns for public transport (linear polycentric structure)	less subsidy demand for operating costs of public transport	increased cost recovery for the operating company due to higher passenger potential	attractive timetable of public transport with short intervals	lower energy consumption and emissions (gases, noise, particulates)
Appropriate patterns for pedestrians (compact high density, mixed use structure)	less spent per capita on infrastructure and utilities than typical suburban development	more customers in the nearby catchment area	good accessibility of necessary facilities; liveable environment	less land demand; lower energy consumption and emissions (gases, noise, particulates)

Table 1: Benefits for different actors from land-use and transport aspects in an ECOCITY

Due to the interdependence of land-use and transport, there is also positive feedback between both:

- A rail track acts as a catalyst promoting the linear development of more compact patterns, constituting a visible alternative to car oriented development.
- A linear polycentric structure of an ECOCITY with higher urban densities increases the passenger potential for public transport. Thus enforcing a beginning axial development by concentrating new construction in appropriate sites along a public transport axis can promote an upgrading from bus to local rail transport, which tends to provide better service quality and attracts more riders than a bus.

Looking at the whole range of benefits to be derived in all sectors of an ECOCITY (including energy, socio-economy, etc.), a large proportion of them can be related to two different aspects: liveability and costs. Most benefits concerning liveability can be experienced as soon as construction is completed. The benefits of cost savings usually operate on a different time scale - savings in infrastructure investment arise short term, but savings in operating costs and life-cycle costs are experienced on a more long term basis[3]. Important examples are listed in the following sections.

Benefits related to liveability

An ECOCITY offers reduced air and noise pollution and a lower risk of injuries by traffic accidents. There is more space for people in an attractive, quiet, safe and healthy environment (car-free streets and squares, a great variety of green spaces), promoting a slower-paced, more relaxed, healthier, sustainable lifestyle. This allows more personal interaction with neighbours resulting also in the presence of more people in public space day and night thus creating a greater sense of community and possibly resulting in lower crime rates.

Close proximity to most necessary facilities in mixed-use areas provides shorter commutes to jobs or to school, for shopping, recreation, to public transport stops, etc., thus saving time. A variety of green areas (an important factor for residents' satisfaction), integrated into as well as in the surroundings of compact settlements, is easily accessible. A balanced social mix and social services for all groups of the inhabitants fosters their well-being and solar architecture provides convenient temperatures and good levels of daylight for high indoor comfort.

These benefits can be experienced by all people, but they are of greater importance for some individual groups: ECOCITY patterns privilege **non-drivers** (who are disadvantaged by car-dependent transport and land use patterns), increasing their mobility and accessibility options. An internal pathway system free of private cars and barriers but with sufficient social control combined with the short distances, creates an attractive safe environment for **children** (to play safely outdoors and travel on their own) as well as for the mobility of **seniors** and the **handicapped**.

Many features of an ECOCITY also contribute to promoting health: building materials include less harmful substances and better air quality reduces the risk of exhaust-related respiratory ailments, while more walking or cycling is an effective way to increase physical activity among otherwise sedentary people.

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[3] important references:
CarFree City USA, *Benefits,* Berkeley, CA http://www.carfreecity.us/benefits.html
NewUrbanism.org, *Benefits of new urbanism*, Alexandria, VA,
http://www.newurbanism.org/pages/416429/index.htm
Todd Litman 2005, Rail Transit In America, A Comprehensive Evaluation of Benefits, Victoria Transport Policy Institute, Victoria, BC, CANADA, http://www.vtpi.org/railben.pdf

For the **municipality** all these aspects of liveability of an ECOCITY are an important marketing factor to increase its attractiveness to citizens and investors as well as for eco-tourism:

- Liveable urban patterns, especially public spaces, and more involvement of the inhabitants in their design increase people's identification with the municipality.
- The standard of accommodation in adjacent built up areas is increased due to improved transport connections and availability of supply facilities in an ECOCITY.
- ECOCITY patterns are also favourable for meeting the challenges of demographic and socio-economic changes (e.g. small sized households, increased share of seniors).

Benefits related to costs

In many categories the costs of an ECOCITY are lower than in conventional urban development:

ECOCITIES have lower **investment** costs

- for infrastructure (streets, sewers, water pipes etc.) because of compact development and
- for parking facilities due to reduced car dependence and thus a lower level of motorisation.

ECOCITIES also feature lower **operating and usage** costs

- for heating and lighting, because of more compact building structures and due to solar gains and high insulation and
- for transportation due to minimised trip lengths (short distances), the resulting higher share of walking and cycling trips as well as an efficient public transport system (lowest costs for car-free households).

ECOCITIES create lower **life-cycle** costs due to

- the use of more durable materials (which may increase up-front investment costs but require less maintenance and/or repair or replacement) and
- the use of materials that are re-usable or recyclable.

ECOCITIES furthermore create less **costs for the general economy**, as they result in

- less environmental damage and harmful emissions and their negative side effects (e.g. flooding, damages to human and environmental health, depletion of natural resources) and
- lower insurance costs due to low crime rates and better general health of population.

However, these latter effects will be less pronounced in just a single ECOCITY development, as they generally manifest themselves above the local scale.

For a **municipality**, additional inhabitants and businesses (of a new ECOCITY neighbourhood) increase the tax base and the more a city commits itself to public transport infrastructure, the less will be spent on transport overall. Conversely, the more a city is built around car dependence, the more of the city's wealth is wasted on just getting around (Newman et al 2001).

Business also benefits from lower household spending on transport as the money saved can be spent on other shopping. Providing appropriate, liveable public space means local retail trade can benefit from resulting increased sales due to increased pedestrian traffic – an effect often encountered in pedestrian precincts even in non-ECOCITIES.

For **developers** the risk of balanced mixed-use projects is lower than in mono-functional residential or commercial developments. Better utilisation of an area (more leasable square footage) due to higher density allows lower selling prices for space, attractive for residents and business.

Benefits for the (natural) environment

Besides actively involved human actors there is another passively involved actor - the natural environment reacting to human interventions. It benefits from an ECOCITY especially in the two main aspects of sustainability - the rates of **resource use** and of **emissions**:

- Less **land demand** and sealed-up area due to compact dense urban patterns (avoiding urban sprawl) allows the preservation of larger self-contained undisturbed natural green areas and agricultural lands.
- Saving **energy** due to minimised and efficient motorised transport as well as solar architecture and low energy housing results in decreased consumption of fossil fuels (and decreased environmental damage in oil-producing regions).
- This contributes to climate protection through reduced CO_2 **emissions** as well as improved regional air quality due to fewer exhaust emissions.

And finally, but most importantly, humankind benefits from the long term protection of the natural basis for life.

Due to knock-on effects, the various benefits do not generally affect one group of actors. Ultimately and when ECOCITIES become implemented on a larger scale, residents for example benefit also from the advantages to the community (e.g. lower costs allow lower taxes), to business (e.g. more economical operation of public transport allows lower costs for passengers) and to the environment (an intact environment provides the basis for a healthy and enjoyable life).

Recapitulation

An ECOCITY provides a better quality of life for almost all inhabitants and helps to sustain this in future. This quality needs not be expensive, but it requires setting appropriate priorities.

BOX 2: Recapitulation

Sectoral objectives for an ECOCITY

Having agreed on a vision for an ECOCITY and knowing, which benefits one wants to attain by creating such a settlement, it is important to clarify how to reach this aim. This section thus provides an overview over the objectives, which need to be fulfilled in the different planning sectors.

Urban structure

Patterns appropriate for sustainable transport

The main aspects to be considered - location and size of the area, qualified density and mixed-use - are explained below in more detail.

The **location of urban development** is of great importance for the efficiency of a sustainable transport system on two levels. Firstly, the selection of an appropriate site for a new development area (quarter, neighbourhood) is essential for ensuring efficient public transport - new developments should be integrated along an existing main axis of local public transport or into an axis of urban development, where a new public transport track could be established or an existing one extended (linear polycentric development). It is also important to consider the quality of the entire public transport system existing in the town and region as a basis for connecting the site into its urban and regional setting. Secondly, the location of particular buildings and facilities within ECOCITIES is important for their accessibility by pedestrians and cyclists and for the distribution of goods. Concentrating the necessary facilities (shops, services, etc.) in a central area creates short distances from all parts of a neighbourhood (this holds especially true for locating a public transport stop in the centre) and allows for easier trip chaining.

The following priorities should be considered, when deciding between different locations favourable for sustainable transport:

- Prefer re-use, renovation, retrofitting and revitalisation of favourably located *existing structures***.**
- Secondly, re-use favourably located *brownfields* for re-urbanisation.
- Lastly, carefully and sparingly use favourably located *greenfield* sites for urbanisation [4].

A further important location requirement for future urban development is the prevention of disturbance through e.g. noise or pollution, concerning in particular the mode of transport making the site accessible. Sites on main supra-regional roads with heavy car traffic are not suitable for locating ECOCITIES because of their huge negative impacts, which are intolerable especially for residential areas. But as sustainable development should be based on mixed use, this implies that other facilities (including public transport stops) should also not be located close to such roads.

The **size of the area** for an ECOCITY settlement should be limited, concentrating urban development (e.g. a new neighbourhood) within a radius of walking distance around one or several public transport stops and providing easy access to the surrounding landscape. On the other hand the area must be large enough to enable an attractive mix of facilities and a proximity of living and working and thus to achieve a high share of short internal trips.

Qualified urban density can be achieved by balancing the requirements for

- reducing demand for land
- achieving short distances (minimising transport demand)
- promoting the viability of attractive infrastructure facilities (e.g. district heating systems) and public transport services, reducing the cost of their provision

with the requirements of

- sufficient distance between buildings for day-lighting and utilisation of solar energy (and / or shading, depending on location and climate) and
- sufficient open and green spaces for social contact and recreation near the dwellings, minimising the area taken by the transport infrastructure.

Mixed-use is achieved by organising a balance of residential, employment and educational uses as well as distribution, supply and recreational facilities on all different levels - from buildings [5] and blocks to neighbourhoods and quarters, city and region. Space needs to be provided for the following facilities:

- at the level of neighbourhoods and for basic daily needs: grocery, pubs and restaurants, kindergarten, primary schools, general practitioner, community and leisure facilities
- at the municipal or regional level and for medium- and long-term needs: e.g. specialised retail and gastronomy, higher schools and further education institutions and hospitals
- The size, number and variety of such facilities should be in balance with the size of the neighbourhood. Ensuring their availability needs careful location management similar to that of shopping centres. Experiences from these also show the importance of "attractors", which serve the entire community (such as special shops, educational or leisure facilities suitable to an ECOCITY). The urban and building structures should offer sufficient variability and flexibility to allow adapting the uses to changing demands.

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[4] These priorities should hold, when sustainable urban development is "standard". For realising **ECOCITY 'model settlements'** another aspect is important: developing **new urban quarters** (on brownfields or greenfields) is advantageous compared to adapting existing ones, because new quarters allow more optimised structures to be designed and these can be implemented in a shorter time span.

[5] 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.

However, new development accounts only for a small part of the total building stock. Thus the main challenge to urban planning will be to adapt existing quarters to an ECOCITY concept. In this case optimised structures can only be achieved in steps and over longer periods of time. The example of model settlements should help to achieve greater acceptance for the necessary regeneration of existing settlements. Generally, both processes - changes in existing urban structures and new urban development - are currently occurring (though often in an unsustainable way) and should further occur (though with commitment to sustainable solutions) in parallel. In the long run, a sensible local combination of both approaches will help to prevent sprawl.

Patterns, which could be summed up as **'elements of sprawl' are definitely not compatible with an ECOCITY** and must be avoided: for example, detached, single-family houses or large shopping and leisure centres on greenfield sites. Their negative impact on the ecological quality of an urban structure is immense.

Urban patterns favourable for solar energy applications

Besides the influence of transport, solar architecture is the second important factor influencing urban structure: one of the most important considerations is the orientation of buildings towards the sun to optimise (passive) solar gains for space heating and daylighting and to also facilitate active (thermal, electrical) use of solar energy. This requires optimising the distances between buildings in relation to their height while also bearing in mind considerations of urban climate (avoiding heat pockets or wind funnelling but allowing the flow of cold air) and considering the requirements for short distances. In hot climates, maximising shading in southern aspects should also be a consideration.

Public spaces for urban comfort and liveability

Public spaces provide the connective tissue between the built structures of a settlement, which allows people to meet and promotes communication in the neighbourhood. To provide a high quality of life, they should meet the following requirements:

- Public areas must form a network of various types of squares, streets and green spaces among a well balanced variety of building typologies and facades. Plants (trees, hedges, lawn, green facades and roofs, terraces), water elements (ponds, watercourses, fountains) and "urban furnishing" (benches, lighting) should be appropriately located and of high aesthetic quality and durability.
- Existing green areas (forests, hedges, grassland) should be integrated into the urban structure and connected within the city as well as with the surrounding landscape by maintaining or creating "green corridors".
- Bioclimatic conditions (wind, sun, rain, snow, etc.) must be considered and e.g. wind protection and exposure to the sun should be possible in winter while protection from the sun and cooling air currents are required in the summer.
- Within the built up structure, the provision of public space should be in balance with semi-public areas (e.g. courtyards) and private spaces (e.g. gardens).
- A clearly arranged network of pathways with distinct hierarchies and clear signposting should enable easy orientation.

Key parts of the public areas should be kept free of cars or only allow limited access and speeds to avoid disturbance (especially regarding safety, noise and exhaust fumes) and maximise the attractiveness of outdoor spaces. The size of car-free areas should be sufficient to allow experiencing all the advantages of living and moving without a car. By maximising urban comfort, there are greater incentives to spend time within the ECOCITY thus also helping to reduce distances of leisure time transport.

Transport infrastructure and systems

The proportion of urban land occupied by the transport infrastructure needs to be balanced with other needs for public space, considering the requirements for qualified urban density. In allocating this transport area, priority should be given to the sustainable modes (pedestrians, cyclists, public transport), planning pedestrian paths as the main network for the internal neighbourhood traffic, complemented by a net of cycle paths as well as direct public transport lines for the connection with other parts of the municipality. All these networks must be integrated into the existing local and regional networks. Barrier-free pathways designed as high quality public spaces (e.g. providing weather protection in arcades, passages or roofed pavements) make walking convenient and especially promote the mobility of children, seniors and the handicapped. Optimising public transport connections and thus maximising their attractiveness requires the co-ordination of railway, light rail, buses and demand-responsive transport services in an integrated system.

Favourable urban patterns should result in a larger share of internal trips within an ECOCITY. For trips out of or into the area however, people also depend on transport services and infrastructure, which already exist in the town and region. Therefore it is important, that the transport concept for an ECOCITY can build on a good existing system of public transport, while simultaneously attempting to 'fill the gaps'.

The area reserved for motorised traffic should be reduced to the necessary minimum, prioritising non-motorised modes within a neighbourhood[6] and concentrating parking spaces in collective car-parks and district parking garages located at the edge of the development. To cut back car ownership, car-sharing and other alternatives should be offered. The delivery of goods should ideally be co-ordinated via a neighbourhood logistics system, that includes e.g. a neighbourhood logistics centre (where external deliveries are collected for further distribution), shopping boxes or multipurpose trolleys for internal goods transportation.

Energy

Energy is a key factor in sustainable development. The energy consumption for human activities needs to be minimised to make them sustainable. The objectives for the transport sector are discussed above - the focus of this section lies on the contribution of building design and supply systems. Two strategies should be combined to minimise the energy demand (mainly for heating) of buildings:

- reducing energy losses through compact design (due to a smaller surface in relation to the volume multi-storeyed buildings require noticeably less heating energy compared to single family houses), high insulation standards for walls, roofs and basements and air-tightness combined with a ventilation system that include efficient air heat exchangers (aiming for low energy houses or passive-houses – i.e. buildings, which require no external input of energy)
- maximising passive solar energy gains through a high ratio of windows and glass elements with high quality glazing on south facades (depending on the climate) as well as active solar gains by instalment of collectors for water heating

Additional solar protection devices (e.g. shading, reflective roller blinds) reduce cooling demand and good day-lighting conditions improve comfort, reducing electricity demand for lighting.

The efficiency of energy supply systems and equipments and the share of renewable energy sources should be maximised - for instance through small-scale co-generation plants producing heat for district heating networks and electricity, based on renewable energy sources (wood pellets, wood chips or sawdust). Further means of electricity generation can be solar-, wind- or small-scale hydropower, depending on their local availability. It is important to consider, that photovoltaic- or wind power installations require back-up systems for periods without sunshine or wind (though this is usually the national grid, which in most countries predominantly provides electricity from non-renewable sources).

[6] including squares and streets allowing access for motorised traffic but giving priority to the non-motorised modes and featuring low speed limits

Material flows

Among the most relevant material flows, water and waste movement occurs during the whole life-cycle of a settlement, while movement of soil and building materials are concentrated in the construction and deconstruction phases. The latter two types of flow can be influenced to a large extent at the planning stage, while the amounts of water used, of the resulting wastewater and of waste depend more on the behaviour of inhabitants.

Excavation for construction sites generates large volumes of material (soils, sand, gravel), which should preferably be re-used on the site (for refilling, landscaping, etc.) or as nearby as possible to minimise the necessary transport distances. The design of buildings can also influence the amount of excavation needed and should aim to minimise this parameter (e.g. by refilling foundation areas).

Building materials must fulfil the requirements of solar architecture, concerning especially thermal conductivity, and should also make a low demand on non-renewable energy and other non-renewable resources in production (giving priority to renewable and recycled materials). They should create high indoor comfort (avoiding the use of substances that are harmful to human health or the environment) and be sourced as locally as possible to minimise transport demand. The recyclability of building materials should also be maximised, which requires avoiding the use of compound materials and providing for easy deconstruction.

Water management concepts, based on an investigation of the natural water cycles of the area (precipitation, surface water and ground water), should include:

- measures to minimise the overall quantity of water extracted from the water cycle for human utilisation (through efficient appliances) and thus the connected production of wastewater (also considering the treatment and re-use of grey water [7] on site);
- measures for sufficient purification of wastewater to avoid negative environmental and health impacts (wastewater treatment) when it is recirculated into the water cycle, as well as
- measures to minimise the change in the natural water cycle, keeping the rate of infiltration of rainwater into the ground water bodies and the rate of run off from the area as it had been before construction (through green areas, permeable surfaces, drainage systems, etc.), while also providing rainwater for human utilisation (rainwater management).

Concerning *waste* the focus should be on minimising the volume generated and optimising the re-use or recycling by providing the necessary infrastructure as well as keeping the transport distances to treatment facilities short (on a municipal or regional scale).

Socio-economic issues

The main urban development objective in the *social sector* is achieving diversity and integration of population groups with respect to income, age, cultural background and lifestyle concepts. Though this cannot be achieved through planning alone, important contributions are the provision of

- a variety of living environments, accommodation types (flats and terraced houses of different sizes, including subsidised housing) and ownership models (owner-occupied, rented or building co-operatives) to promote a balanced population mix and
- accessible social infrastructure for all generations (from child to senior care), including health, educational, leisure, cultural, spiritual and administration facilities.

[7] Grey water is household waste water, that is not contaminated by human sewage – e.g. from showers, washing machines or kitchens. After on-site treatment it can for example be used for watering gardens and public green spaces.

A diversified and crisis-resistant local *economy* should provide an appropriate number of workplaces in balance with the population, considering the qualification of the available labour force. This requires attracting ecologically and socially compatible businesses (with a focus on economically viable small and medium-sized enterprises), by providing information on regional and local economic strengths (including the availability of commercial space and financing instruments) as well as on access to markets for goods and services, to communication and to sustainable transport networks. Alternative financing models for the ecological infrastructure (e.g. the sale of shares for energy-facilities, public private partnerships) as well as for operating the technical infrastructure (e.g. contracting) can promote the implementation of an ECOCITY project – if the agreements are well thought out to ensure the safe guarding of public interests.

Sources:

Planning Urban Structures for Sustainable Transport, Philine Gaffron, Uwe Schubert, Franz Skala, Tina Wagner in Land-use and Transport Planning: European Perspectives on Integrated Policies, Ed: Marshall & Banister, Elsevier: Oxford 2007

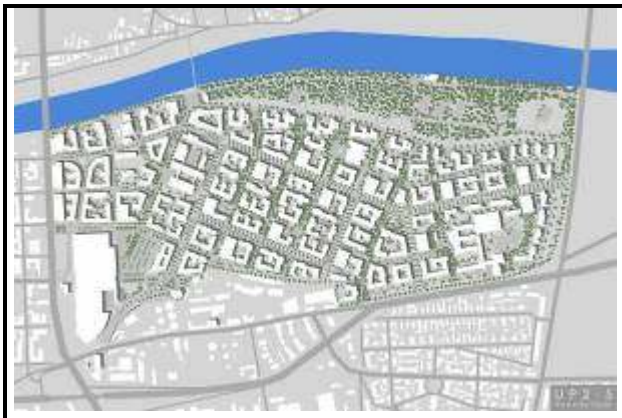
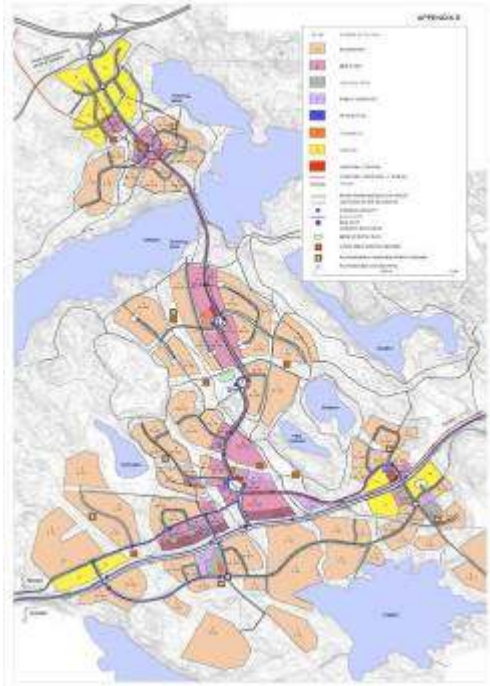
Short description of concepts developed for the ECOCITY model settlements

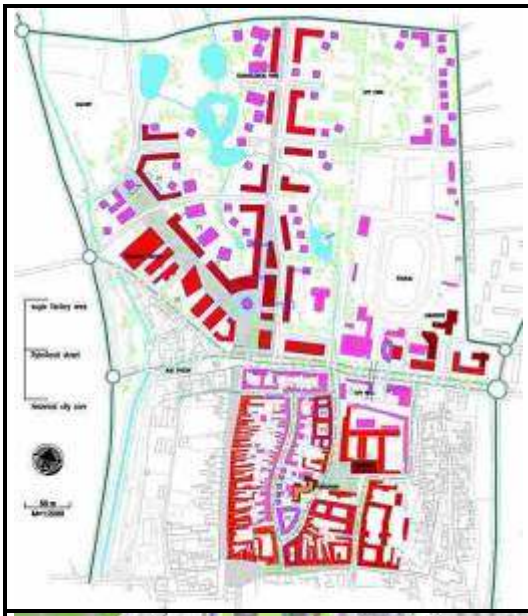
The vision and the objectives for an ECOCITY formulated above are very ambitious. They set standards and describe a target state, toward which urban development should head. The concepts for the model settlements developed within the ECOCITY project meet these standards to different degrees, each having their own specific strengths and showing possible steps towards an ECOCITY. If these solutions fulfil the expectations can only be found out after the implementation of the plans.

The seven concepts are described in further detail in ECOCITY Book I (Gaffron, Huismans, Skala 2006).

Source:

Encouraging walking, the role of urban design, Experiences of the EU-ECOCITY project, Uwe Schubert, Franz Skala, Walk21 conference "Putting Pedestrians First", Toronto 2007

	GYOER **municipality:** 130 000 inhabitants **Ecocity site:** about 11 000 inhabitants brownfield development The availability of an abandoned industrial area offers the opportunity for a long-term urban development adjacent to the historical city centre, but also to the green belt of the Danube river bed.
	TAMPERE **municipality:** 198 000 inhabitants **Ecocity site Vuores:** 16 000 inhabitants and employees greenfield development The Vuores greenfield area was selected to concentrate urban development in an area at the edge of Tampere (with parts also in the neighbouring municipality) instead of quite uncontrolled sprawl all around the city.



TRNAVA

municipality:

70 000 inhabitants

Ecocity site:

3000 new inhabitants, urban renovation and brownfield development

An existing part of the historical core was selected as site for an improvement of urban structure and the transport system combined with redevelopment of a neighbouring industrial site (brownfield).

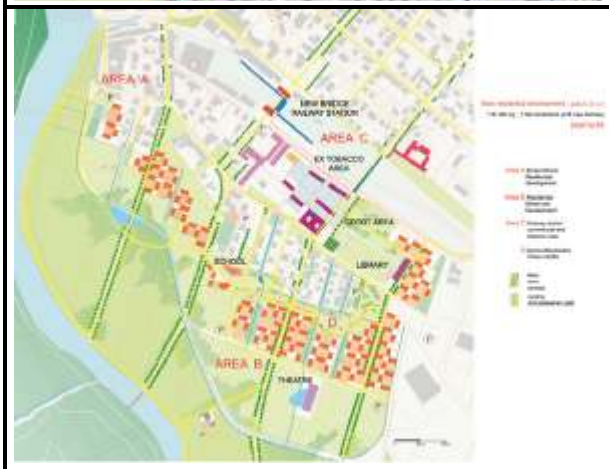
TUEBINGEN

municipality:
70 000 inhabitants

Ecocity site:

about 3300 inhabitants, densification, brownfield and greenfield development

The Ecocity site encloses three different types of areas at medium distance from the town centre. In a participative planning process two scenarios were developed and brought together in the final masterplan.



UMBERTIDE

municipality:
15000 inhabitants

Ecocity site:

1350 inhabitants,

urban renewal project

The project focused on the development of an urban district around the local railway station linked with the historical city, in order to create a central node for the modern city and its mobility needs.

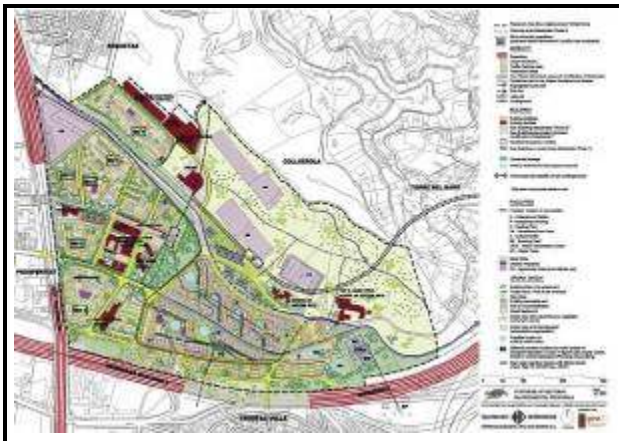
	BARCELONA **municipality:** 1.5 million inhabitants **Ecocity site Trinitat Nova:** 1045 new housing units replacing 891 ones to be demolished urban renewal project on a brownfield site Trinitat Nova, on the outskirts of Barcelona,, is one of the areas of social housing created during the 1950s. (only the part “urban and environmental planning” was worked on within the ECOCITY project)

Table 2: Ecocity Concepts for 6 municipalities

The example Bad Ischl

The way the vision of an Ecocity of short distances can be realised is briefly analysed in the frame of the case study master-plan developed for Bad Ischl in Austria.

BAD ISCHL

municipality:

14 000 inhabitants

Ecocity site

Planned for about 2000 inhabitants,

greenfield development

The site for the ECOCITY model settlement was selected to reinforce the development axis between the centre of Bad Ischl and the neighbouring communities Strobl and St. Wolfgang.

Table 3: Ecocity Concept Bad Ischl, Location of Site

As an alternative to urban sprawl a new compact sub-centre for the community was designed within a radius of 300 m around the stop of the public transport line in the centre, on the main axis.

Key elements of the concept:

- location of facilities, necessary for a balanced mixed use in a central area to create short distances from all parts of the sub-centre and to allow easy trip chaining
- locating facilities, which are connected with transport of goods (supermarket, business yard, logistics centre), near the access to the main road passing by the edge of the site
- design of a liveable public space, providing a barrier-free network of pathways and squares by keeping car traffic in garages on the edge of the settlement
- conserving sensitive parts of the greenfield site (e.g. a small creek and its typical vegetation, green corridors, small forests) and integrating them into the settlement pattern
- giving priority to attractive multi-storeyed residential and commercial buildings with appropriate height (maximum 4, minimum 2 storeys) and with high insulation standards, most of them oriented to the South to promote the use of solar energy, thus minimising heating demand
- concentrating small public services in “service points” within public space to make these services easily and quickly accessible.

The following figures show the master-plan (Fig.8) and the details of the green space- (Fig.9), density- (Fig.10) and mixed use (Fig.11) concepts to illustrate the “Characteristics making the urban structure appropriate for pedestrians” presented above (p. 8).

Figure 2: Master-plan Bad Ischl

Figure 3: Green and Open Space Concept

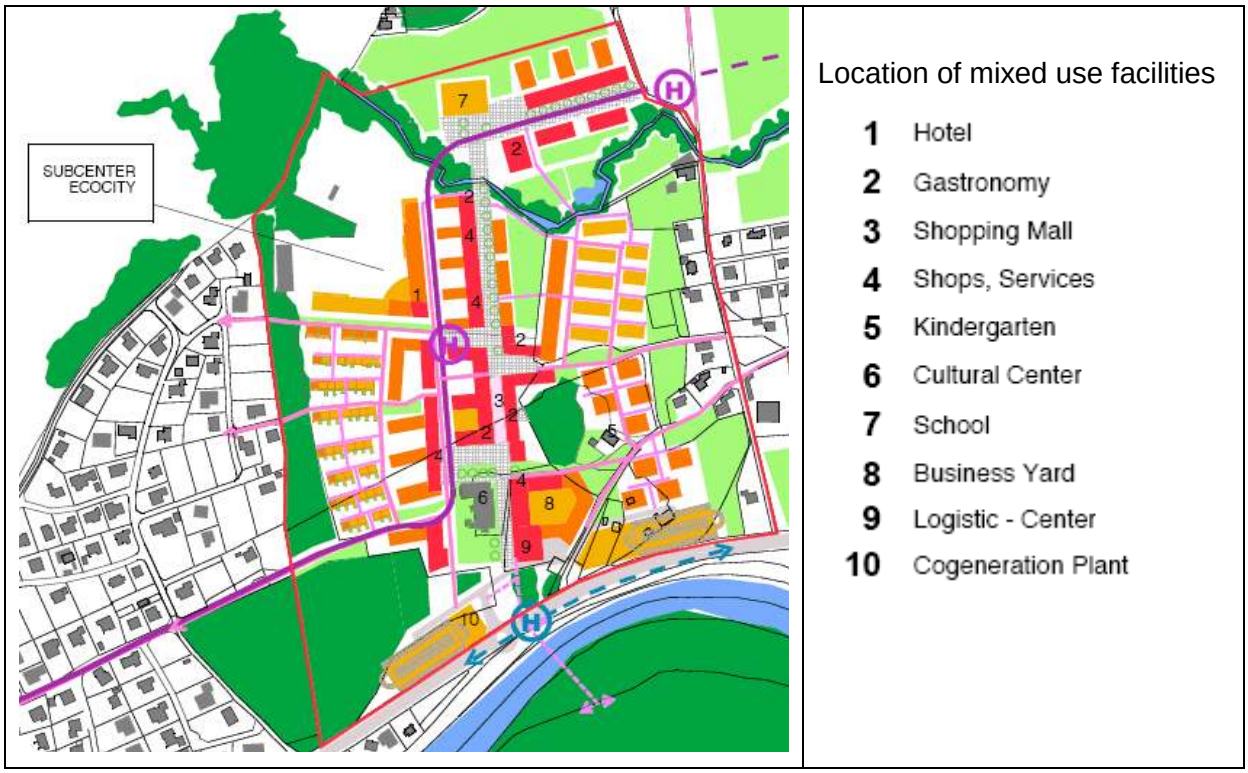


Figure 4: Mixed use facilities