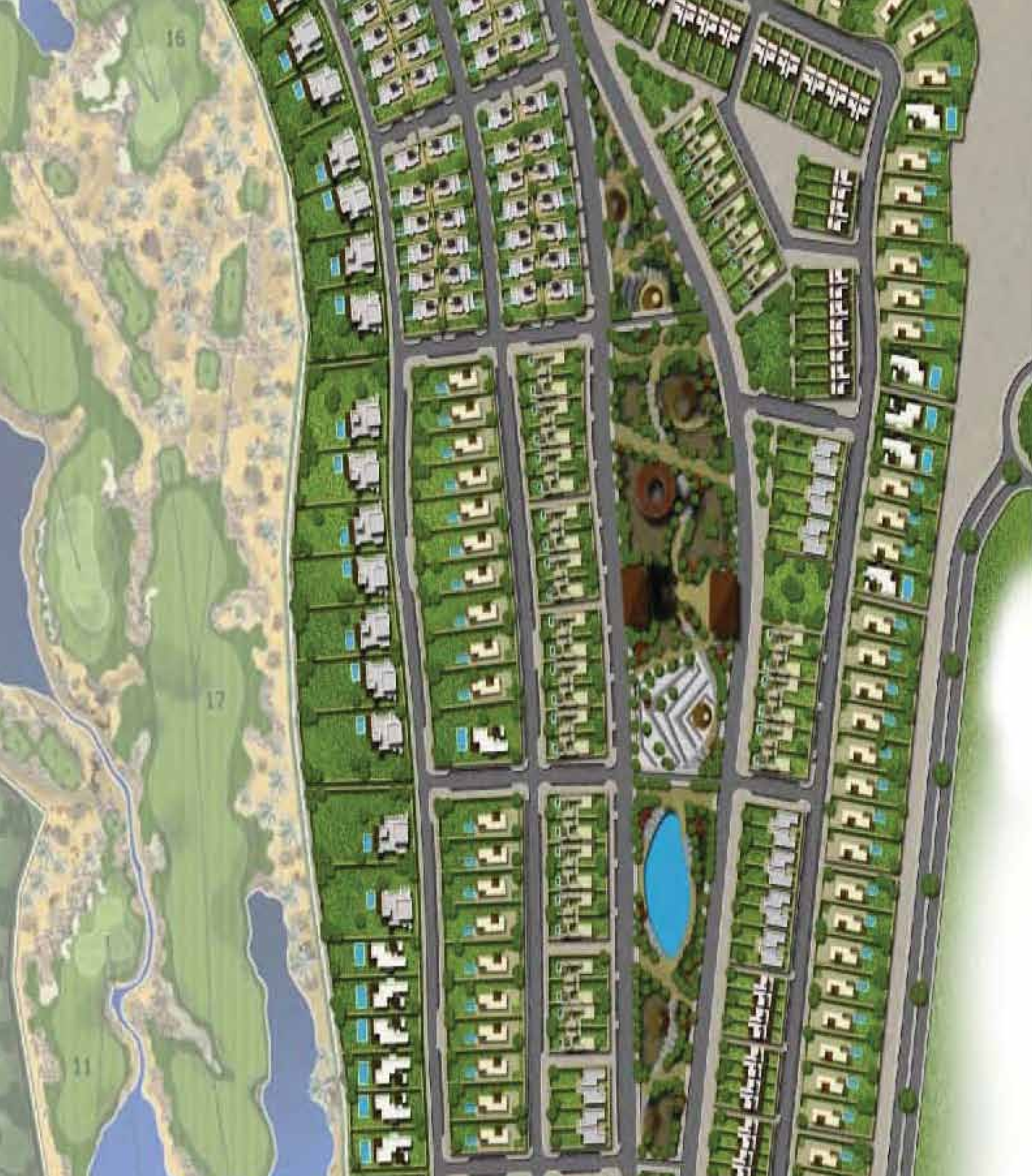
Energy Efficiency Urban Planning Guidelines for MENA region

October 2013

MED-ENEC Energy Efficiency in the Construction Sector in the Mediterranean

This project is funded by the European Union



Cover and above: the NEWGIZA urban development located in Giza, Egypt, including 1,500 acres and 5000 residential units with mixed functions such as business districts, retail outlets, parks, sports and educational facilities; all within a short distance from neighborhoods' centers. An electric trolley-bus system is planned to reduce car traffic. The residential blocks are designed to make optimal use of daylight and natural ventilation. The landscaping and streets include pavement with a low heat absorption coefficient, to lower the heat island effect. Master Planner: Earth, Arch. Ibrahim Mohasseb. Architect: New Giza Design Studio (NGDS), Arch. Amr Ghaly.

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Shaded mid-block pedestrian connection within transit-oriented development, in Al Rehab City, New Cairo. The trees in the landscaping design provide shading on buildings and contribute to a pleasant micro climate for pedestrians.

Introduction

Energy Efficiency potential in the Building Sector

Buildings account for a significant portion of primary energy consumption in south and east Mediterranean countries. By 2030 these countries are expecting a population increase of 40 million people and an increase of 24 million new housing units[1]). Growing populations and new housing stock increase energy demands of buildings, and cooling requires the largest energy load in these countries.

Therefore, when planning for new urban communities to accommodate future populations, efficient use of energy resources should be considered.

In order to be most effective and feasible, the reduction of energy consumption of buildings, and the use of renewable energies should start with urban development.

This covers a variety of scales, from regional and city levels, to district and neighbourhood levels, as well as plot allocation levels.

Affordable and sustainable solutions for communities are needed to secure energy supply, and to reduce energy subsidies. New markets for energy efficient products will be created when energy efficiency is introduced on urban planning level.

Why Energy Efficiency for Urban Planning

Urban planning is the basis for energy efficient buildings. Planning new cities is a long and complicated process, which involves many stakeholders. Decisions made at the city or district level affect micro-climates in public space and influence the final energy consumption of buildings, their cooling, heating or lighting loads.

Planning for energy efficiency at an early stage includes context specific issues such as site selection, type of regional connections, transportation structure and type, the main street layout, as well as the prevailing orientation of new developments.

Energy efficient urban planning offers opportunities to enhance the quality of urban life by providing spatial solutions, designed for a healthy and comfortable- built environment with minimum energy consumption.

Passive methods that increase shade, cooling and ventilation at all scales, aim to reduce energy consumption, thus the focus of this brochure.

Energy Efficient design and urban planning is the most cost effective way to reduce energy consumption of buildings.

Related Policy Framework

"Energy Efficient practices are in the process of being implemented by participating countries in the region in the form of National Energy Efficiency Action Plans (NEEAPs) which set targets and propose related measures to reduce energy consumption and promote the use of renewable energy (RE).

Egypt has a target of 20% RE by 2020[2]) and the NEEAP includes measures for street lighting and solar water heaters)"[3])

This brochure provides **Energy Efficient Urban Planning Guidelines** that are developed with, and to be considered by governmental urban planners, developers, and designers, when planning for new communities.

The aim is to reduce the energy loads of future buildings (especially for cooling) and the need for individual motorized transportation by providing cost-effective ways to create a pleasant urban environment.

Guidelines Review Meeting at NUCA, September 2013

To promote Energy Efficiency in the Mediterranean construction sector, and to reduce the CO_2 emission of buildings, MED-ENEC publishes a series of brochures. This brochure on EE Urban Planning Guidelines aims at improving the health of new communities through energy efficiency.

For other brochures is this series, check the website: www.med-enec.eu

Kurt Wiesegart

Background

The EE Urban Planning Workshop

The content of this brochure is a result of the Energy Efficient Urban Planning training workshop conducted at the Urban Training Institute (UTI) of the Housing Building Research Centre (HBRC), under the Ministry of Housing Utilities & Urban Development) in Cairo, (Egypt)*.
The purpose of the workshop was to:

- Transfer best practices of energy efficiency in urban planning,
- Raise awareness among governmental urban planners and
- Assess the application of methods, strategies and instruments in the Egyptian planning context.

The training focused on various aspects of energy efficient city and neighbourhood planning, and on methodologies and instruments to integrate energy efficiency in urban planning and design. Each thematic session was followed by a discussion of practical cases for the application of instruments and methods in the Egyptian context, to understand the current state of energy efficiency aspects in urban planning in Egypt.
As a result of these discussions general policy recommendations were identified, to be considered for a future legal framework. Additionally, a practical checklist for future urban development and design projects was generated.
The full training report can be found on the MED-ENEC website: www.med-enec.eu

EE Urban Planning Training discussions, December 2012

Key success factors:

- Develop a pilot project in cooperation with private developers, which consider energy efficiency and the economic interests and market viability.
- Develop guidelines for common practice, based on the conclusions from this pilot project.
- Set up handbooks, trainings and other forms of dissemination of good practices.

The EE Urban Planning Brochure summarizes the training:

- **Principles of Energy Efficiency for Urban Planning** (Chapter 3).
- **The Energy Efficiency Urban Planning Guidelines**, (Chapter 4) structured by scale, explaining each guideline with illustrations.
- **The Energy Efficiency Urban Planning Checklist** (Chapter 5) to be used for on-going and new large-scale development projects to improve the energy efficiency of its future buildings.
- **Implementation** (Chapter 6) general policy recommendations are provided to improve the legal, institutional and organizational framework.

The draft of these guidelines have been reviewed with public and private stakeholders during a meeting arranged in cooperation with New Urban Community Authority (NUCA), to encourage participation in formulation and understanding of the EE urban planning guidelines by all stakeholders.
Feedback from governmental, NGO, educational and private sector participants have been assessed and incorporated into this brochure.

The *Energy Efficiency Urban Planning Guidelines* and *Checklist* are made for general use in the Mediterranean region in an attempt to get energy efficiency on the agenda of urban planners, and include a selection of strategies for dry hot and warm humid climates. The authors are open to comments and recommendations.

* The training was developed and conducted by Frank Schwartze and Aram Yeretzian (December 2012) in cooperation with Dr. Doa'a el Sherif, Head of the UTI and Florentine Visser, MED-ENEC.

Historic cities are inspiring, Al Muez Street in Islamic Cairo, a traditional neighbourhood with energy efficient elements in the urban plan: orientation along the main wind flow, to increase ventilation, while entrances are located perpendicular, to avoid entry of dust, shaded narrow streets providing pedestrian comfort and reduction of solar heat gain on the buildings, a tight network of services and facilities encourage walking, reducing the need for car use.

Principles of Energy Efficiency for Urban Planning

Energy efficient architectural design is only possible when the site and climatic condition are considered appropriately at the urban planning level. So, passive design strategies are the most cost-effective approach to improve the energy efficiency of buildings. Figure 3.1 shows that urban planning is the basis of cost effective energy efficiency buildings, and can reduce the investment cost of a building.
The urban design defines if alternative building forms (morphology). Certain building forms or typologies are more efficient in energy consumption than others (see Guidelines Chapter 4).

The following principles form the basis for the energy efficient urban planning guidelines at a city, neighbourhood and plot level:

- Make use of existing climate and site conditions to support sustainable passive design strategies for heating and cooling techniques and energy efficient indoor and outdoor comfort.
- Encourage energy efficient transport modes such as (mass) public transit and non - motorized transportation (such as biking and walking).
- Promote compact urban growth strategies and urban densities to sustain economic feasibility of public facilities and transit. Integrate residential functions in mixed-use development, and allow for the distribution of services within short distances.
- Provide amenities for a shaded comfortable outdoor environment and public space.
- Accommodate renewable energy solutions through integration and flexibility in planning and design, to further minimize the carbon footprint.

Al Rehab bus service for residents to commute in and out of Rehab City (New Cairo). The bus service starts daily at 6:00 a.m.

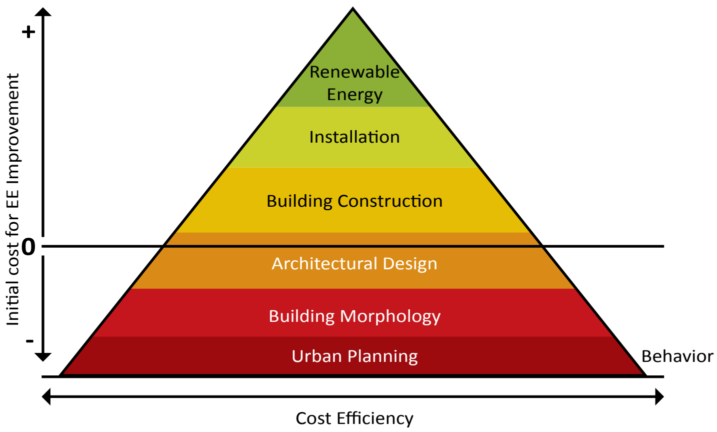


Figure 3.1: Strategy for Cost Effective Energy Efficient Buildings

Structure of Energy Efficiency Urban Planning Guidelines

The guidelines cover various aspects and scales of interventions for energy efficient urban planning and are based on the above principles, structured according to the following categories:

Context	Urban Structure	Urban Morphology	Building Typology	Renewable Energy
Climate	Layout	Massing	Building Type	Flexibility + Integration
Topography	Mobility + Accessibility	Outdoor Space	Architectural Elements	
Framework	Zoning	Parcellation		
	Density			

Mahata Square, Amman, a public space with shading devices, encourages use of outdoor space. Such a shading element could also be used to integrate Photo Voltaic (PV) panels for electricity generation.

Energy Efficiency Urban Planning Guidelines

These guidelines are the result of discussions and recommendations from training sessions held with the MED-ENEC partners in Egypt in 2010-2012, which were organized to promote energy efficiency (EE) in planning for new urban communities. They are based on international best practices for environmental sustainability, and built on traditional methods that have been used in neighbourhood planning in the region for centuries. These methods have proven to create comfortable outdoor and indoor climates, and allow for design of energy efficient buildings, based on passive design strategies, as opposed to active strategies, that require energy sources.

Both strategies create comfort for residents and can cut down the energy consumption. However, passive strategies are the most cost effective approach as they use natural elements, in particular solar and wind, to achieve comfort.

The guidelines will help to achieve energy efficiency at various scales simultaneously (regional, city, neighbourhood and building levels). They provide the framework for reduction of motorized transportation and cost effective energy efficient buildings. To achieve optimum efficiencies at both macro level (country - urban) and micro level (building - end user) the inter-connection between the different guideline subjects, as indicated in this chapter, to build upon each other, and is important to achieve the optimal level of energy efficiency.

The following pages present the EE Urban Planning Guidelines for new communities, and include application examples for New Cairo, a new urban development outside Cairo, Egypt.

An integrated example is provided in Figures 4.2.1c and 4.2.1d, showing the conceptual application of the EE Urban Planning Guidelines, at city level.

The guidelines focus on hot climates, as this is the prevailing climate condition in the MED-ENEC partner countries. Where necessary, separate recommendations are provided for Hot-Dry and Warm-Humid climates.

Although these guidelines were developed for new urban (unplanned) areas, a number of subjects can also be applied to planned or existing built up areas. This is indicated in the following guidelines.

For each site development or implementation, authorities will need to review which guidelines are specifically applicable, and set the priorities for the subjects of implementation, related to the social-economic framework (see Chapter 6 for Implementation of guidelines in Egypt).

NEW GIZA project, integrates attractive pedestrian space

and allows building typologies that fit the climate, such as the courtyard buildings

Master Planner: Earth, Arch. Ibrahim Mohasseb. Architect: New Giza Design Studio (NGDS), Arch. Amr Ghaly.

4.1 Context

The following guidelines emphasise the need to analyse the climatic and physical characteristics of the site context. The site conditions such as climate, orientation towards sun, wind, existing slope, or natural features define the most appropriate strategies for planning and designing the outdoor environment as well as urban form and morphology, to reduce the energy consumption, especially the cooling loads at a building level. See Figure 4.1.2

4.1.1 Climate

Analyze climate conditions for the site, including temperature ranges, solar irradiation, relative humidity, prevailing wind direction and speed in order to assess the most appropriate strategies for a comfortable public, outdoor, space and optimal conditions for passive design strategies for future buildings.
Based on the climatic site condition a selection can be made of the following strategies:

- Natural ventilation,
- Shading,
- Evaporative cooling,
- Heat accumulation and reflection (material selection).

4.1.2 Topography

Streets should be oriented to accommodate existing topographic features such as hills and valleys to preserve natural areas and to make use of existing climatic conditions, as wind. In cases where topographic features can naturally collect water, vegetation is encouraged, providing cooling and dust collection*.

For *Warm and Humid Climates* open spaces should be oriented to prevailing winds, to encourage air movement and reduce humidity

4.1.3 Framework

The new urban development should consider existing neighbourhood sustainability certification programs, according to national or international rating systems (e.g. Green Pyramid, Estidama, or LEED Neighbourhood Rating Systems).

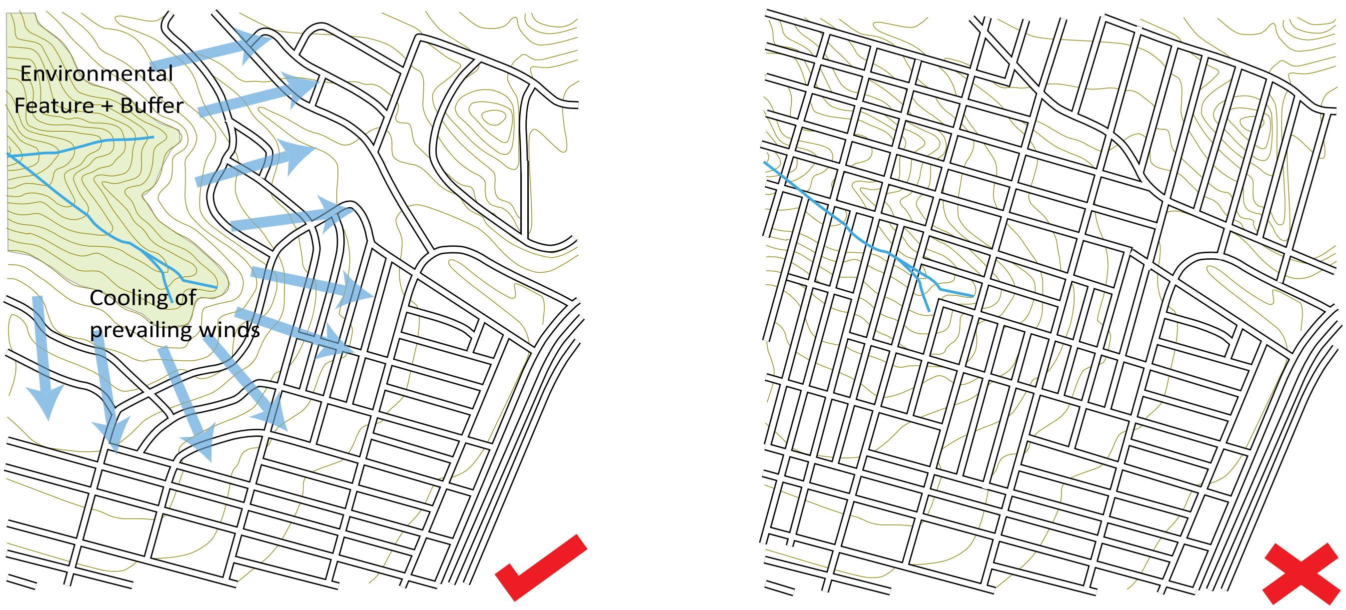


Figure 4.1.2: Environmental features are to be integrated into planning of new developments for natural cooling mechanisms

* Applicable to unplanned areas only.

4.2 Urban Structure

4.2.1 Layout

The urban plan layout plays an important role to achieve significant energy efficiencies at a metropolitan / city level as it determines the proximity of site location, the layout orientation of the new development, as well as the availability of services, amenities and related transportation connections. The following guidelines are illustrated in Figure 4.2.1a and recommended to be considered when developing the urban layout:

- For new urban development, consider first to (re) develop existing areas or abandoned sites within the city boundary, before deciding to locate new developments in remote, natural, landscapes. This avoids long travel distances, and makes use of existing resources such as roads, infrastructure, services and public amenities.
- When inner city areas are not available for development, new urban communities should be located within proximity to municipal boundaries of the closest main metropolis in order to use existing resources, amenities and services efficiently.
- Connections to the nearest metropolis should be planned through regular express public transit (every 20 minutes)*, such as trains.
- Each new city should be structured through connected centers and sub-centers within a compact footprint, demarcating an urban edge.
- New Cities should have district centers or corridors within two kilometers of each other, and be connected by regional public mass transport systems, like light rail, metro or public buses.*
- Each district should consist of a number of neighbourhoods, having neighbourhood centers or corridors within 700 metres of each other, connected by mass transport systems.

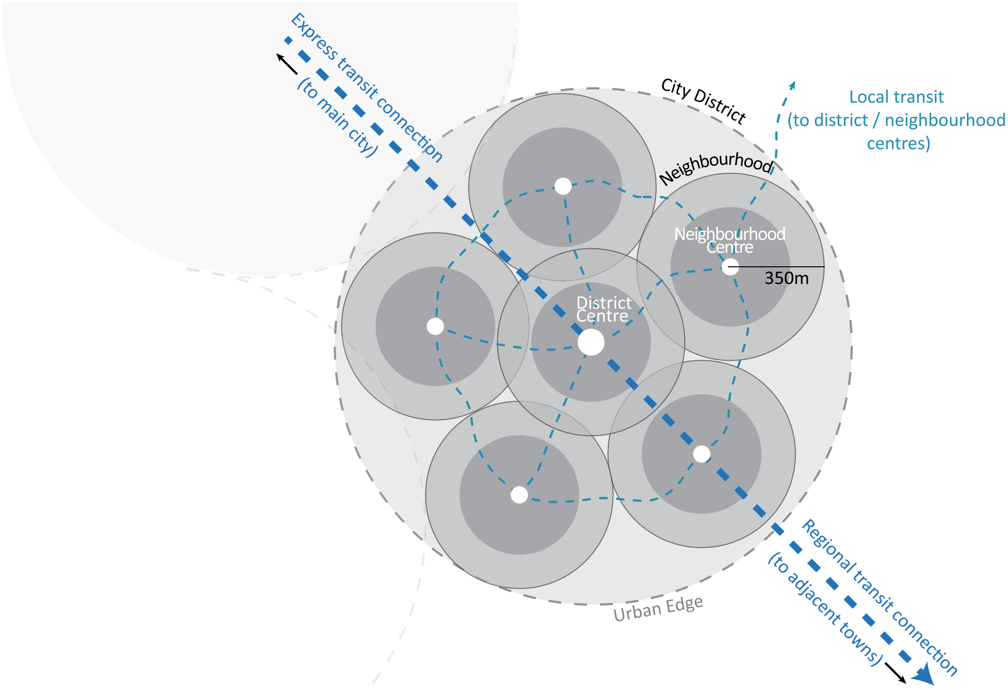


Figure 4.2.1a Energy Efficient location of new communities with district and neighbourhood centres or corridors, connected or by a public transit network

* Implementation of public transit services needs to be coordinated with the Ministry of Transport and other stakeholders, and has to match ridership potential, to maintain and make public transport services economic and feasible for either private or public developers.

The street layout planning of communities should consider cooling and ventilation of public space and built fabric, therefore the street orientation needs to accommodate inbound winds, which reduce heat gain and encourage natural ventilation.

- The main streets, indicated by a red arrow in Figure 4.2.1b, should be oriented along the main wind direction*. This results in a Northwest / Southeast axis, when the prevailing winds are coming from the NW direction, see figure below.

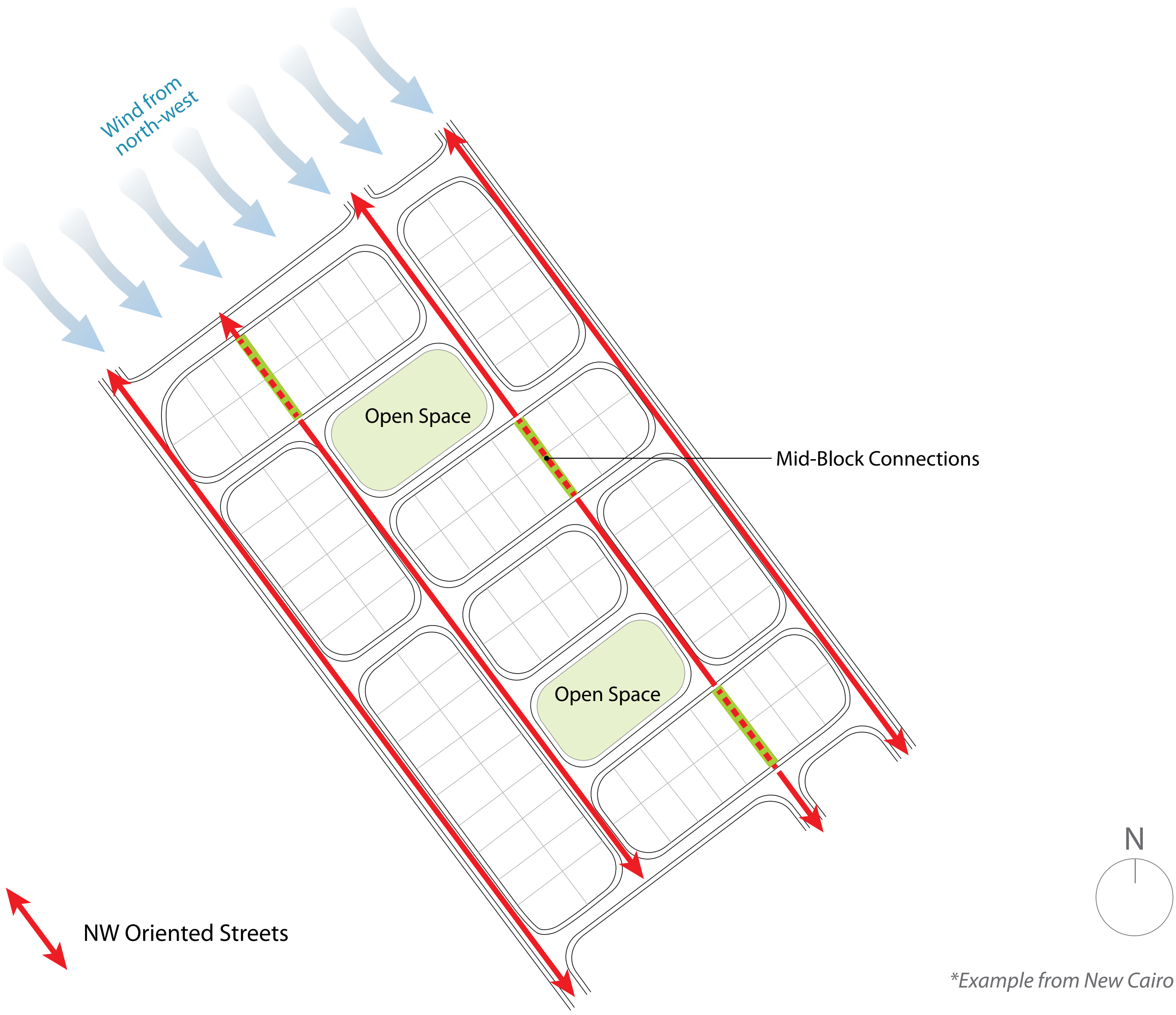


Figure 4.2.1b Example of Energy Efficient street orientation to accommodate prevailing winds

* Applicable to unplanned areas only.

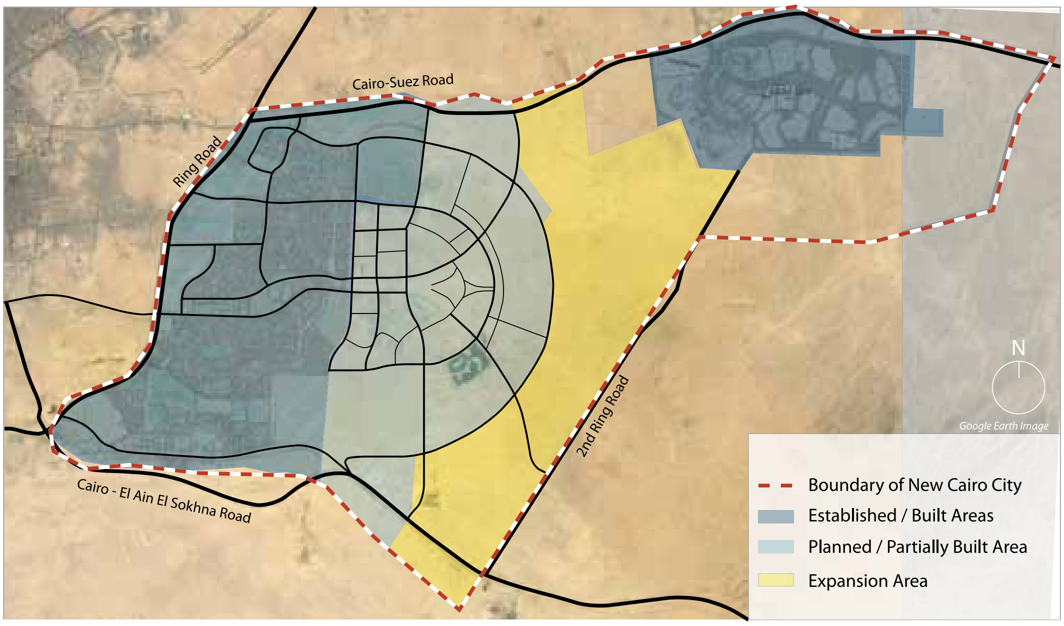


Figure 4.2.1c: Existing plan for New Cairo (a new urban community outside of Cairo, Egypt), indicating the development boundaries, built, planned and expansion areas

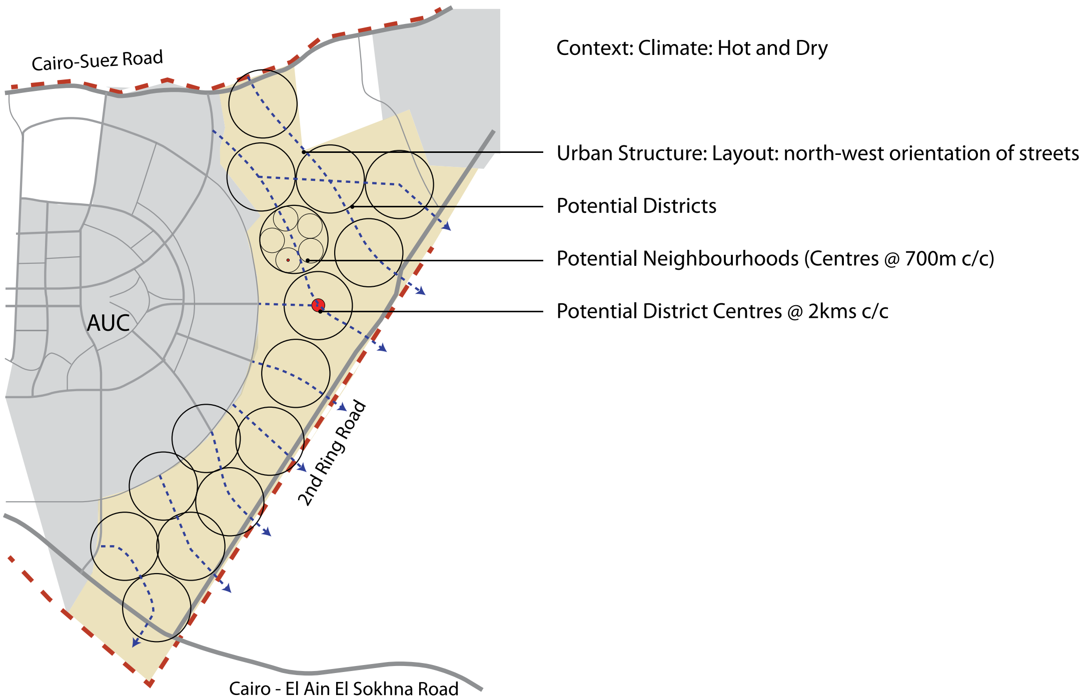


Figure 4.2.1d New Cairo expansion area, with application of EE Urban Planning guidelines on large for urban structure and orientation to allow natural ventilation for cooling, allocation of districts, neighbourhoods and services to support public transport, and non motorized individual transportation, such as walking and cycling

4.2.2 Mobility + Accessibility

In order to ensure efficient ways of transporting people and goods, new communities need to be planned to include the following guidelines regarding easy access to various types of mobility such as walking, bicycle, bus, (light) rail, shared taxi or carpooling within short distances.

To allow for the most efficient option for mobility, related to the distances travelled by residents, the urban plan needs to include access to facilities such as:

- Shaded pedestrian sidewalks, for distances shorter than 700 meter.
- Bus stops, (could includeminibus, Bus Rapid Transit).
- Bicycle lanes and parking, for distances shorter than 4.6 kilometer.
- (Underground) Metro or tram stations.

The Street Network should be highly connective and should consider the following, which is indicated in Figure 4.2.2b:

- Linkage with the existing road hierarchy system (Arterials vs. Collectors vs. Local Streets).
- Intersections should be located between 150 to 200 meters apart within residential zones.
- Mid-Block Connections should be introduced to increase pedestrian connectivity and walkable access to non-motorized transport and public transit.
- Average neighborhood block perimeter of 700 meters (access to public transport an average of 350 meters from any resident).

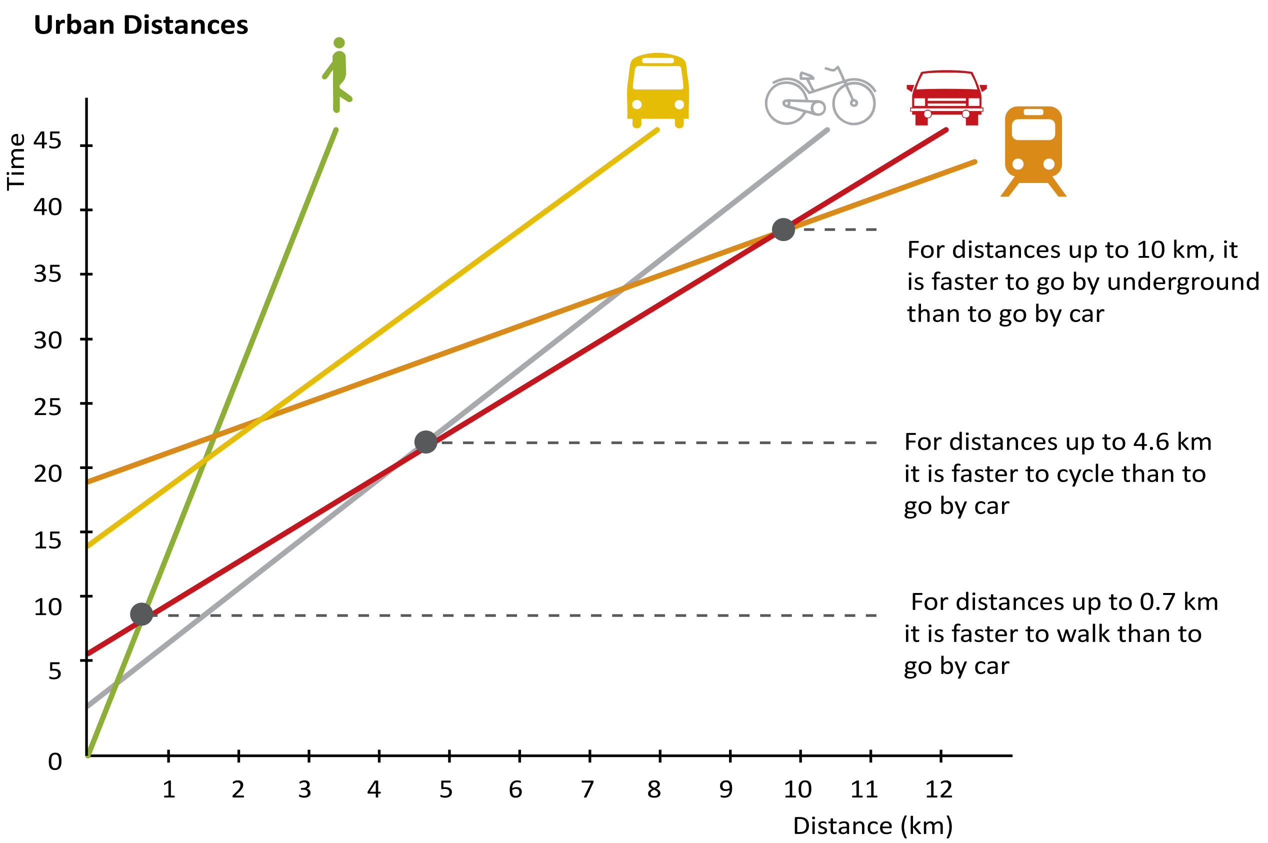


Figure 4.2.2a Efficient distances for various modes of transport

Multi-modal Transportation Framework:

Walking Distance within 350m of Centre

Central Public Transit Service + Stop

Connective Streets + Mid-Block Connections within Road Hierarchy

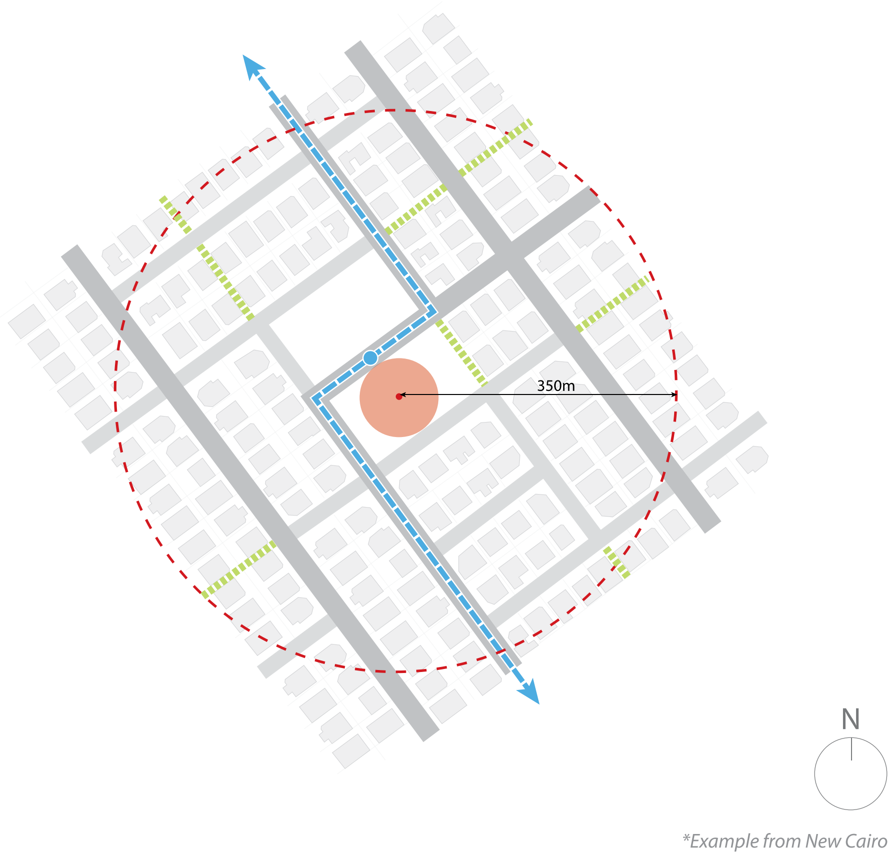


Figure 4.2.2b Energy Efficient city of short distances and access to transit

4.2.3 Zoning

Accommodating a mix of uses within walking distances, encourages pedestrian access to urban services and amenities such as public and economic facilities, parks, and public transit. This can be achieved by establishing mixed-use corridors or centres that distributes traffic over various periods of the day, and reduces the dependence on individual vehicles for mobility, which in turn, increases energy efficiencies, and reduces emissions and latent heat. See Figure 4.2.3a, Figure 4.2.3b.

Each neighbourhood should accommodate the following mix of uses and urban services and amenities at an average distance of 350 meters* from any resident:

- Public Transit Stop
- Mixed Use-Retail and Office
- Public Facilities
- Parks / Open Spaces

*This is based on a six-minute walk at a speed of 3,5km per hour

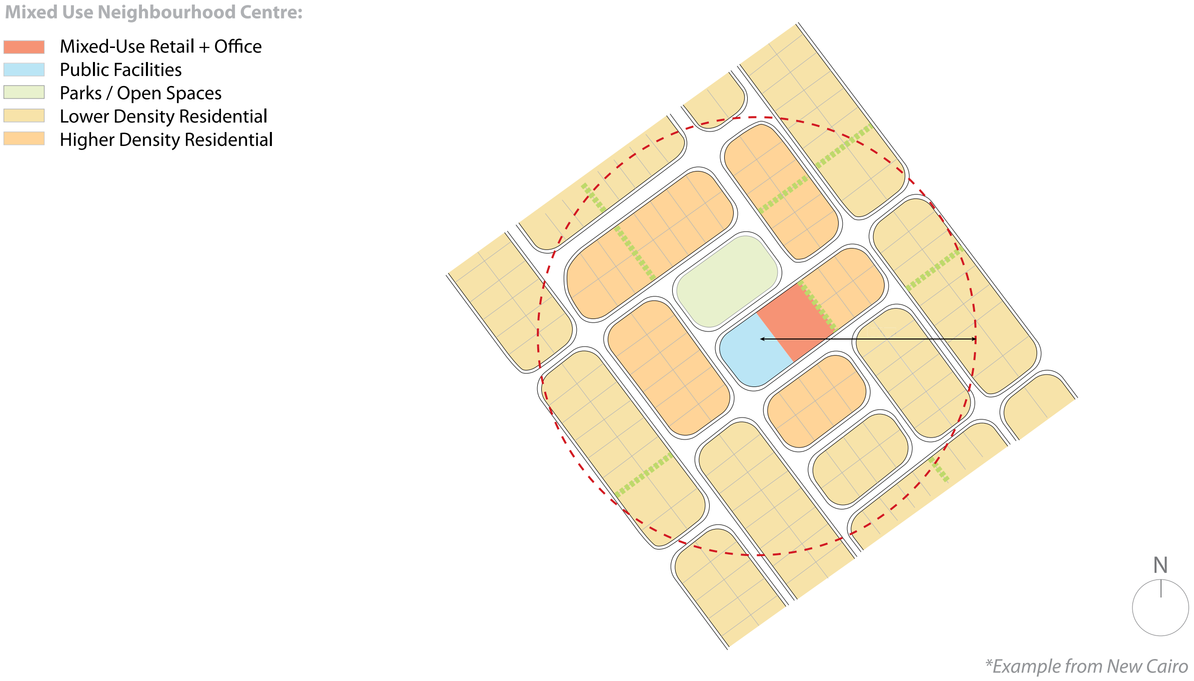


Figure 4.2.3a Zoning mixed use centres consisting of public facilities, parks and retail within walking distances (350m radius)

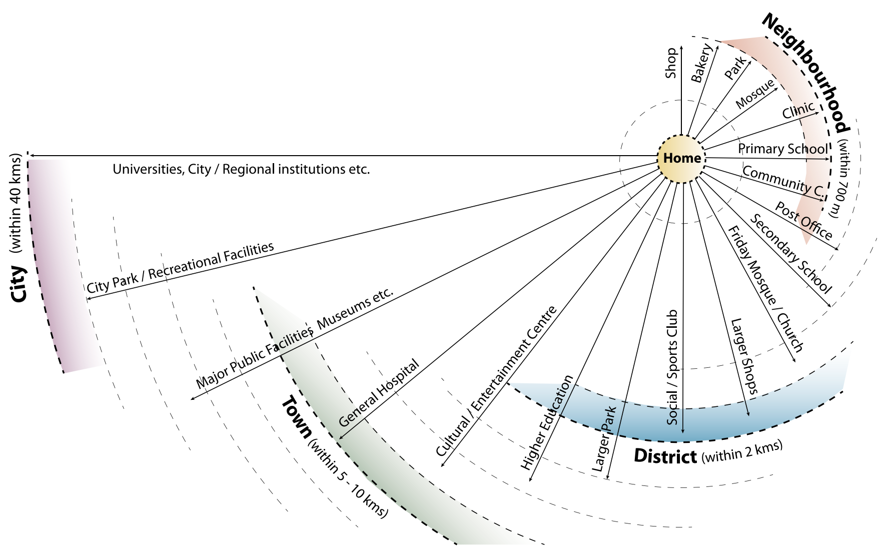


Figure 4.2.3b Range of functions and recommended distances from the city to neighbourhood level

* The implementation of services needs to be coordinated with the Ministry of Education, Transport, Health and other stakeholders.

4.2.4 Density

Adequate densities support economic feasibility of mass public transport and can achieve additional energy efficiency in the built up morphology. Through a variety of building typologies and unit sizes a wide range of populations and residents can be accommodated. This provides choices for affordability and sustains the community, by reduction of commuting distances for service employment. See Figure 4.2.5 and 4.3.1.

The following are recommended densities for different urban areas, in order to provide feasible amounts of ridership for mass public transport (bus and / or light rail), support mixed functions, public and urban quality*:

- Central areas up to 125 Dwelling units per Hectare (225 People per Feddan)**
- Semi-central areas up to 30 Dwelling units per Hectare (54 People per Feddan)
- Peripheral areas up to 20 Dwelling Units per Hectare (36 People per Feddan)

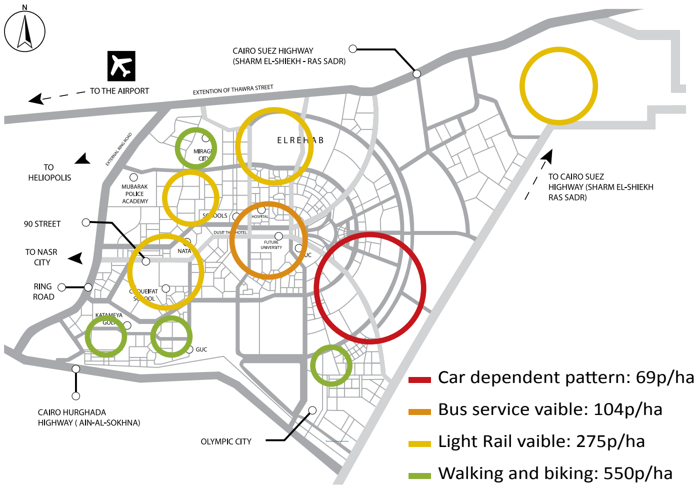


Figure 4.2.4 Potential modes of transportation for New Cairo

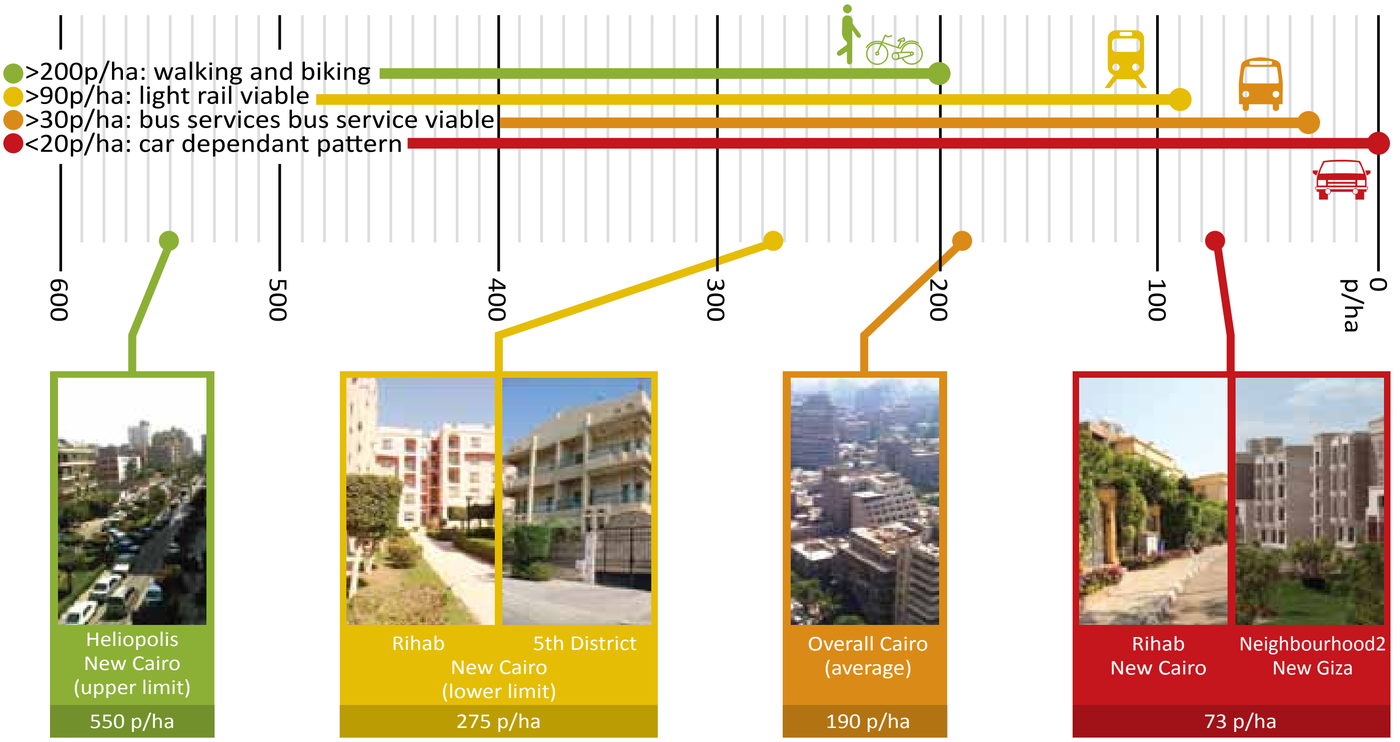


Figure 4.2.5 Examples of Cairo Neighbourhoods with supporting densities(in person per hectare) for various modes of transport, such as walking, biking, (light) rail, (public) buses, and cars***

* Central and Semi-Central Areas can be defined as mixed use centres or corridors (District and Neighbourhood Level).

** For Calculation in Egypt: 4.3 people per dwelling unit is used as per NUCA standards, and 0.42 hectares = 1 Feddan.

*** Indication of density based on New Cairo ToR (NUCA), GOPP 2050 strategy, and NEW GIZA project info.

4.3 Urban Morphology

4.3.1 Massing

The configuration of building mass, related to the specific climate type, influences indoor and outdoor comfort. Certain building typologies increase shading and ventilation, which also can reduce the cooling load. The recommended form of massing is different for *Hot-Dry* and *Warm-Humid* climates. Potential massing configurations for recommended densities mentioned in 4.2.5, are provided in Figure 4.3.1* and described below, as follows:

- ***Hot and Dry climate:*** low rise, high density and narrow streets are the recommended elements of the urban form, to achieve optimal energy efficiency. Since the shading of streets is maximized, creating a more comfortable micro-climate for pedestrians. Another result in when buildings provide shade on each other, is a lower cooling load for the buildings.

- ***Warm and Humid climates:*** a dispersed building pattern with irregular open spaces is preferred, to provide continuous air movements to all buildings and outdoor spaces, to transfer the humidity, and create a more comfortable climate. The building distribution should not obstruct the prevailing winds to provide ventilation for outdoor public space and the indoor space of buildings.

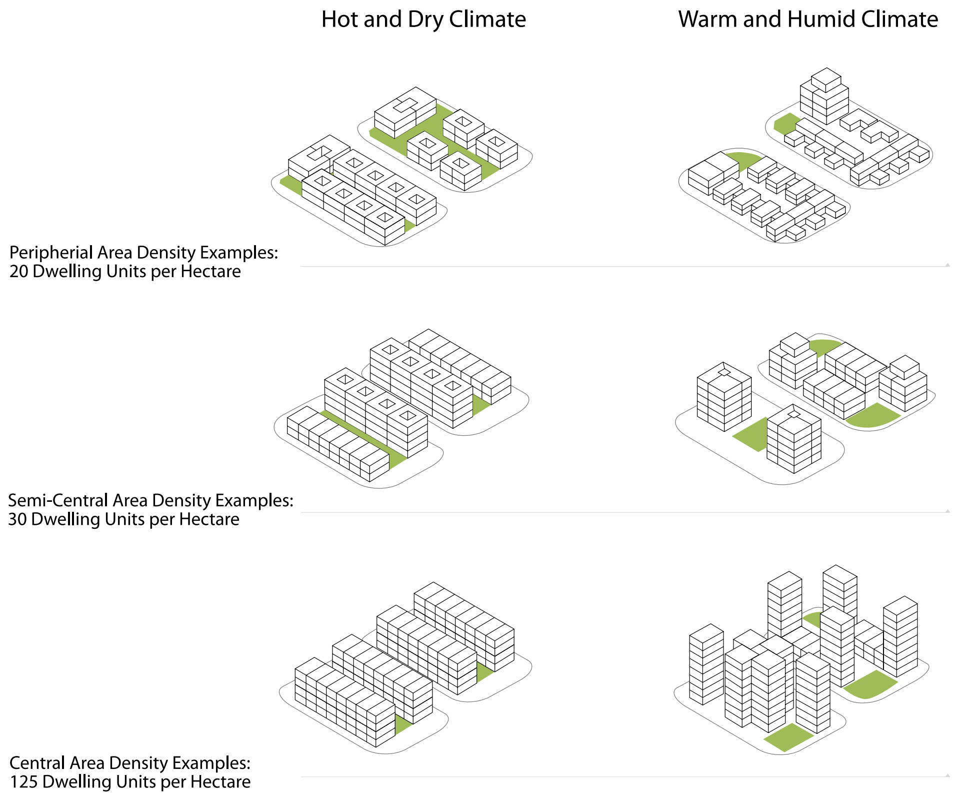


Figure 4.3.1 Examples of massing configurations related to different recommended densities, to achieve energy efficiencies in the form of reduced solar gain and increased ventilation, for both *Hot + Dry* and *Warm + Humid* climates

* Applicable to unplanned areas only.
Central and Semi-Central Areas can be defined as mixed use centres or corridors (District and Neighbourhood Level).

4.3.2 Outdoor Space

To support the short distances and a mix of uses, pedestrian networks should have comfortable micro-climatic conditions in order to access services and amenities easily without depending on private automobiles.

To create a comfortable outdoor pedestrian space the following guidelines should be addressed; ensure the use of porous, light-coloured materials for outdoor public spaces and surfaces, to reduce the urban heat island effect, and thereby lowering the outdoor ambient temperature and reducing cooling loads of adjacent buildings.

Native vegetation uses less water, and provides dust protection to enhance natural ventilation for public outdoor space and buildings, and reduce the relative humidity supporting a more comfortable outdoor space. See Figure 4.3.2. It is recommended to:

- Use soft landscaping elements (i.e. vegetation), such as trees, shrubs and vines, to maximize the shading of streets and outdoor spaces for pedestrians.
- Encourage the use of porous, reflective, light-coloured materials for a minimum of 20% of all street and parking lot surfaces*.
- Encourage the shading of a minimum of 50% of the outdoor public open spaces, such as plazas and parks.

For *Hot and Dry climates*, vegetation provides dust protection for building ventilation and increases relative humidity. Water elements increase outdoor comfort level through modification of humidity.

For *Warm and Humid climates*, vegetation provides a green belt protecting the settlement from the undesired winds.

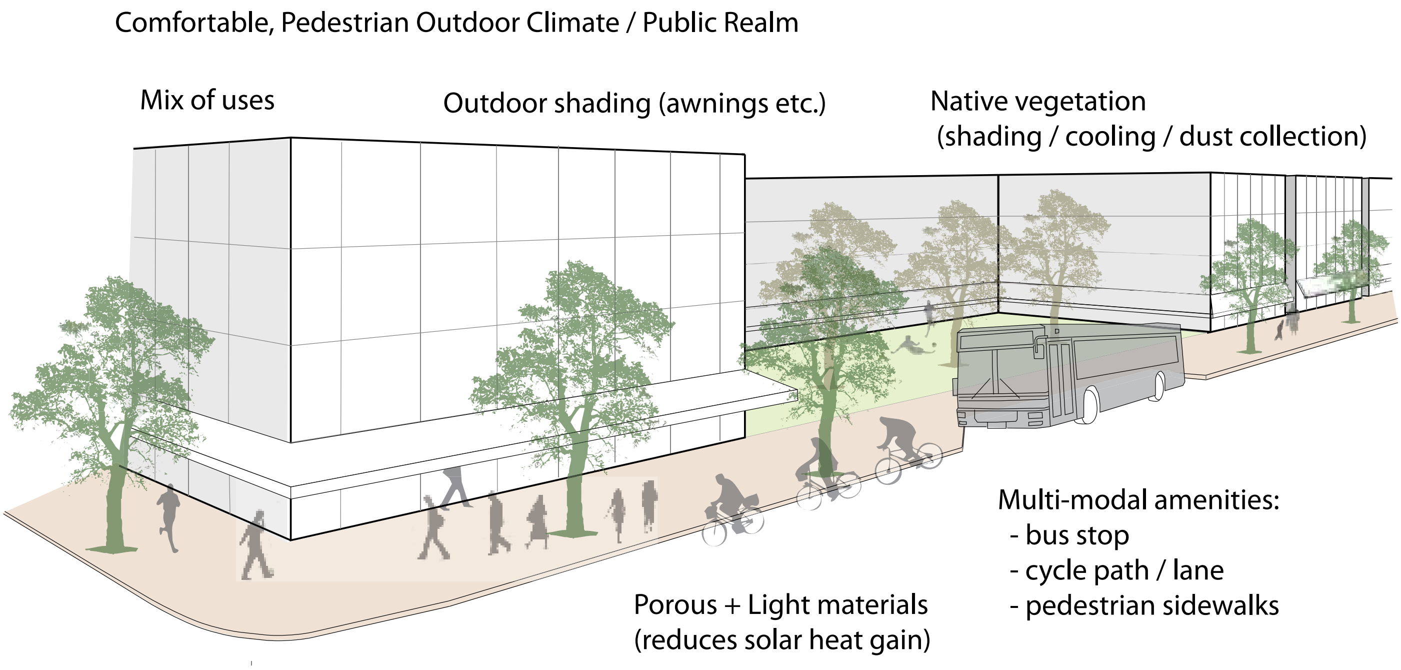


Figure 4.3.2 Example of mixed-use, shaded spaces contributing to energy efficiency and comfortable outdoor space through building awnings, and native trees

* Can be increased to higher percentages, depending on a review of outdoor materials and existing local standards by authorities.

4.3.3 Parcellation

On the plot level, parcellation needs to ensure that the plot fabric is flexible enough to accommodate a variety of building types and green spaces. The following guidelines ensure comfortable, shaded, natural environments, which can make use of passive solar and wind conditions, contributing to cooling efficiency by reducing solar heat absorption. See Figure 4.3.3*:

- The parcel fabric should be flexible to accommodate courtyard and other building types that enhance natural light and vegetation, with mid-block connections, and central open spaces.
- Within the parcel, a minimum of 20% of exposed surface area should be vegetated / covered with absorptive elements. This can be implemented at the ground or roof level (in the form of green roofs).

For Hot and Dry climates, courtyards are encouraged with a 1:1 ratio, for natural light and ventilation

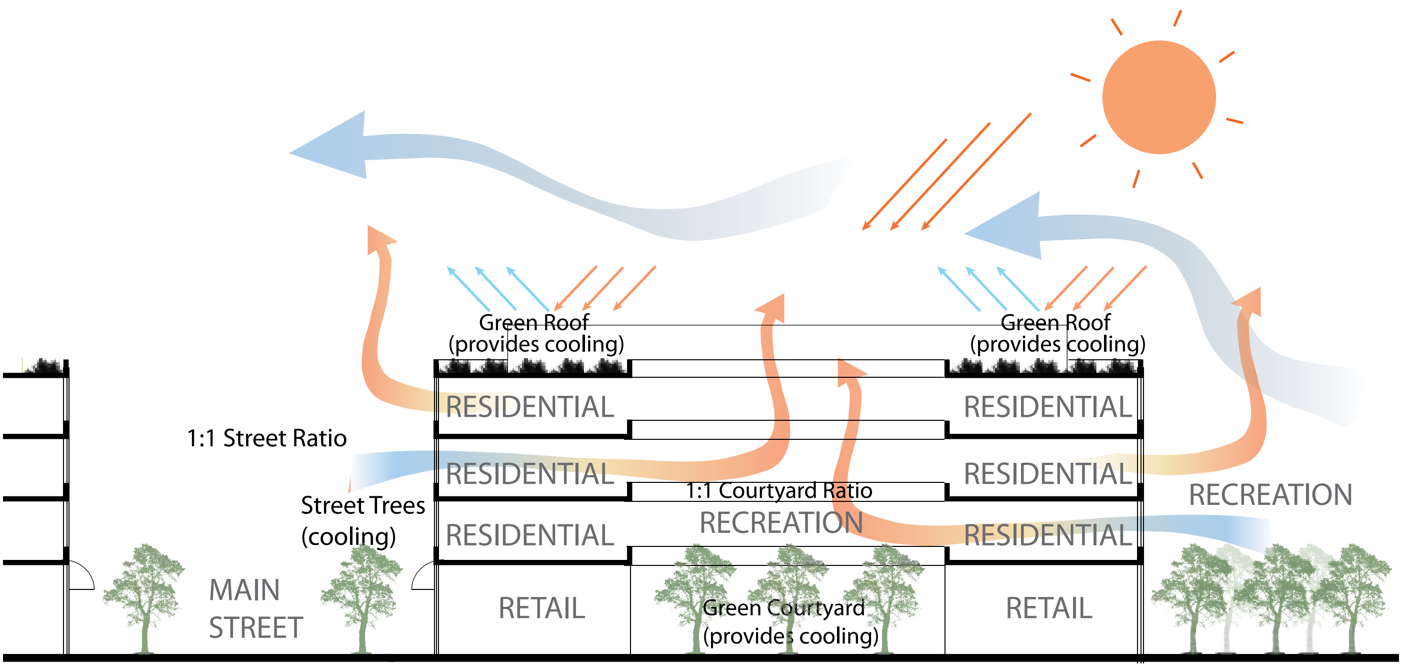


Figure 4.3.3 Maximizing natural light and ventilation and providing a minimum of 20% of green open space within building plots, encourages gardens and green roofs, which reduce solar heat gain and provide cooling – increasing energy efficiencies in cooling loads

* Applicable to un-built areas only.
Consult authorities for recommended green roof suppliers and energy efficient application of green roof practices.

4.4 Building Typology

4.4.1 Building Type

Building typology, form and design can cater to various aspects of passive cooling for a comfortable indoor climate, and reduce the cooling load of buildings.
The below strategies guide urban fabric development for new cities at the building level, and improves the micro-climate through reduced solar gain. See Figure 4.4.1.

The following passive design strategies for sun and wind, provide general parameters for built-form in line with prevalent climate:

- Sun: The architectural concept should address optimal use or protection from the solar radiation, for both building and outdoor space. Building envelopes should be oriented along the East-West axis (i.e. the largest part of the facade facing the North and South side). The South facing façades should have small openings and horizontal shading.

- Wind: Buildings should be oriented in such a way that the prevailing winds can be used for most optimal natural ventilation.

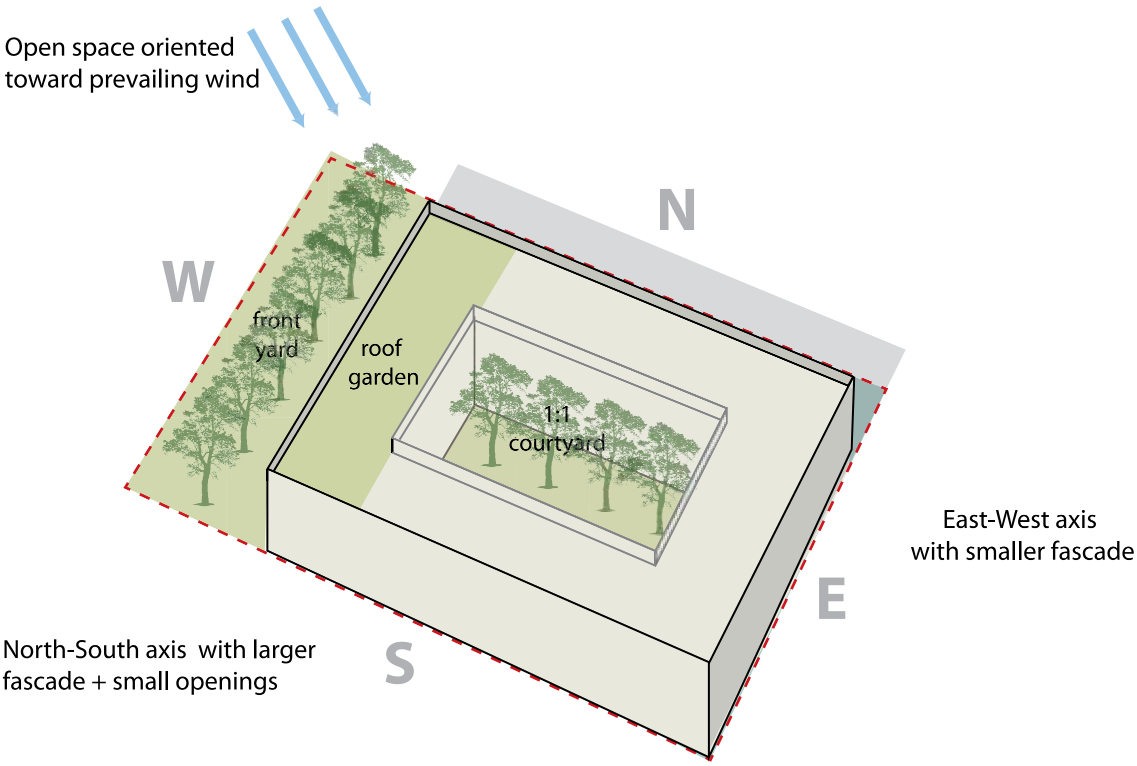


Figure 4.4.1: Example of energy efficient building type (courtyard type), accommodating natural light and ventilation

* Applicable to un-built areas only.

4.4.2 Architectural Elements:

Building envelope designs should optimize window-wall ratios, allowing sufficient daylight, while minimizing the opening that provide heat gain. Window shading concepts should be used in order to match the climatic conditions, maximize natural light and ventilation. Green roofs should be promoted, as they improve the shading and thermal capacity of the building envelope and reduce the solar heat gain. See Figure 4.4.2.

The following guidelines list energy efficient architectural design strategies to consider:

- Optimize window wall ratios: a maximum 18% of the overall envelope for window openings[4)]*.
- Use window shading concepts, matching the climatic conditions.
- Use light colors for elevations as recommended by LEED or the Green Pyramid rating system, however avoid whites for over glare.
- Utilize green roofs or green walls where feasible.
- Use local building materials as much as possible.

For more details on EE measured at building level please refer to MED-ENEC 'EE Building Guidelines brochure'.

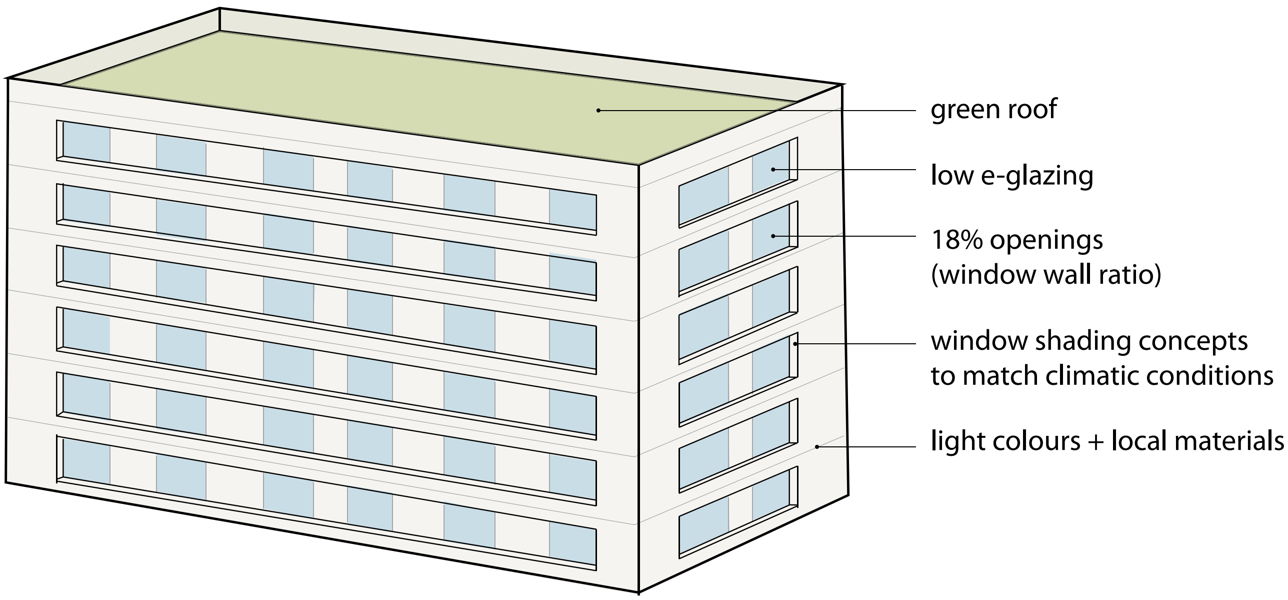


Figure 4.4.2 Example of building type with adequate window wall ratios, shading concepts to maximize natural light and ventilation, and green roofs for efficiencies related to shading and thermal capacity of the building

* Applicable to un-built areas only.
The 18% for opening sis a general guideline and can be reviewed by authorities as per unique site conditions. The intention is to accommodate adequate natural light and minimize solar heat gain.

4.5 Renewable Energy

4.5.1 Flexibility
Supply of renewable energy should be integrated with a National Energy Efficiency Action Plan (NEEAP), which indicates where and how the country plans to reach its future target for the share of renewable energy in their total energy consumption.

Planning and design of new communities should accommodate implementation of renewable energies (like solar thermal, photo voltaic, concentrated solar power, or wind energy) from the start. In addition, options for future installation of such systems are to be included. See Figure 4.5.1

Renewable energy can be integrated by allowing flexibility in design and planning of new communities at a building, plot, neighbourhood or district level. It needs to consider space allocation and requirements for the following:

- Domestic (i.e. building level) solar hot water
- Solar LED street lighting
- District systems for heating and cooling
- Energy and electricity generation and distribution at a neighbourhood scale

4.5.2 Integration
Integration of Renewable energy can take place on different levels and needs to be considered according to the site specific conditions (such as orientation towards the sun):
- District level, electric power, cooling, or hotwater supply for the new neighbourhood.
- Neighbourhood level, integrated in elements of the public space, such as shading devices (for instance on-parking spaces).
- Building level, integrated in the building envelope design: facades and roof.

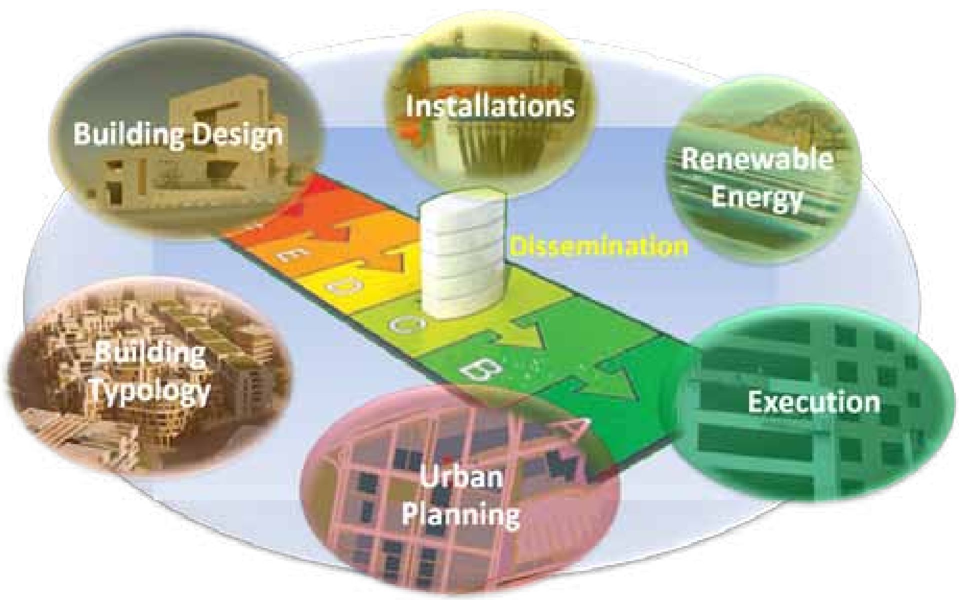


Figure 4.5.1 Integrated Approach for cost effective energy efficient buildings

Princess Noura Bint Abdurrahman University for Women (PNUW) Project in Riyadh, Saudi Arabia, includes solar thermal district heating system (around 36,000 m2 with a total capacity of approximately 25 MW the largest in the world, provides a significant savings on fuel consumption. Solar thermal installation by Millennium Energy Industries, Jordan.
Future urban developments need to consider the integration of renewable energy at early design stage.

MED-ENEC
Energy Efficiency in the Construction Sector in the Mediterranean

The Energy Efficiency Urban Planning Checklist

This checklist is to be used by urban planners and designers for on-going and new large-scale development projects, to improve the energy efficiency of its future buildings.

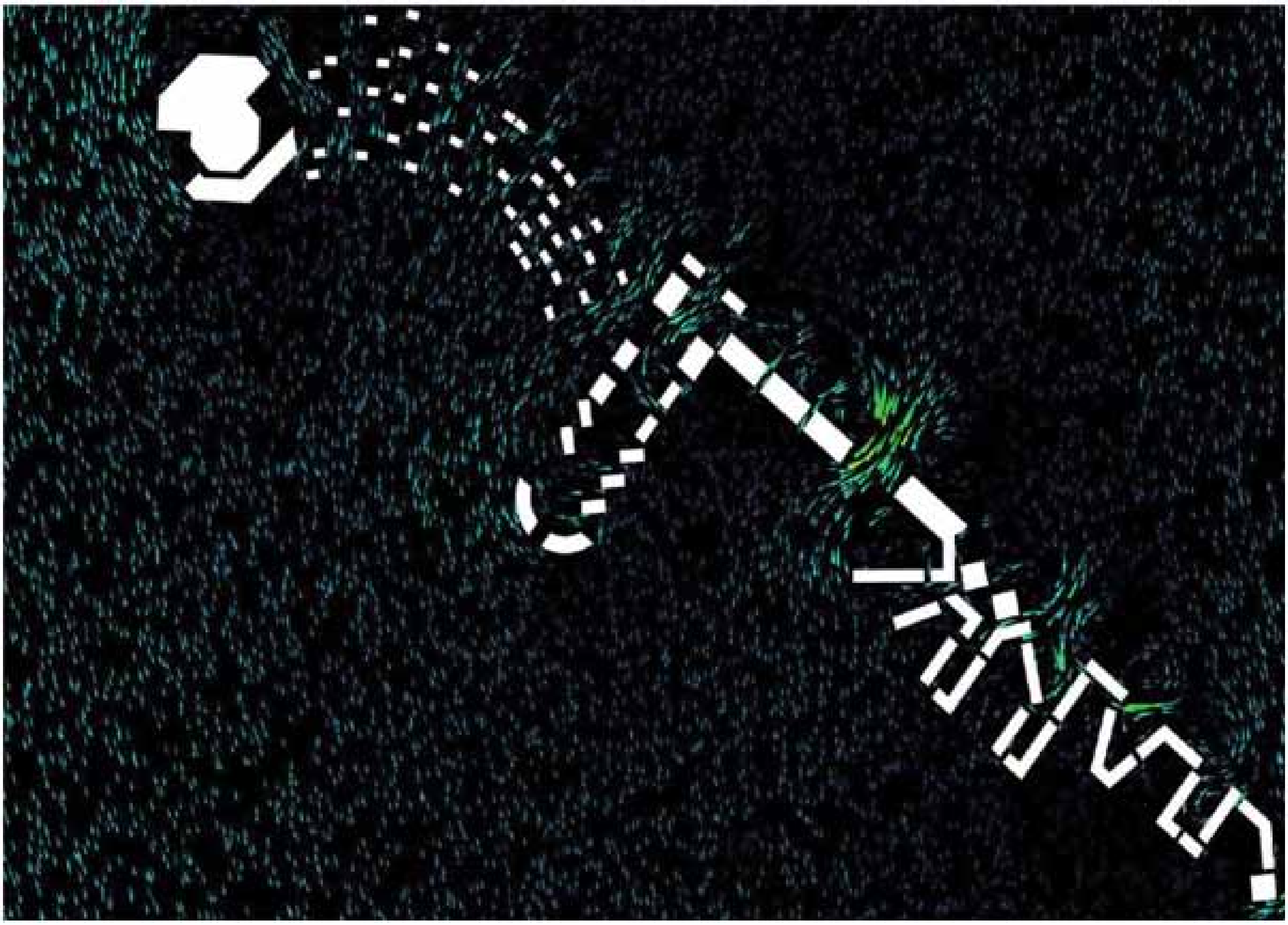
Context		
Climate:	What are the climatic conditions of the site (temperature ranges, solar radiation, relative humidity, prevailing wind direction and speed)?	☐
Topography:	What are the specific characteristics of the site in terms of topography, and/or natural conditions?	☐
	Does the street layout and development provide strategies for reduction of energy consumption by considering the climate requirements, topographical situation, and urban context?	☐
Framework:	Has the development followed neighborhood sustainability certification, according to national or international rating systems (e.g. Green Pyramid, Estidama, or LEED Neighbourhood?)	☐

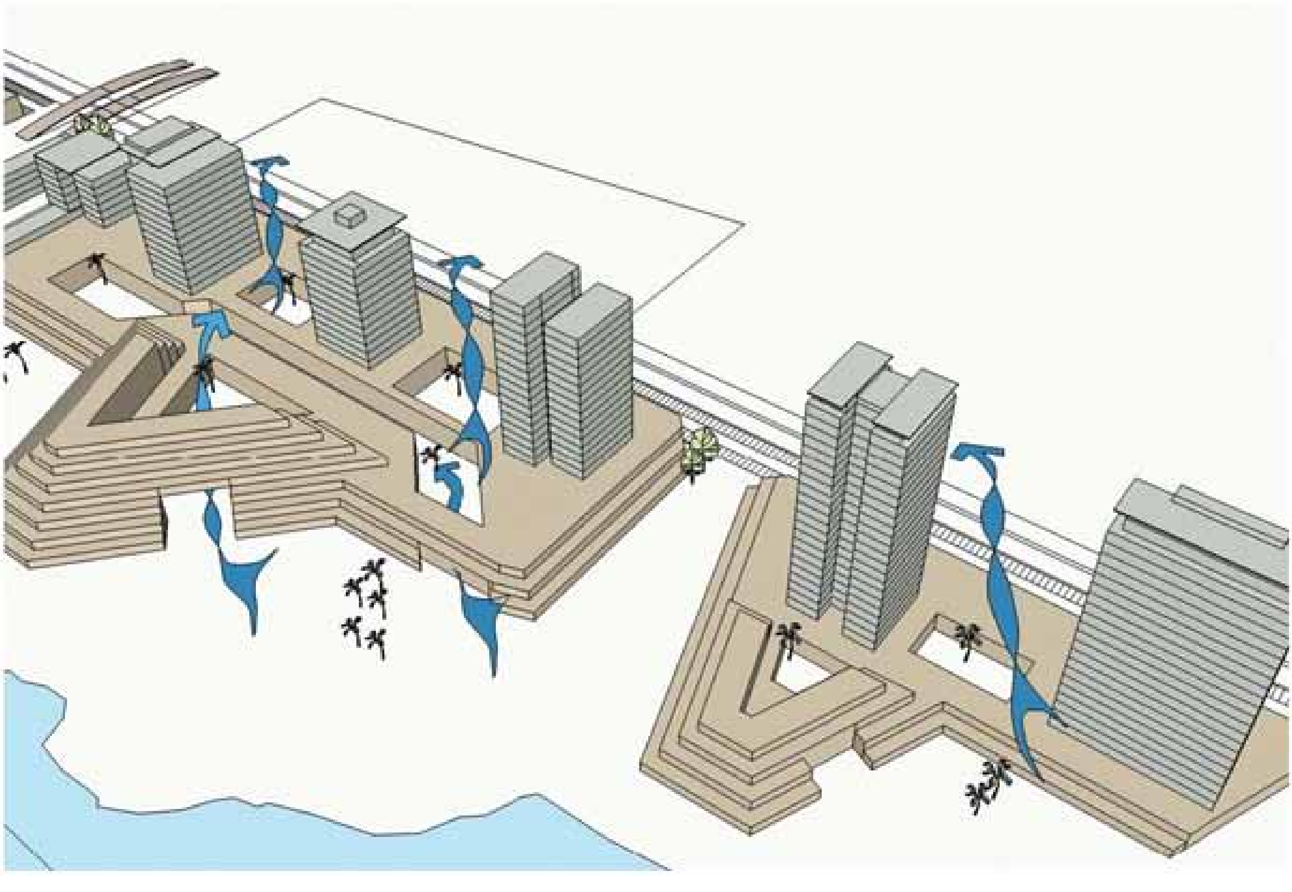
Urban Structure		
Layout:	Is the urban layout structured by connected corridors or district centers and neighbourhood sub-centers?	☐
	Is the development and street layout connected to existing infrastructure and urban areas?	☐
	Are there inner city areas that can be re-developed to re-use land?	☐
Mobility + Accessibility:	Does the development allow access to public transport systems within a walking distance?	☐
	Does the street and pedestrian network allow for optimal connections for non-motorized transport?	☐
	Does the development allow for access to daily basic services within a walking distance?	☐
Zoning:	Does the development allow for distribution of mixed uses on a neighbourhood level?	☐
Density:	Does the planned population density support the feasibility of public transport?	☐
	Does the planned population density support a range of household incomes?	☐

Urban Morphology		
Massing:	Is the building mass configuration appropriate to the context and climate?	☐
	Do the street profiles contribute to the shading and ventilation strategy?	☐
	Do the set-backs required on all sides contribute to the shading and ventilation strategy?	☐
Outdoor Space:	Does the main layout concept and direction support outdoor climate comfort?	☐
Parcellation:	Does the parcellation link with the appropriate distribution of building mass?	☐
	Do the building plots allow flexible building typologies and architectural design?	☐

Building Typology		
Building Typology:	Does the development include a range of building typologies addressing specific locations, orientation and massing limitations?	☐
	Can passive design strategies, in line with climatic and socio-economic context, be developed? (e.g. courtyard building typologies with central open space to optimize daylight access, shading and ventilation).	☐
Architectural Elements:	Can the window wall ratio and shading be optimized to match the climate conditions?	☐
	Can light-coloured surfaces be used for the built form and elevations?	☐
	Can green roofs be accommodated?	☐

Renewable Energies		
Flexibility	Is space allocation for renewable energy integrated into the built + outdoor planning and design?	☐
Integration	Is there an Energy Action Plan for the new development?	☐





Studies to optimize the wind flow were done for a new public-private project in Lattakia (Syria) by Prime Design (Lebanon). The project includes the following energy efficiency features: functional zoning and shading of public space, reduction of automobile use, promotion of public transport

Implementation

In order to ensure effective implementation of the guidelines, appropriate legal and administrative frameworks need to be streamlined, coordinated among the responsible ministries*. All stakeholders need to provide recommendations for interim and long-term application methods.
The implementation discussions in Cairo included the following set of policy recommendations and supporting activities:

Policy Recommendations

- Standards, guidelines, checklists, as well as existing codes for EE need to be harmonized and integrated in planning and decision making procedures on all levels.
- A legal framework needs to be created - for mixed-used, flexible and dense urban neighbourhoods.
- Synergies need to be created - between formal procedures, mandatory standards and the evaluation set for sustainable urban communities (like the Green Pyramid Rating system in Egypt).
- Develop one single assessment and evaluation procedure for developments under public authority.
- Prepare an Energy Action Plan for new developments, requiring fulfilment of a mandatory check list based on the local climate conditions.

Supporting Activities

- Assess the role and capacity of municipal councils to evaluate the EE aspects, standards and applicable guidelines in urban development projects.
- Include integration of EE aspects in the curricula of the academic education of planners, engineers and architects in line with developed standards and guidelines.

Implementation of Guidelines: Egypt

Under the legal framework of Building Law119/2008, New Urban Communities Authority (NUCA), provides all regulations pertaining to new communities outside of metropolitan municipal boundaries in the form of a Terms of Reference (TOR), and is responsible for providing the infrastructure.

Currently most of the urban boundary of New Cairo is either planned, under construction or sold for private development.

Legal Framework and Institutional set-up:

Example of stakeholders and their roles in Egypt

Legal Framework

- Building Law 119 / 2008
- New Urban Community Authority (NUCA) for new community master plan projects
- General Organization of Physical Planning (GOPP) for the existing neighbourhoods

Responsibility for Implementation

- Ministry of Housing Utilities and Urban Development, NUCA and GOPP)
- Local Municipalities / Municipal Council
- Ministry of Electricity
- Ministry of Transport
- Ministry of Water Resources
- The creation of a special Unit for the Environment

Regulatory Authority

- Ministry of Housing and Urban Communities (NUCA, GOPP)
- Ministry of Tourism
- Ministry of Industry

Responsible Authorities for monitoring

- Supreme Council for Urban Planning
- Municipal / City councils
- Non-Governmental Organizations
- Ministry of Environment
- Monitoring unit at NUCA
- Egyptian Green Building Council
- Proposal to create a new independent counsel.

Areas that are under development, in terms of planning, can incorporate guidelines applicable to un-built areas. NUCA could consider providing incentives to these developers (e.g. increased density). This incentive could also be offered to developers of unplanned areas, to encourage the guidelines implementation.
For future extensions, these EE urban planning guidelines can be incorporated as an appendix to the Terms of

* Such as Ministry of Urban Planning, Housing, Electricity, Transport, Education and/or Health.

Reference for new urban communities, and thus be mandatory for developers.
The box on the previous page indicates the legal framework for Egypt, and the related regulatory and monitoring authorities, ie. the institutional set-up with recommendations to improve the implementation of energy efficiency in urban planning.

Summary

In order for EE aspects of urban planning to be fully integrated into the planning and decision-making framework, the understanding and rationale for energy efficient urban planning practices need to be discussed with all stakeholders, so that the guidelines can be collaborative in ownership.
In addition, NUCA should set time frames and assigned responsibilities for various entities, transparency and accountability help to streamline the process of implementing energy efficiency.

Regulatory Recommendations from Training

- Create infrastructural networks and provide adequate links with the existing networks.
- Definition of mandatory or recommended land use.
- Defined relationship between height of buildings and the space in between.
- Control the specification of construction materials to be energy efficient.
- Define a comprehensive energy plan.
- Include energy efficiency requirements in the Terms of Reference for investor bidding to new urban development.
- Enforce the EE Building Code.
- Coordinate the regulations, guidelines and urban plan development with all relevant authorities, ministries and stakeholders*.

The next Steps to support EE urban planning include a detailed review for capacity building across all stakeholders, aswell as detailing of the implementation process for:

1. Types of development (compounds vs. associations vs. private housing on plots, rental properties, built / unbuilt).
2. Building regulations for each type, or TORs, to be reviewed on how to insert the EE regulations.
3. Institutional framework for all items, including transportation feasibility (mapping who is responsible for implementing what, according to development type). This includes getting an understanding of all stakeholders and starting conversations of what incentives can be made feasible.
4. Regulatory framework for each type of development (how does each application get processed upto the building permitting), and where and how to apply the guidelines.
5. Improvement of integration of affordable and public housing into the cities, from an EE perspective to supports efficient transportation of workers to the cities.
6. Assessing the above for another community for example NUCA Alexandria etc. to ensure the development process is the same, and can spread in terms of capacity building and works for all.
7. Assess who and how do permitting authorities (like NUCA) currently follows up (i.e. check) on whether developers are abiding by the TOR. If not, what do they do? Penalties, fines, special departments from various stakeholders. Is there a special department, or are there other kinds of violation regulations in place?
8. Review of incentive based and top-down approaches to implement the guidelines (by consulting and mapping the same as above, but from a developer and market perspective to ensure they both meet).
9. Ensuring that each guideline, mentioned in this brochure, is covered in the future TORs for new urban communities with specifications that do not contradict fire separations and setback and other regulations as common practice by development.


Provide a balance between climate appropriate, efficient, higher density inner city areas of Cairo (left) in comparison with newly built, gated communities outside of Cairo (right), which have insufficient densities to achieve efficiencies. Urban planning has to set the right balance to allow cost effective EE buildings.

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p. 1 Top EE Building typology - TU Berlin Campus in El Gouna Egypt © Orascom
Middle: Urban Planning based on energy efficient transport .
Bottom: Targets for Renewable Energy requires new urban developments to integrate space for it. www.masdar.ae/en/#city/detail/masdar-city-solar-pv-plant

p. 2 Shaded mid-block pedestrian connection - Al Rehab City, New Cairo @ Florentine Visser)

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p. 5 Al Muez Street in Islamic Cairo © Al Kably

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p.27 Inner city @ http://mw2.google.com/mw-panoramio/photos/medium/89447982.jpg, Gated communities outside Cairo, Egypt @ Mohamed Hosny, http://static.panoramio.com photos/1920x1280/25580976.jpg

Figures

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4.2.1b Energy Efficient orientation of streets to accommodate prevailing winds, Al Kably

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4.2.4 Potential modes of transportation for New Cairo, NUCA - Eng Maha Sultan

4.2.5 Examples of central mixed use areas for various modes of transport applied for Cairo, based on UN Habitat (Ed.) (2010): Urban Planning for City Leaders, Nairobi, www.unhabitat.org/pmss/getElectronicVersion.aspx?nr=3385&alt=1

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List of Abbreviations

EE	Energy Efficiency
EU	European Union
HBRC	Housing Building Research Centre
km	Kilometer
MED-ENEC	Energy Efficiency in the Construction Sector in the Mediterranean
MENA	Middle East and North Africa
NGO	Non Governmental Organisation
NUCA	New Urban Communities Authority
p/ha	persons per hectare
RE	Renewable Energy
UTI	Urban Training Institute

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