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COMPREHENSIVE DISSERTATION

The Future of Green Cities

Transformation of Corfu City into a Green One

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Statement of originality

I confirm that I am the sole author of the text submitted for this dissertation, and that all quotations, summaries or extracts from published sources have been correctly referenced.

I confirm that this dissertation, in whole or in part, has not been previously submitted for any other award at this or any other institution.

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Abstract

One of the most important and commonly discussed topics nowadays is the one of preserving and saving the environment. A topic discussed by all of us and especially the media because of the pollution and environmental contamination.

The physical environment is everything we live in; land, air, sea, water, forests and animals. There is also the social environment which has been created by the man and the relationship between the physical and social environment is interpedent. The causes are many but the result remains the same; the environment is ruined with severe consequences for everyone and everything in it.

In order to manage to save and preserve the environment, there should be a mass action and in large scale. Of course it is very important that people grow environmental consciousness; however this alone is not sufficient. Worldwide both governments and nations have realized the importance of environmentalism and have started moving towards it, taking several measures in order to make the cities 'greener'. The greater goal is to manage to transform the cities into green ones.

This paper aims to provide the theoretical background on how to transform a city into a green one, explaining at the same time the advantages and disadvantages of several measures and ways of doing it and also researching the different combinations of these measures.

At the end of this paper, the guidelines of how to transform a city into a green one will have been established. Additionally a proposal for transforming Corfu City, Greece into a green one will have been made, aiming by this way to constitute a very good example and role model for other cities.

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Chapter 1: Introduction

1.1 Statement of the problem

In recent years the environmental pollution because of the great technological process and rapid industrial development is getting more and more dangerous and in many cases catastrophic for the Earth's biosphere. It is divided into urban and industrial pollution and air, water and soil pollution and tends to destroy the fauna and flora of the earth; the fundamental conditions of life in our planet. For example, vast amounts of industrial waste pollute the sea, not only kill the plankton and eliminate many kinds of the animal kingdom but also endanger the health of the people. Factory chimneys emit thousands of tons of poisonous gases and particles, making the life unbearable for millions of urban citizens.

The main problems caused by the degradation of the environment are:

- Greenhouse effect
- Ozone hole
- Atmosphere, water and soil pollution
- Acid rain
- Radioactive pollution
- Temperature ascent
- Ice melting

- Increase of sea level
- Extreme and extensive weather phenomena
- Loss of biodiversity
- Problems in human health

The economic growth of a country is expected to increase in line with the environmental burden. Although activities such as industry, intensive agriculture, transport, tourism etc. increase the GDP (Gross Domestic Product), they also add pollutants, reduce the naturalness and generally degrade the environment. Undoubtedly the need for economic growth is greater than ever. The disconnection between the environmental pressure and the economic growth (decoupling) has been discussed as part of an ecological modernization. Consequently, the decoupling is promoted as a central objective of international environmental policy, as it is a realistic possibility and in fact a prerequisite for reduction of the global environmental degradation. However in most of the big cities we observe an environmental deficit, disproportionate both to the level of economic development which is mainly due to failure of efficient environmental policy and also a lack of true and actual social concern. However technological progress and industrial development are not the only to blame for this situation. It is also related to the unwillingness to act against this problem.

Care for the environment involves developing a stronger social conscience, the promotion of which requires adequate and sustained ideological processes such as education, awareness, information and promotion and enhancement of the volunteerism's value.

The European Union has been the leader in the worldwide environmental rescue campaign. Its environmental policy:

- Requires a high level of environmental protection
- Supports the available scientific and technical knowledge
- Launches prevention and precaution
- Aims at "healing" in the source
- Authorizes a polluter liability
- Pursues sustainability (as a post- industrial cultural change)

Greece has a deficit of environmental policy in contrast to other EU countries. Often this is overlooked since the Greek environment in general appears to be in good shape with little pollution and extensive nature mainly because of the limited industrialization. Tourism is supposed to be the main pillar of economic growth. For that reason there is a need to preserve a high-quality environment.

The delay in environmental policy is rather associated with the limited development of a genuine social concern for the environment. The high ecological interest shown in opinion polls is partly plasmatic as it is not accompanied by the essential awareness of the problem or the willingness to act.

The main pollution problems in Greece are:

- Air pollution
- Water pollution
- Solid waste
- Fires threatening biodiversity and natural resources
- Noise pollution

Sustainability is the main object to preserve humanity. This can be succeeded in a private level, in a society level, in a national level, in a worldwide level. In order to have efficient results though, the level of mobilization demanded, is at least the national one. As the global population amasses in big cities, we have to transform them in “green cities”.

Green city is defined as the city that improves the quality of life of its citizens by promoting the sustainable and balanced development and production and safeguards the social cohesion, while ensuring the protection of the environment throughout the national territory and reinforcing the country's position in international level. In this context also seeks to upgrade the urban environment by respecting the needs and protecting the rights of citizens.



Fig. 1.1

1.2 Aims and objectives

The aim of this paper is to explore the ways in which a city can be transformed into a green one.

The objectives are:

- Explore the methods that can transform a city into a green one.
- Explore the possible combinations of the above mentioned methods.
- Application of the knowledge gained.

The main objective is to try and find feasible solutions that can enhance the environment in which we all live in, benefit from and get affected. This is both for our own benefit but also for the greater goal; to preserve and enhance the environment.

1.3 Methodology

The methodology of this paper will be the following:

1. Research on the ways and methods that make a city a green one.
2. Detailed analysis of each of the methods in order to understand the advantages and disadvantages of each one and when each method is more suitable.
3. Analysis of several case studies in order to observe the combination of different methods and projects.
4. Analysis of already published questionnaires to evaluate the results and benefits for existed green cities.
5. Implementation of the information gathered into a specific city (Corfu), aiming to provide the theoretical background for transforming similar cities into “green cities”
6. Interviews with local architects and specialized personnel of the Municipality of Corfu in order to crosscheck that the proposed alterations match with the needs of the local people.

1.4 Outcome

The outcome of the paper will be as following:

- Chapter 1- Introduction: Statement of the problem, its historical background and analysis of this paper's structure.
- Chapter 2- Literature Review: Research on the background of green cities.
- Chapter 3- Context: Presentation of Corfu as a case study and proposal of different measures in order to transform it into a green city.
- Chapter 4- Methodology: Quantitative analysis based on studying already published questionnaires and qualitative analysis based on both case studies of green cities and interviews with specialized and appropriate magnates of Corfu Island.
- Chapter 5- A step further beyond- what more could we do if ideally were starting to build a city from the beginning?: Analysis of some more solutions
- Chapter 6- Conclusion: Summarize the results gathered and evaluation of this paper's outcome.

Chapter 2: Literature Review

Over the past few decades, the idea of sustainable architecture seems to have become a common trend in the development of the world's major cities. Allowing for a more reasonable use of the natural resources and a way for people to coexist with nature without destroying it, sustainable architecture seems to be the only way out of the existing environmental problems in urban environment. The emergence of green cities, where sustainable environment has spawned, is a major breakthrough.

2.1 Sustainable Environmental Policy as the Key Means to Fight the Emerging Issues

The development of green cities has sufficient grounds to base on and is quite reasonable in the light of the current emphasis on the technological development and the boost of industries all over the world, while the environmental issues remain unresolved. According to the results of the green city policy which has been conducted in several worlds' major megalopolises by UN-Habitat, the local authorities have managed to stress the necessity of green spaces rather successfully; moreover, the so-called environmental harmony has been discovered.

The UN-Habitat is an organization established by the United Nations in order to promote socially and environmentally sustainable cities with the goal of providing adequate shelter for all. Part of its action is to produce an annual report regarding the environmental issues in accordance to the social ones.

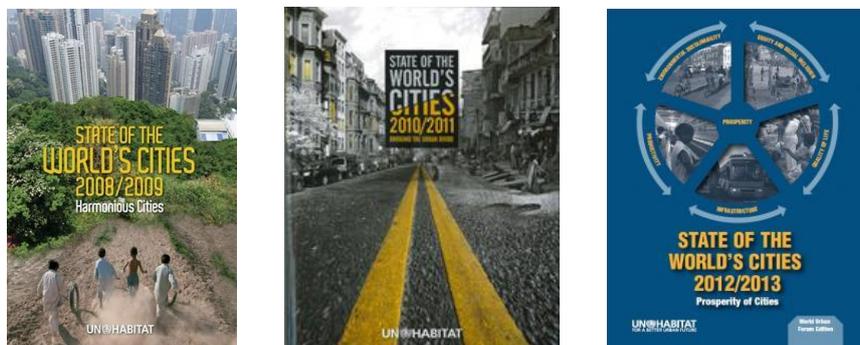


Fig. 2.1.1, 2.1.2, 2.1.3

According to the UN-Habitat 2008, there are three basic types of harmony which the residents of big cities must strive for:

- the spatial harmony
- the social harmony
- the environmental harmony

In the 2008's report, it is emphasized that "A city cannot be harmonious if some groups concentrate resources and opportunities while others remain impoverished and marginalized" (UNO Habitat, 2008, p. x), which means that, to achieve full growth and impeccable development, the city authorities have to focus on the environmental harmony as much as they do on the social aspects of people's lives.

There is no reason to deny that most cities are already pushed to the breaking point with developing their industries in order to take the top position, sweeping the competitors away and retaining their high position; hence, certain cities might not be able to find enough resources to sustain the environment and at the same time remain on top of the economical ladder, which means that the idea of harmony between these three constituents can possibly become a failure. To their credit, though, the members of the UN-Habitat have taken into account the above-mentioned limitation of their solution, adjusting their theory to the countries which have low economical standards. According to the UN-Habitat, each of the existing dominant cities

has the above-mentioned elements in a misbalance "In many cities, wealth and poverty coexist in close proximity: rich, well-serviced neighbourhoods and gated residential communities are often situated near dense inner-city or suburban slum communities that lack even the most basic of services." (UNO Habitat, 2008, p. xii). Therefore, according to UN-Habitat, before turning a certain major city into the so-called green city, there is a reason to check if the basic services which the local authorities must offer to the population are provided and whether these facilities follow some standards.

The UN-Habitat 2008's report tried to establish the harmony between the results of the environmental policies, the social issues and the spatial concerns. It clarifies that throwing the existing funds solely on the environmental issues is most likely to cost certain cities decay in other spheres, such as economics or social development. In addition, it did not focus much on the urban trends at the time which could be observed in larger cities, paying attention rather to the means of reaching harmony between the economical, political and environmental elements in big cities.

In an attempt to correct the mistakes which the previous report had, the UN-Habitat issued its next paper on the trends which megalopolises seemed to have at the time, which were a major breakthrough and the herald of a completely new era for the world's largest green cities. The 2010 paper, points out at the exact problems which stand in the way of making green cities

and at the same time retaining some scraps of economical dominance and can be summarized as:

- Urbanization; which is highly linked to the development process as soon as it creates severe social stratifications, social and cultural divides
- Differential in the population growth according to the different regions of the world, or the different time periods
- Regional trends, mainly between the developing countries and slum areas of the world, which have thankfully started to decrease
- The disjuncture between policy aims and processes
- Lack of coordination between national, provincial and local authorities
- The interests of some groups which in many cases interfere with the urban policies
- The misinforming which in addition to unclear institutional coordination deprives any environmental growth
- The constant policy change for urban expansion and evolution

The previous report that UN-Habitat (2008) offered, provided a detailed account on the existing elements of big cities' harmony. Starting with the world's megacities in 2007 and what they are going to look like presumably in 2025, the paper then skipped to the pessimistic observations of the 90's and 00's, which made the report a bit of confuse. On the contrary, the analysis of the 2010 offers figures and data which are fully related to the state of big

cities. While in 2008 report the researchers have only decided on what makes a city harmonious and proved that the idea of green cities is worth existing, in 2010 report, the results of the green city policy are already evident. In addition, the reports addressed such issues as the versatility of the megalopolis society: “A society cannot claim to be harmonious if large sections of its population are deprived of basic needs while other sections live in opulence” (UNO Habitat, 2008, p. x) and “the urban divide between “haves” and “have nots” opens up a gap [...] which can produce social instability or at least generate high social and economic costs not only for the urban poor, but for society at large” (UNO Habitat, 2010, p. viii).

Speaking about unifying a multi-layer urban society, it is obvious that a society cannot be homogenous – on the contrary, its multiple layers serve their specific purposes, making the society a clockwork mechanism. Without its different substrata, the society is most likely to stop functioning. Therefore, the UN-Habitat’s idea of making the society of green cities more homogenous can possibly fall flat in future or lead to some drastic changes. Analyzing the given change in the UN-Habitat’s attitudes towards the green city policy, one can assume that this change must have been triggered by a lack of understanding of the way in which a megalopolis society is built and the delicate balance in which its elements are arranged.

After all the attempts which have been made by the UN-Habitat to implement the idea of green cities and stumbling upon a number of obstacles, such as

the misbalanced economic state that did not allow for giving the environmental issues much focus, the UN-Habitat report of 2012 accounts of the current situation and plans for the future seem much more realistic, since it is evident now that the organization knows the key problems which it will meet on its way and will have to overcome.

Since the previous records showed that large cities need to get their priorities in line and that the environmental issues can be solved only once the economical and political concerns are out of the way, the idea of green cities' prosperity came to the forth. It is rather reasonable that from the concept of merely making cities cleaner and less polluted, the UN-Habitat came to the complex ideas of having the many elements of a city's prosperity in balance. Moreover, it is important to stress out that the UN-Habitat did not deny any of the original premises of their concept, but, on the contrary, stretched these premises to the point when they embraced every single element that adds to the well-being of the citizens.

It starts with the necessity to spread environmental awareness and states the results of the existing issues within world's largest cities as well as smaller towns: "In many cities, national economic policies and investments are mostly the result of government decisions and budget allocations" (UNO Habitat, 2008, p. xi) and then attempts to define the very concept of green cities as "resilient and inclusive towns and cities" (UNO Habitat 2010, p. v), the UN-Habitat finally came to developing the strategy for the further course of

actions. Therefore, it can be considered that the idea of green cities has evolved greatly over the past few years.

In addition, it was very successful that the UN-Habitat finally managed to tie in the necessity for cities to develop their environmental strategies and the effect which the latter can have on the city's economics: "However, responses to global crises must also allow for a vigorous role for cities" (UNO Habitat, 2012, p. 11). Therefore, it can be concluded that at present, the course for improving the existing situation with the green cities has been set.

Despite the fact that there are a number of obstacles in the way of the implementation of the green cities program, the UN-Habitat seems to have managed to come up with a decent and a very detailed strategy concerning every point of greening the world's major cities. For instance, it is quite surprising to see that the aspect of the environment and the public space has been taken to a completely new level. According to the report offered in the research by Simpson and Zimmermann, the idea of making public spaces greener and at the same time keeping the city's infrastructure undamaged has been recently updated: **"Urban development planning increasingly focuses upon the spatial environment in terms of the revitalization of districts and city centres, urban public spaces and the interconnection of fragmented urban landscapes, and to develop a conscious and welcoming image of humane liveability within the urban experience"** (Simpson & Zimmermann, 2012, p. 40).

It is truly remarkable that in such short amount of time, the UN-Habitat came from simple concepts to the concerns that large cities have, and complex ideas of how to rearrange cities with the minimum of changes and the maximum positive impact on the environment. The idea offered by Simpson and Zimmermann already is a legitimate problem solution which has been successfully introduced into a number of cities and will be introduced to even more of them in the future. Of course, it must be admitted that the practical solutions which Simpson and Zimmermann offer are very flawed, which is quite understandable, as soon as the idea of green cities is relatively new, and there was not much that could have been done in the timeslot from 2000 to 2012.

In addition, it is quite impressive that the authors deal with the transportation issue as well, since the latter poses quite a number of threats to the environment with all the pollution and the CO₂ emissions that it causes: “Sustainable urban transport research and practice has focused on specific problems such as pollution, road safety and on various measures and their effects” (Simpson & Zimmermann, 2012, p. 39). Even though Simpson and Zimmermann stress that a more integrated approach is required to figure out to what extent the transportation issues impact the environment, it is still quite impressive that the transport issue has finally been mentioned in regard to its impact on the nature.

However, despite all the positive aspects of the research offered by Simpson and Zimmermann, it is still clear that some of the concerns for the environment remain unresolved, such as the abovementioned transport pollution issue. One has to give credit to the existing researches, though, for highlighting not only the negative aspects of using oil-powered transport, but also the fact that there is no alternative to the petrol cars at present and the fact that, once banning the latter from using, one will inevitably observe the city's decay (Simpson & Zimmermann, 2012, p. 40); this is a very legitimate point.

Another idea is to create "affordable, attractive, comfortable and sustainable buildings" (Simpson & Zimmermann, 2012, p. 39). It seems a perfect solution, yet, sadly enough, the change of attitudes towards the environment, which the given approach requires, is quite hard to make, as the researchers claim (Simpson & Zimmermann, 2012, p. 40). Hence, the aspect of sustainable architecture needs further development (Sassi, 2012).

Stretching the idea of green cities to the concept of green urbanism, Timothy Beatley offered a renewed approach to the problems which urbanism has posed to the humankind in terms of environmental sustainability. It states clear-cut problems which need to be solved in the nearest future: "How cities sustain themselves as access to resources beyond their boundaries diminishes is one of the greatest challenges for the future" (Beatley, 2012, p.185). Therefore, it can be considered that the concept of green cities has

made the humankind aware of the existing problems and that at present, the green cities approach has become fully reasonable; moreover, it seems that the green cities strategy is currently the only way to sustain the environment and at the same time retain the same economical and social status for the world's largest cities (Beatley, 2012, p.185).

Furthermore, is worth mentioning the fact that Beatley brings the issue of an ecological footprint and tries to define its reasonable boundaries. The moment which defines the boundaries for people's habitat, can be considered as the pivoting moment in the development of the green cities concept, because Beatley eventually brings the audience not to think about how to make people's impact on the nature milder, but how to keep it to the minimum, without spreading cities further until there is not a single untouched spot left on the planet.

Another important issue concerning the green city concept which Beatley mentions is the fact that each of the world's largest cities requires a unique approach in the implementation of the above-mentioned idea. According to Beatley, **the major resources of each city, as well as its infrastructure, the main weaknesses and the key assets, are to be analyzed before getting down to making the city green.** As a matter of fact, Beatley reconsiders the entire idea of the green city; while the UN-Habitat considered a green city the one which is "safer, greener and better serviced" (UNO Habitat, 2008, p. 35), Beatley broadens the concept, pointing out that "in a

green city, green areas are diverse and functional, from an ecological as well as experiential point of view” (Beatley, 2012, p. 115). Therefore, in 2012, the idea of a green city is not making the entire city be buried in abundance, but turning the megalopolis more environmentally friendly (Cohen, 2010). It is clear that the current point of green city development is not yet the point of destination and there is much more to discover; however, the provided solutions seem rather adequate responses to the current environmental concerns.

2.2 The problematic sectors of modern cities

The main problematic sectors of the modern cities can be summarized as:

1. Atmosphere

The problem of air pollution in cities is in relation to the emission of pollutants such as CO₂, NO_x, SO, particulate and NO₂ and O₃, derived from vehicle emissions, heating and air conditioning of buildings, the production process of industries and power plants, etc. These pollutants and their micro particles contribute to the greenhouse effect, the creation of photochemical smog and acid rain with serious consequences to the environment and the health of the citizens.



Fig. 2.2.1

2. Temperature

Temperature in urban areas is several degrees higher compared to regional areas. This is because the rougher surfaces (concrete, blocks,

marbles, etc.) absorb heat more rapidly than the liquid soil and reflect other surfaces, heating the local microclimate (Boscoe,2003). The volume of a city's building is the result of multiplying its surface per area of land. This helps in storing more heat during the day, the emission of which at night makes impossible dew. The incidence of this phenomenon in buildings is stronger with increasing height and whether their direction is west (Bernatzky, 1974). Buildings finally block the passing air that could be beneficial as a cleaning agent urban air (Bernatzky, 1974).

Also the lack of vegetation in cities contributes to the intensity of the phenomenon adding to the lack of moisture, which would help to exhaust the temperature, after all the rain water reaches the sewer system (Bernatzky, 1974).

The increase of the area of green spaces could reduce this phenomenon. Measurements have shown that, in parks width 50-100m., the temperature drops up to 3.5C (Bernatzky, 1974).

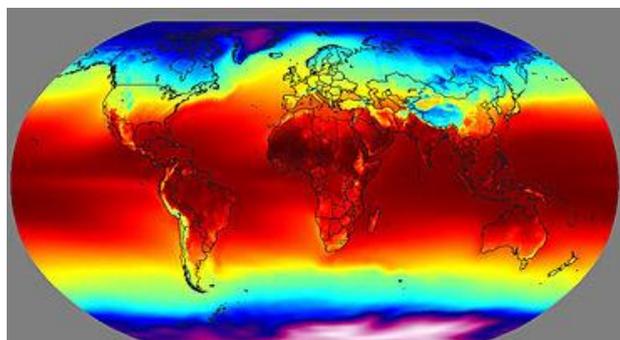


Fig. 2.2.2

3. Draining Water

Urban areas exhibit stronger effects of runoff rain water from natural areas due to a greater proportion of non-absorbent surfaces, which has now become a great environmental concern. The inability of retaining large amounts of water after storms from the surfaces of urban areas, leads to phenomena such as sewerage flooding and pollution of streams (Boscoe, 2003). The reason is that the rainwater that passes through urban environments carries many harmful elements and residues such as insecticides, heavy metals, etc., which may end up in lakes and rivers (VanWoert, 2005).



Fig. 2.2.3

4. Energy Consumption

The large increase in world population and the corresponding expansion of urban centres has led to excessive consumption of energy as a result of the increasing consumer needs and their needs

for energy, resulting in all fields (Industry, Trade, Home - building sector, etc.). Especially in Greece, residential sector accounts for approximately 30% of final energy consumption at a national level and therefore is responsible for 40% of total production of carbon dioxide (Greek Ministry of Environment).

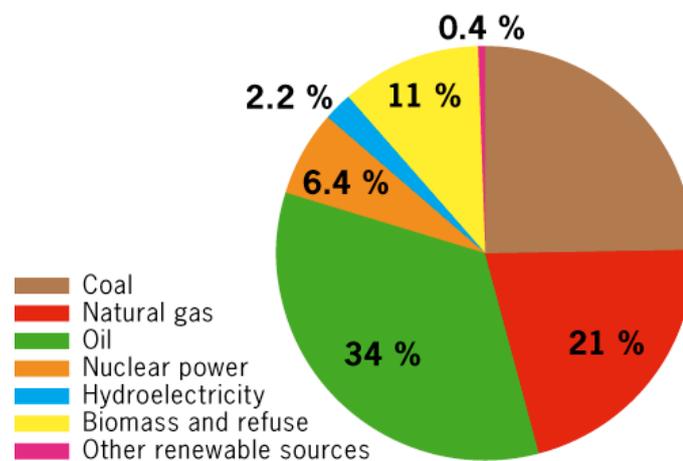


Fig. 2.2.4

5. Public Health

The lack of sufficient oxygen and quality air in the cities is the cause of many diseases and reduces the work productivity of people. Moreover, the prevailing colours in urban environments (red, yellow and gray), increase the levels of stress and fatigue. Instead, colours that would benefit the citizen's psychology, such as blue and green, are becoming rarer (Bernatzky, 1974).

2.3 Historical Background

The trend and the roots of a green network date very early from the early 20th century when Schmidt in 1912 (Haaren and Reich, 2004) proposed spatial planning of cities, recognizing the value of green networks in cities. However, the main roots and origins of environmental education can be found in the global environmental movement of the 60's and its precursor movements of the first decades of the 20th century, characterized by the movements of "conservation", the "study" and the "protection" of the environment. Internationally speaking, the concept of environmentalism matured and developed in the late 50's and during the 60's. It was the result of queries and concerns of sensitive and conscious citizens. At the same time there was the answer to the request of the international community to address the ever-increasing environmental problems.

Key facts and dates:

- The First International Meeting on Environmental Education was held in Nevada, USA in 1970. In this meeting the term "Environmental Education" is established and the first definition of it is formed: "Environmental Education is the process of recognizing values and clarifying concepts to develop in people and in social groups the necessary skills and attitudes for the understanding and appreciation of the interdependence of man, culture and

biophysical environment. Environmental education requires practical engagement in decision-making and involves the formation of a code of conduct for any human issues and problems relating to the quality of the environment.”.

- In Stockholm in 1972 was met the first Intergovernmental Conference on the “Human Environment”. In this conference is recognized for the very first time by the international community the need for promotion and strengthen of the environmental education in order to face the environmental pollution. Also in this meeting was established the U. N .E. P. which later on was renamed into U. N. E. S. C. O.

- In Belgrade in 1975 was established the famous “Charter of Belgrade” in which is expressed the opinion that the most important role of the environmental education has to be "the conformation of a world population with awareness and concern for the environment and global environmental problems, a population with knowledge, skills and desire to compete personally and collectively to address these problems and prevent the development of new ones in the future”.

- The First Intergovernmental Conference was organized in Tbilisi, Georgia in 1977. This conference was a milestone and a landmark in the history of environmental education in which were established the content, the

goals, the objectives, the characteristics and the basic methodological approaches. The document "Declaration of Tbilisi and the 41 proposals" is the most valuable text up to today regarding the environmentalism.

- In 1987 in Moscow was organized the International Conference on Environmental Education and Instruction and Training. During this conference were observed the following:

- The state of the global environment was very alarming, although in a society level there was an increased awareness and action to tackle environmental problems. Problems such as the diversion of the greenhouse effect or thinning of the ozone layer, acid rain, pollution and contamination, loss of biodiversity, deforestation, desertification and depletion of natural resources worsen everyday due to the fatal ecological crisis.

- The environmental action cannot be effective as long as it faces the problems only in a technocratic way. These problems will only be solved with a rather long way, which will aim to shape a new global environmental ethos by shaping new attitudes, behaviours, values, knowledge and skills of individuals and social groups.

- The environmental education has the ability and can help promote the concept of sustainable development to the public.

- At the World Conference of Rio de Janeiro in 1992 and at the International Conference in Thessaloniki in 1997 is established the connection between the environmental education and the sustainable development. It is worth noting that U. N. E. S. C. O.'s interest in an independent activity is significantly restricted since 1995.



United Nations
Educational, Scientific and
Cultural Organization

Fig. 2.3

2.4 Conclusion

“The role of cities as providers of economic, social and environmental functions is:

- Environment: to reduce environmental impact and resource use to ‘sustainable’ levels, and enhance environmental quality and safety.
- Economy: to enhance long term resilience, competitiveness, employment and equitable distribution of resources.
- Society: to enhance health, education, security, equity, cohesion, diversity and ‘quality of life’. ” (Ravetz, 2000)

“The methods for capacity and quality assessment are:

- Critical capacity: level of pollution which causes significant or irreversible damage to human or ecological health.
- Ecological footprint: the notional land area needed to supply primary energy, materials and products.
- Environmental space: estimates the global equal distribution of resources and assimilation capacity.
- Ecological rucksack: a ratio of total material consumption to useful outputs of goods or services.
- Eco-indicators: global targets for environmental pressures to minimize human and ecological risk

- Natural step: long term goals for zero emissions, zero minerals use and zero toxic chemical accumulation.
- Urban capacity: acceptable pressures and thresholds in the physical, environmental, social and economic functions of cities.” (Ravetz, 2000)

Having in mind all these, there are several ways of transforming a city into a green one, that concur with the methods that Mr. Joe Ravetz indicates.

To summarize, green cities can offer:

- Connection of different urban functions
- Recreational opportunities (Haaren and Reich, 2004)
- Ability to design walking routes (Southworth, 2005) and prompting residents to become more ‘pedestrians’
- The possibility to enrich the biodiversity of cities (Sarikou, 2005) (Haaren and Reich, 2004) and facilitate establishment of colonization of new habitats (European Habitat Directive, 1992)
- Improvement of thermal comfort and urban microclimate (Giannas, 2001) (Georgiou and Zafeiriadis, 2006)

Another important role of a green city has to do with each economy. How we build our cities determines how we use energy within them. Denser, more

walk able communities use much less energy than car-dependent ones. Multifamily homes use much less than homes on big lots. Compact urban infrastructure beats sprawling systems (Steffen, 2012).

Of course certain disadvantages may occur from such transformations, such as demands for a high capital in terms of money in the beginning, or the need of demolition of parts of a city and nuisance during the transformation of the city but the greater goal is very important; the environmental preservation and the benefits both for it and also for the people.

Based on statistics published in *“Going Green; How cities are leading the next economy”* (LSE Cities, Going Green, p21), the most successful outcome of green policy objectives had to do with increasing recycling and composting action (23%), then increasing green spaces (14%), reducing water pollution (14%) and air pollution (14%), increasing energy efficiency (12%), protecting/enhancing biodiversity and ecosystems (8%), increasing energy security (7%), reducing greenhouse gas emissions (5%) and finally reducing resource consumption (3%).

The greater aim is to allocate all the ways that can enhance a city and help transform it into a green one, and also investigate the possible combination of these ways in order to have the maximum environmental benefit with the minimum cost and nuisance to the people’s lives.

Chapter 3: Context- Corfu as a Case Study

In order to provide the background for each city aiming to be transformed into a green one, a theoretical application of the knowledge gained will be proposed for Corfu Island, Greece.



Fig. 3.1.1 Corfu and its location in Greece



Fig. 3.1.2

3.1 General Information

Corfu Island is the most North- West island of Greece, in the Ionian Sea (part of the Mediterranean Sea). Its coast line covers a length of 217 km in total, forming several bays and headlands. The terrain is mainly mountainous, especially in its Northern part.

It is one of the densest islands of Mediterranean in terms of population (193 inhabitants/ km²). It covers an area of 591 km² and reaches a population of 103.300 people (Greek Government's Census, 2011).

The capital city of the island (Corfu) has a population of approximately 35,000 people, and the rest of the population is spread throughout the island in several villages. Its architectural style has many influences; the island was occupied throughout its history by Venetians, French and English conquerors, making it an architectural intersection of many styles and nations. Corfu's old city is an UNESCO World Heritage Landmark since 2007.



Fig. 3.1.3, 3.1.4, 3.1.5

The World Heritage Committee inscribed the Old Town of Corfu Island, Greece, on the World Heritage List on the basis of criterion (iv). The urban and port ensemble of Corfu, dominated by its fortresses of Venetian origin, constitutes an architectural example of outstanding universal value in both its authenticity and its integrity.

The overall form of the fortifications has been retained and displays traces of Venetian occupation, including the Old Citadel and the New Fort, but primarily interventions from the British period. The present form of the ensemble results from the works in the 19th and 20th centuries. The authenticity and integrity of the urban fabric are primarily those of a neo-classical town.

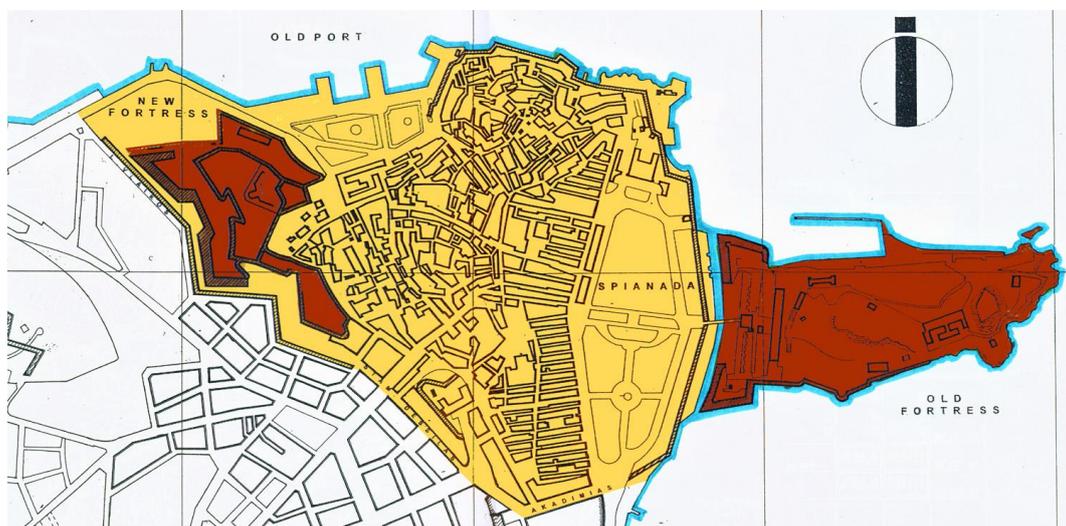


Fig. 3.1.6: Old Town of Corfu Island

Following is the map of the City Centre of Corfu Island. The area surrounded by the bold, black line is the Old Town of Corfu Island.



Fig. 3.1.7: Old Town of Corfu Island and the rest of the city centre

3.2 Proposed alterations/ addendums to the city

3.2.1 Public Transportation

Transportations are responsible for the 31% of the total energy consumption in Europe and responsible for the 21% of the pollutants that worsen the greenhouse effect (40% of these pollutants turns up in the European cities). The pollutants rate is constantly rising with the transportation being responsible for the 74% of them. The propulsion of the public transport is imperative as soon as it is one of the best solutions to both save energy and reduce the environmental pollution. Public transport consumes 3 to 4 times less energy per passenger per km compared to cars.

Of course in order to convince citizens to use the public transport, the authorities should cater for the best possible service, which is succeeded with measures such as:

- Bus priority measures- new bus lanes
- Comprehensible information system for the passengers
- Efficient services- waiting areas
- New routes to cover the most part of the city possible
- Park and ride spaces
- Guided buses

- Clean buses

In Corfu, there are two bus-services; the first one is the municipal bus service that serves the city centre and its surroundings, in a circle of radius approximately 12 km and the second one is the bus system that serves and connects the rest of the island with the city centre. The first bus service is quite good, with frequent routes all around the city. However the second system needs a lot of improvement both in term of facilities but mainly in terms of routes and schedules.

Although public transport seems to be satisfactory there is a lack of parking spaces and a lot of traffic congestion, in Corfu Town. The town is densely built with utter inability to create parking spaces.

It seems that the city needs a new infrastructure, more parking places and a new management system for the urban mobility. The concept of the Park-and-ride facilities, located in the suburbs of the town, with connections to public transport, allowing people to head into the city centre to leave their vehicles and transfer to the bus system, seems to be very attractive. Also a new mini bus system that would run very frequently between the car parks and the city centre would complete the plan. We should try to prevent the entry of people to the city center and give them incentives to use public transportation. This will achieve

a reduction of pollutants and noise in the city and also improve aesthetic image of it.

The existing parking areas (blue spots) and the proposed new ones (red spots), are shown on the following diagram.

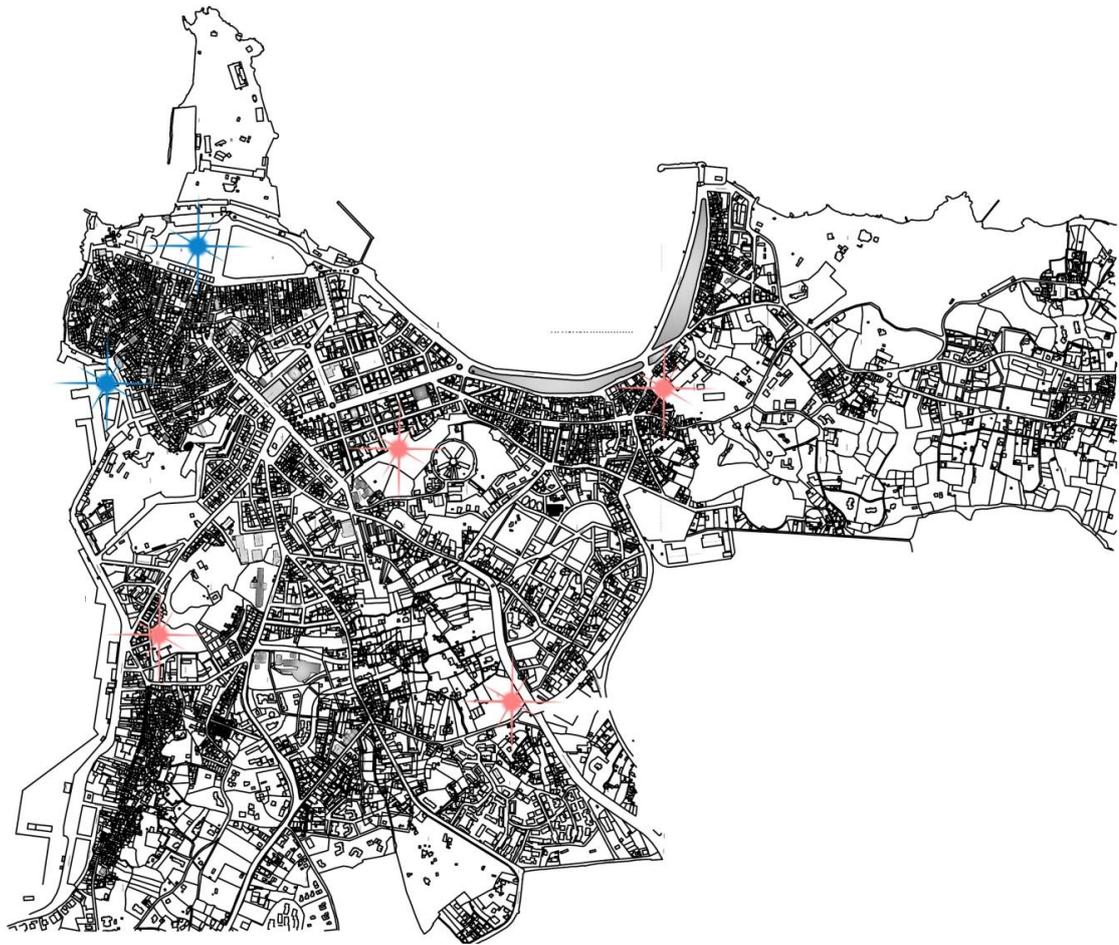


Fig. 3.2.1.1

We should also consider the installation tram routes in the city, in order to reduce crowding and pollutants.



Fig. 3.2.1.2

3.2.2 Bike Lanes

Bike lanes should be established in the cities as soon as cycling contributes both into our transportation and also in entertaining ourselves. The environmental benefit for a city that has bike lanes is great as soon as:

- It is beneficial for our health
- It is an environmental friendly mean of transport
- Low maintenance cost
- Flexible mean of transport that can be parked everywhere
- Less money spent in gas, oil etc.



Fig. 3.2.2.1

Corfu has already a bike lane system since 2009. However this system does not work anymore, as soon as the routes were not sufficient and they were in many parts misplaced causing trouble to the pedestrians, the traffic and the cyclists. Also, due to lack of environmental concern of the public, several of these routes are nowadays destroyed or ignored.

There should be a new study of where and how these bike lanes should be placed and also aim to create more routes; the current bike lanes are mostly for the tourists and visitors of the island, as they cross mainly the historic parts of the city, leaving out the new town.

The current bike lanes are shown on the diagram.

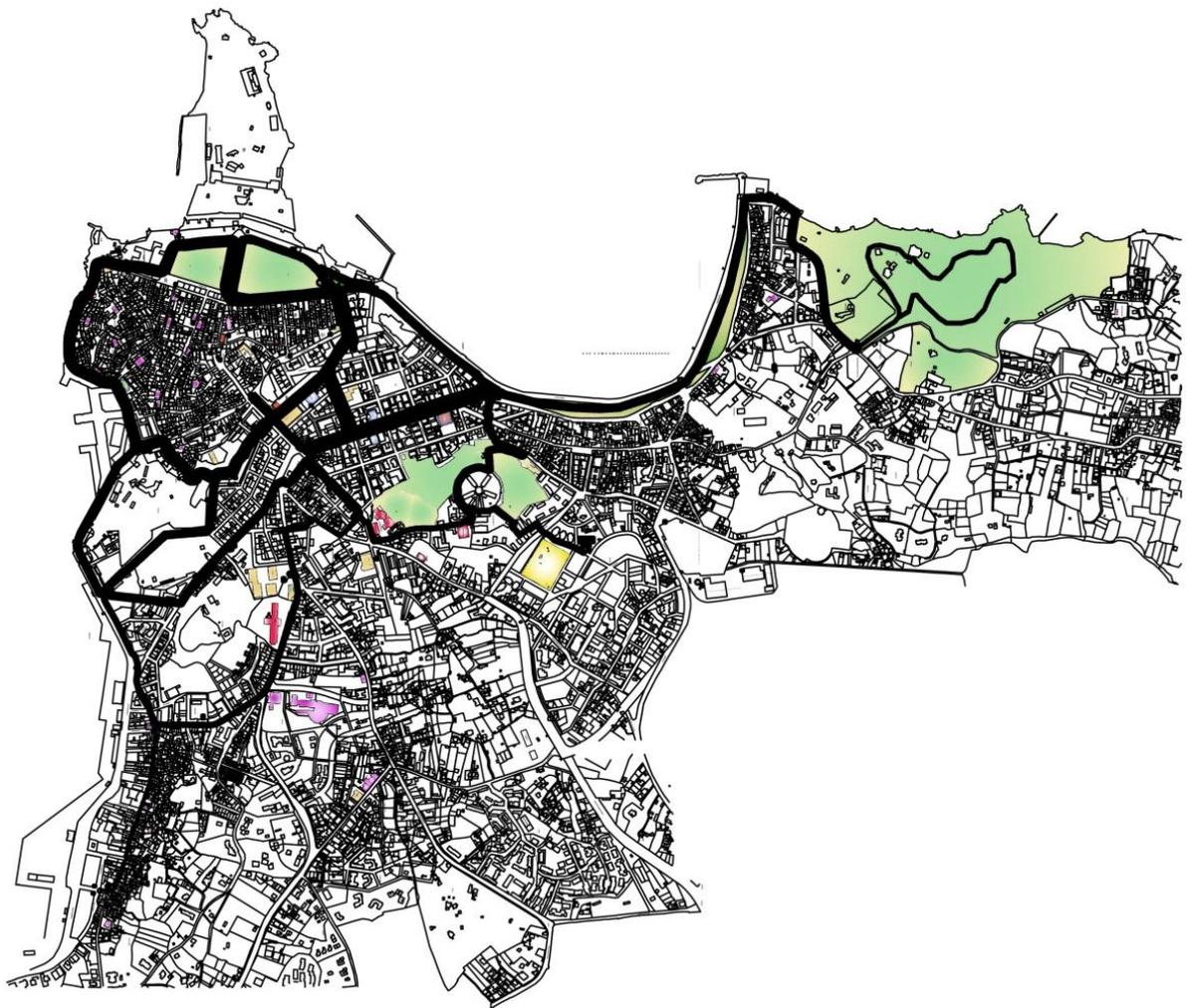


Fig. 3.2.2.2

3.2.3 Green Buildings

Buildings are responsible for the conquest of land, energy and water consumption and environmental pollution. The decrease of their energy consumption and the pollution they cause is really important, not to say essential for the future with all the climatic change occurring.

The term green building is referred to the energy consumption of it. It is also referred in the erection or the renovation of it by using environmental friendly processes that use the maximum efficiency of the available resources during its lifetime.

All buildings can more or less be transformed into green buildings. The benefits of them affect the energy consumption, the economy and the society:

- Protection and improvement of the biodiversity of the ecosystem
- Improvement on the water and air quality
- Reduction in the waste streams
- Preservation and restoration of the natural resources
- Reduction in the operating cost of the building
- Outspread and creation of new green products and services
- Improvement on the productivity of the building's users
- Optimization of the building's cycle of life
- Improvement in the living quality

- Emergence of the aesthetics

There are several techniques in order to make a building green:

1. Improve the building's envelope

The energy consumption of a building is highly connected on its envelope. As years go by there is the tendency to better insulate the building in order to have less energy loss.

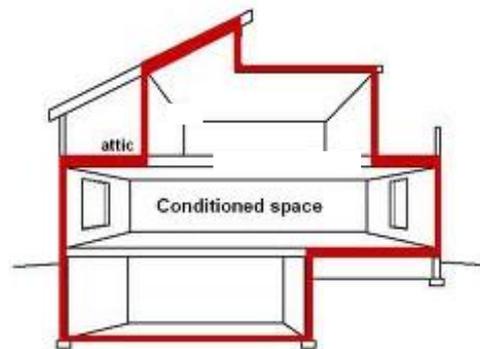


Fig. 3.2.3.1

2. Upgrade its heating and cooling system

New technologies which are more energy efficient and less harmful to the environment can be implemented such as:

- Air systems
- Heat pumps
- Radiant floor heating



Fig. 3.2.3.2

3. Green roofs

Green roofs are the new outbreak and the new trend in most European cities, offering great advantages such as:

- The temperature on the inside of the building drops during summer from 3 to 10 °C.
- During winter there is less energy loss from the inside towards outside.
- The insulation used in the green roof, which is located beneath the green layer protects much better from the UV radiation and the fluctuation of the air temperature.
- Because of the evaporation phenomenon the temperature drops even more during the night.
- The rain water is used for irrigating.
- The air pollutants are filtered and captured in the green roof and also if the building's users use the green roof as a terrace, they also live in a healthier and more beautiful environment.
- The green roof also acts as a noise barrier.

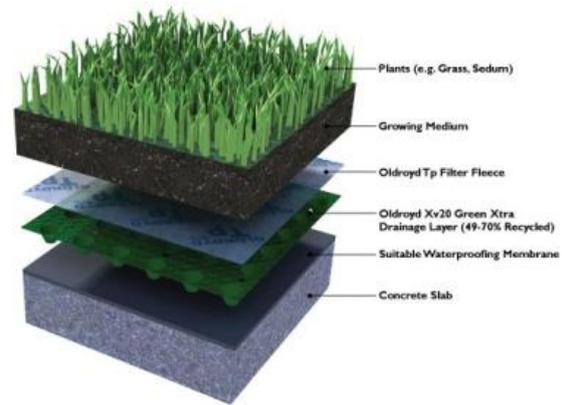


Fig. 3.2.3.4

4. Implementation of PV panels

The implementation of PV panels is also a highly rising trend as it offers many benefits such as:

- They have a long lifetime
- They have zero function cost
- Their maintenance cost is very low
- They are very flexible in terms of upgrading
- They are autonomous



Fig. 3.2.3.5

5. Design improvements- green facades, green spaces etc.

The implementation of green facades and generally green spaces in the buildings can be very beneficial for both environmental reasons (as their action is similar to the parks explained earlier in this paper) and social reasons as they enhance the aesthetics, they offer a healthier environment and also add to the psychology of the citizen, as it reduces the sense of being in a big, bustling urban centre.



Fig. 3.2.3.6

Corfu's most buildings, especially in the city centre were built until 1970's. Of course during that time there was no serious environmental concern and education; so this building lack to this sector and most of them are categorized under the category D. It is obvious that their environmental performance must be improved.

Regarding the rest of the island, there are either very old houses in the villages, that are also very traditional and not many alterations to them can be made or new buildings, built with more environmental concern.

Consequently, most of the buildings that should change are located in the city centre.

3.2.4 Recycling and Composting Programs

Recycling is the process of collection and elaboration of waste and the production of new products from the elaborated waste. It is a very beneficial technique as soon as through it we succeed:

- Conservation of the natural resources
- Reduction in the pollution and the health risks associated with the incineration and land filling
- Reduction in the amount of waste and its disposal cost
- New jobs are created contributing to the economic development of the society
- A greener and more sustainable way of thinking is 'cultivated' to the citizens



Fig. 3.2.4.1

Furthermore to add to the impact that the recycling process can have for the environment, we have the process of composting. Composting

is the process in which the organic waste is recycled and offers many benefits such as:

- Low cost procedure
- Short in time procedure (less than 6 months), making it a widely used one
- Does not produce/ release harmful substances to the environment
- The product of this process is fully and naturally absorbed by the environment
- Creates 4 times more new jobs in comparison to other techniques such as land filing

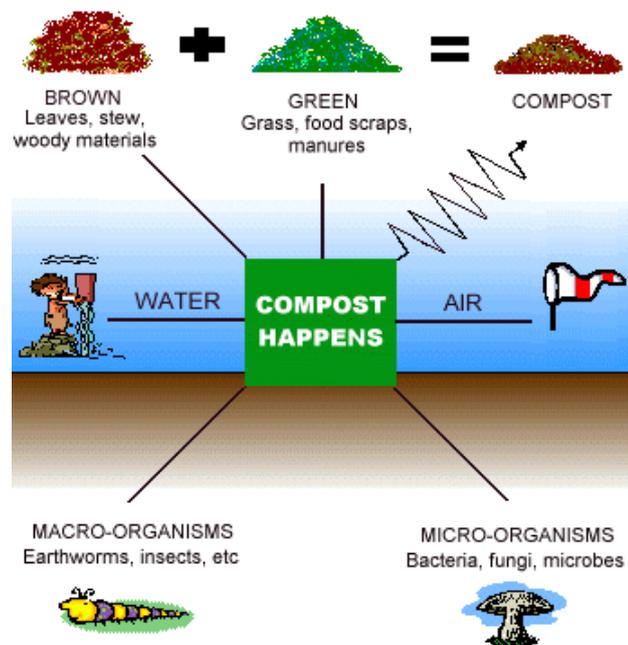


Fig. 3.2.4.2

Corfu lacks in terms of recycling and composting programs. The wastes of the city are land filled, and the sewage undertakes biological treatment. There is a program for collecting the recyclable elements from municipal solid waste (such as metals, plastics, glass and paper) and then disposing them into blue containers. After their collection, recovery of these materials in a specialized facility takes place.

It is vital to encourage the citizens to recycle and compost their waste. Also it is vital that the appropriate facilities for this aim are constructed, so a new complex of buildings for recycling and composting should be created somewhere in the middle part of the island, in order to be able to serve the whole of it.

3.2.5 Renewable energy sources

Renewable energy sources is defined as the non fossil energy sources, such as wind, solar and geothermal energy, wave energy, tidal energy, hydro energy and gases resulting from landfills, sewage treatment and biogas. They are clear and environmentally friendly sources that produce electricity without releasing pollutants or toxic gases.

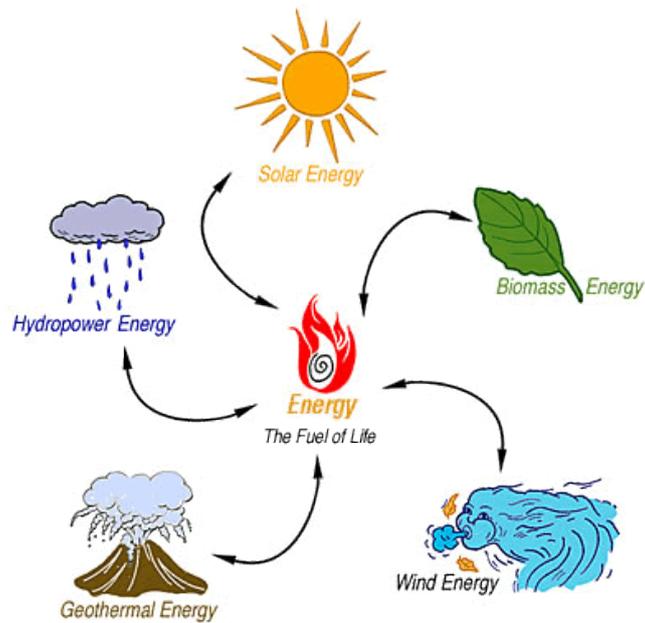


Fig. 3.2.5.1

1. Exploitation of wind, solar and biomass

- Wind energy

Exploitation of the wind energy is succeeded mainly through wind turbines, in wind parks. These turbines convert the wind's kinetic energy into mechanical one and then into electric one. This way of energy production is very efficient and can cover high demands of energy need. . If the energy production is higher, it can be stored for future use.



Fig. 3.2.5.2

- Solar energy

Exploitation of the solar energy is succeeded mainly through the installment of PV panels. The PV panels absorb the solar energy and transform it into electric one. They have great benefits such as:

- Environmentally friendly technology; No pollutants or harmful substances are produced
- The solar energy is inexhaustible and has no cost

- The system produces no noise
- Almost zero cost of maintenance.
- Long lifetime
- Can be installed in already built structures such as on the roof of a building



Fig. 3.2.5.3

- Energy from biomass

Generally biomass is defined as the material that has biological (organic) origin. In other words in the term biomass is contained any material derived directly or indirectly from the nature. The biomass produced every year in our planet is estimated to be 172 billion tones and only a small part of it is exploited as soon as only the 1/7

of the worldwide energy demand is covered by biomass energy. Biomass energy is produced by:

- The vegetable materials derived from physical ecosystems and energy crops
- The by-products and residues of plant, animal, forestry and fishing production
- The residues derived from the processing of the above mentioned materials
- The biological part of urban sewage and garbage

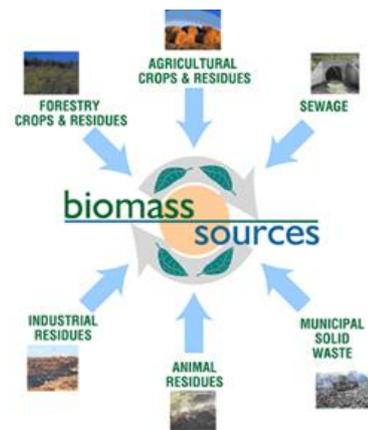


Fig. 3.2.5.4

Biomass does not produce any CO₂ or any other harmful substance. The benefits of using biomass as a renewable source of energy are:

- Wider diversification of the raw materials used
- Reduction on the dependence of the imported energy
- More environmentally friendly energy production

- Substantial contribution to the implementation of decentralized production
- Introduction of new “clean” technologies for the combustion of solid fuels in the energy system
- Energy reclamation of the waste generated and overall, a better management of them

2. Exploitation of geothermal energy

Geothermal energy is defined as the energy derived from the internal part of the earth and appears in the form of hot water or steam. Geothermal areas are often identified by the steam coming out of cracks on the earth’s crust or by the presence of hot springs. There are two main implementations of this kind of energy:

- Heat utilization of land for power generation and other uses (such as heating buildings and greenhouses).
- Exploitation of the warm masses of soil or groundwater to help operate heat pumps

The advantages of this kind of renewable energy are:

- Exchange savings by reducing oil imports

- Conservation of natural resources mainly by reducing the consumption of domestic lignite reserves
- Healthy environment

However the big disadvantage of this kind of renewable energy is that it cannot be applied everywhere, as soon there is the demand of some kind of hot water or steam deposit. Also it demands a considerable amount of money for the facilities of mining.



Fig. 3.2.5.5

3. Exploitation of the sea's energy

The sea covers the 75% of the planet's surface and can be considered a colossal, global energy "reservoir". It absorbs huge amounts of wind and solar power, which later on appear with the form of wave energy. Additionally it "contains" several other forms of energy in the aqua system such as tidal energy,

the ocean thermal energy and the salinity power. All these types of energy have a common element; the high energy density which is the highest amongst the different types of renewable energy. Nowadays the main two ways of taking advantage of the sea's energy is by using the wave and the tidal energy.



Fig. 3.2.5.6

- The wave energy

It is estimated that if we used even the 1% of the wave potential of our planet then the worldwide energy demand would be covered by 4 times. The facilities needed for using the wave energy have the benefit of not covering any land and also the visual and audio disturbance is zero as they are implemented in the sea.

There are 4 different techniques:

- Pulsating water columns
- Floats
- Floating docks
- Floating modular systems



Fig. 3.2.5.7

- The tidal energy

The technologies associated with the tidal energy take advantage of the fluctuations in the sea level during the

tide. These fluctuations are inherent in “tidal streams” which are horizontal displacements of marine mass, of about the same frequency. The streams are quiet strong and particularly suitable for energy use, also because they appear at relatively shallow depths

Generally this way of producing energy is considered as a highly efficient one. The technologies are similar to the ones used to produce wind energy with the difference that because of the greater density of the water, the size of the tidal stream needed to produce the same energy is much smaller (approximately the $\frac{1}{4}$ of it). Finally, similar to the wave energy, the visual and audio disturbance is zero.



Fig. 3.2.5.8

It is more than obvious that in the most part of Greece, due to its location and weather, it is highly recommended and beneficial to use or invest to renewable energy sources. Greece has a superb sun radiation capacity

Particularly in the tourist island of Corfu, the most core combination of renewable energy sources for energy supply should be:

- Solar or photovoltaic energy by developing PV parks. During the summer months, when radiation is at its peak, the island has a huge increase in demand due to the influx of millions of tourists. And state agencies, local industries, and many hotels have shown a strong willingness to use photovoltaic energy.
- Wind, or aeolic, power as Corfu has a profile of more than 8 metres/second and/or 2,500 wind hours. This attractive wind profile calls for the installation of wind farms.
- Sea energy; this one would probably be the most beneficial way as Corfu Island is surrounded by sea and in the west faces the open sea of Adriatic.

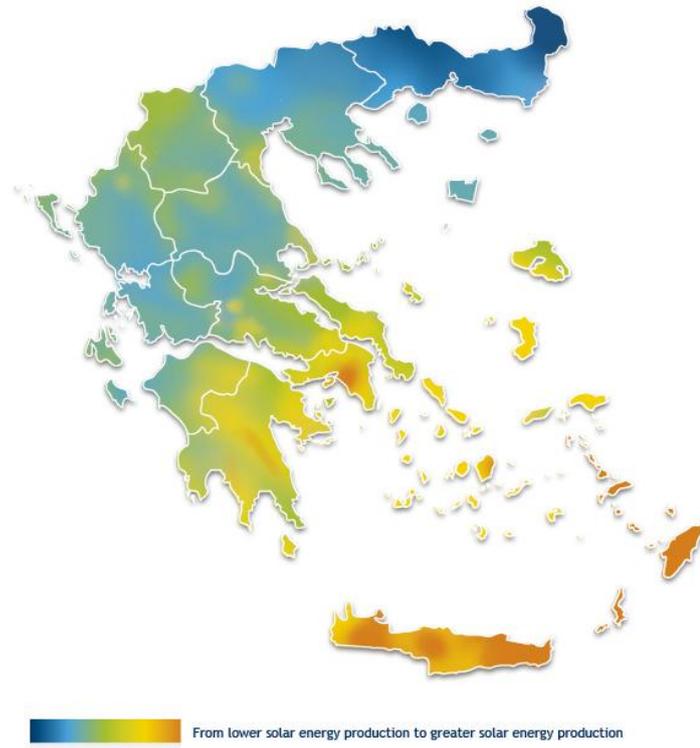


Fig. 3.2.5.9 Solar Map

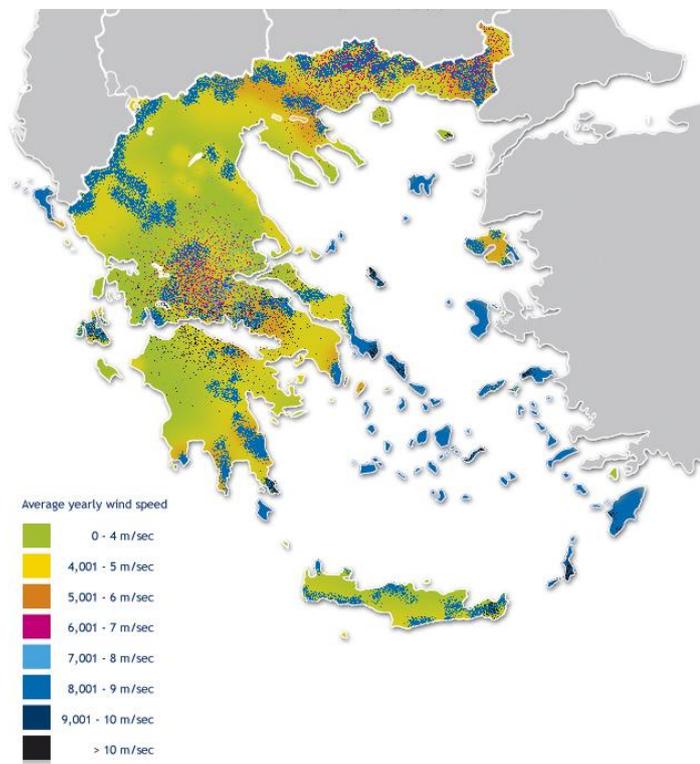


Fig. 3.2.5.10 Wind Map

3.2.6 Eco-Vertical Farms inside the city

It is estimated that by 2050 the 80% of the worldwide population will live in the cities. It is also estimated that the human population will rise by then at a minimum of 3 billion people and that 1 billion hectares of new land (about 20% more land than the surface of Brazil!) will be needed to produce enough food for all these people if we continue farming with the traditional way. Nowadays more than 80% of the earth's land is suitable for farming with approximately the 15% of it been ruined by false management.

The concept of eco –vertical farms, established in the heart of the cities is a rising value. Such farms should be established in the heart of the city offering enhancement of the environment, microclimate improvement, sustainable organic food production throughout the year and possible comeback of ecosystems that have been sacrifice for horizontal farming.

The advantages are many:

- Production throughout the year
- 1 internal acre will be equivalent to 4-30 outdoor ones or more depending on the farm's type and the site
- No crop failure due to weather conditions (e.g. droughts, floods and pests)
- All food grown organically; No herbicides, pesticides or fertilizers
- Returns farmland to nature by restoring ecosystem functions
- Dramatically reduces fossil fuel use (no need for tractors, plows, transport, storage etc.)
- Converts abandoned urban properties into food production centers
- Creates sustainable urban environments
- New job opportunities

Apart from all these advantages, eco-vertical farms can attract alternative masses of people enhancing by this way the local tourism, with great benefits for the economy, something really important as we are all aware of the worldwide economic crisis that plagues lots of countries nowadays.

Considering the case of Corfu, there is an excellent location to create a mixed-use concept with farming, a community garden, and a neighborhood market. It is a plot of land of 1 hectare in the heart of the new town, which hosts the facilities of the old city hospital. The plot is next to the biggest school complex in Corfu, near the Ionian University and in the heart of a dense urban area, with lack of open spaces. This idea assumes all the above mentioned advantages, but most important gives environmental consciousness to the new generations.



Fig. 3.2.6.1

This spot is presented on the following diagrams:

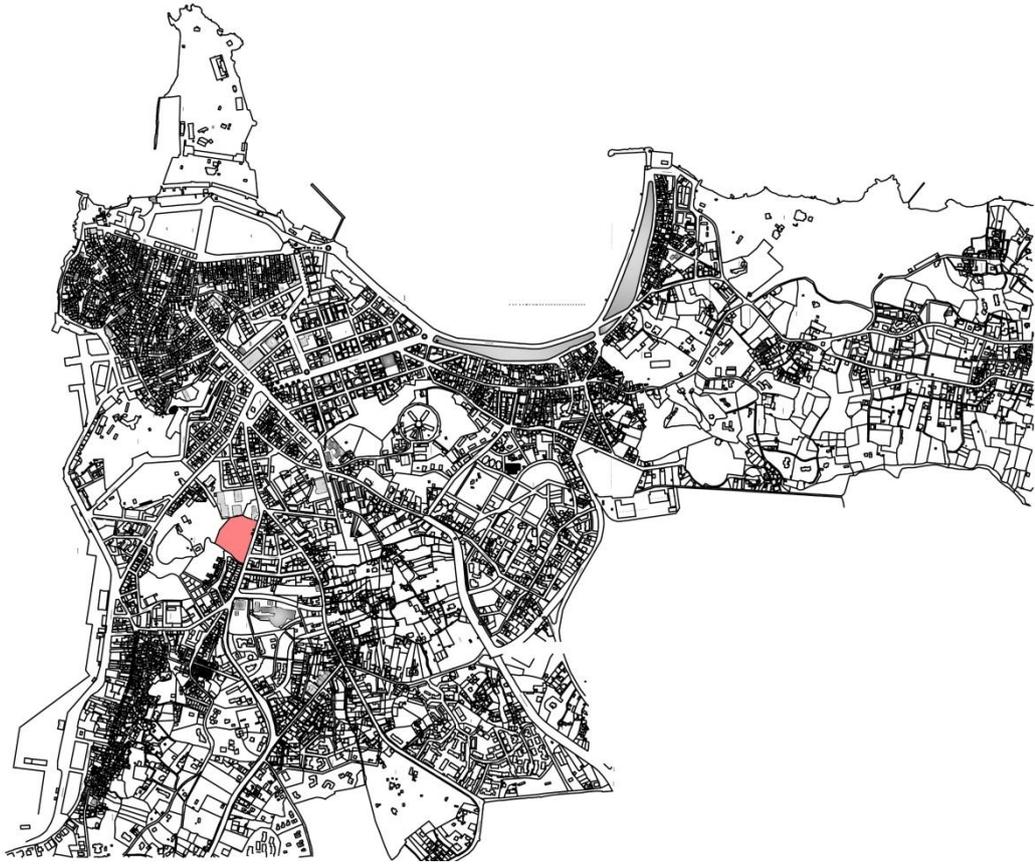


Fig. 3.2.6.2

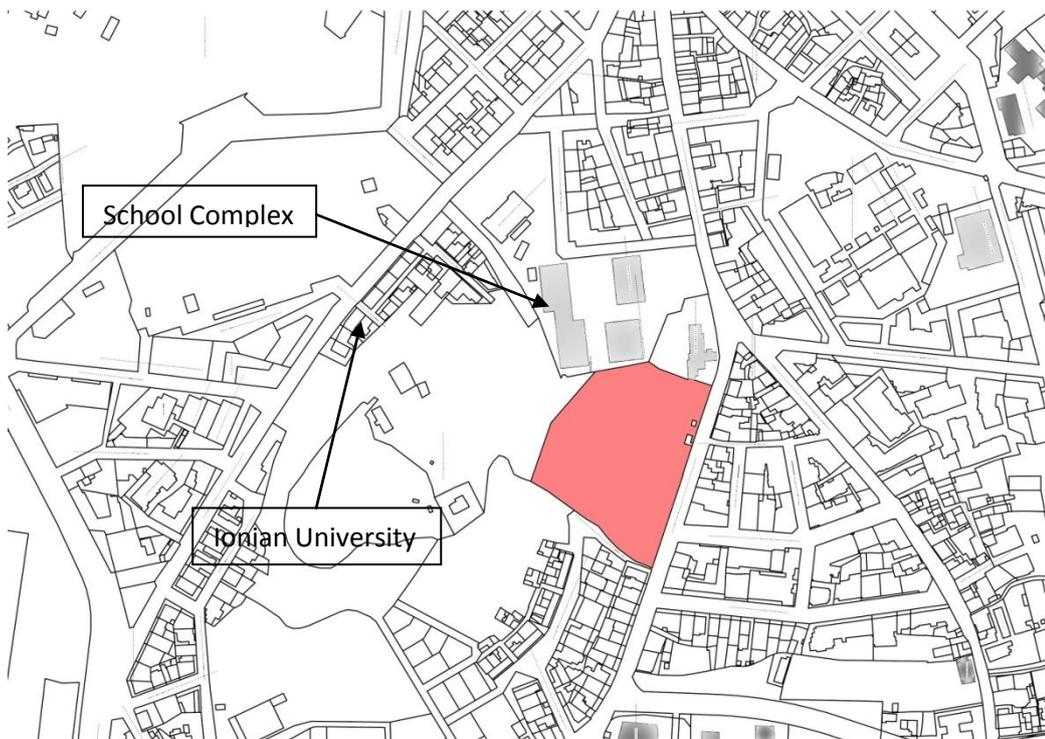


Fig. 3.2.6.3

Chapter 4: Methodology

4.1 Quantitative Analysis

4.1.1 Examination of already published questionnaires/ analyses

At this point of this paper, it is important to examine two other aspects regarding green cities; these are the public awareness and the economic impact of environmentalism and green growth.

Are the people conscious/ aware of the environmental problems? Are they aware of what environmentalism and its benefits are?

In order to investigate these aspects, analysis of the results of already commenced questionnaires and statistics will follow.

Based on a questionnaire commenced in the citizens of Ithaki Island (a similar island to Corfu Island) regarding the green growth the results showed that (Green Growth, p12-17):

- Almost half of the respondents (53%) claimed to know well enough or very well what the term green growth represents (p12)

- The knowledge regarding green growth derived mainly from the television programs (32%), from internet and web (26%), from the social environment (22%) and in the last positions are the press (11%) and other printed resources (9%) (p12)
- The 81% of the respondents claims that green growth can provide a better way of living and protect the environment (p13)
- Regarding the question "Which renewable sources of energy do you know?", the 20% of the respondents claims the wind, same amount the sun, 19% the water, 14% the wave energy, 13% geothermal energy, 9% biomass energy, 2% the natural gas and 1% both the petroleum and the lignite (p14)
- 69% of the respondents claimed to use in their everyday life energy saving devices (p15)
- 22% of the respondents claimed to recycle every day, frequently the 25% of them, rarely the 34% of them and never the 19% of them (p16)
- The majority of the respondents (70%) are willing to replace their car with a hybrid one (p16)
- Finally also the majority of the respondents (69%) claims to urge their social entourage to preserve and safeguard the environment (p17)

Also based on statistics published by LSE Cities *“Going Green; How cities are leading the next economy”*:

- In order to make the green objectives a crucial part of a city’s political agenda the most important role seems to play the change in the local political leadership (27%), then the public opinion/ awareness (20%), then the pressure from national/ super national government (17%), then pressure from stakeholders (16%), then the sewage treatment and disposal (12%) and finally a particular crisis (8%) (p20)
- The most important problems to be improved when talking about environmentalism is the air pollution (10%), and then follow the severe storms and flooding (9%), the solid waste processing and disposal (8%) and the litter/ dumped household waste (8%), the storm ware management (7%) and the sewage treatment and disposal (7%), the clean drinking water (6%), the noise pollution (6%) and the water shortages (6%), then the lack/ loss of green space (4,5%), the ground contamination (4%), the energy shortages/ scarcity (4%) and the water shortages/ droughts (4%), the sea level rise (3,5%) and the loss of ecologically productive land (3,5%), the food shortages (3%), the land/ soil erosion (2%) and forest fires (2%), the light pollution (1,5%) and

finally the timber, mineral and other natural resource shortages (1%) (16)

As we see from the statistics, although there is some environmental concern, it is not considered as sufficient, when only half of the respondents claim to know what green growth is or recycle in a frequent basis. Also it is quite interesting that the majority of the respondents knew the wind, water and solar energy as renewable energy sources and unknown the energy from biomass.

Also we note that there is not only one prominent environmental problem in urban areas; it is the combination and the coexistence of them that should be faced.

On the other hand we observe a very positive attitude towards green growth and environmentalism from the citizens. The aim from now on should be to inform the public better and mainly make it more active towards environmentalism, obligating the government to move towards sustainability.

Regarding the economic relation to environmentalism, based again on statistics published in the *"Going Green; How cities are leading the next economy"* (p25), the respondents have claimed

that environmentalism helps in attracting/ stimulating investment (13%), increasing innovation (10%), job creation (10%) and reducing unemployment (10%), economic growth (GDP) (9%), entrepreneurship/ new SME creation (8%), economic resilience (7,5%) and attracting skilled workers (7,5%), increasing city revenue (7%) and economic efficiency (7%), promoting ecotourism (6%) and finally productivity enhancement (5%).

Additionally the green factors that provide the biggest economic benefit to the local economies are the green transport (20%), the green retrofitting of existing buildings (18%), the renewable energy (17%), the new green buildings (16%), the energy distribution and management (13%), the green goods and services (9%) and the green finance (7%). (*“Going Green; How cities are leading the next economy”*, p26)

4.2 Qualitative Analysis

4.2.1 Case Studies

The European society is mostly urban as the 80% of European citizens live in the cities. This does not mean though that the environment should be neglected. In order to reward cities that have met high environmental standards and have set ambitious environmental targets for the future, the European Commission decided to reward each year a city with the title "Green Capital of Europe". The aim of this award is for the cities to develop a healthy competition in the field of sustainability and promotion of the environmental protection, the use of renewable energy and eco- projects.

Following are presented the five, far too now, cities awarded with this title (as soon as this institution was established in 2010) along with some other great examples in order to observe and study the different combinations of the several methods, and their astonishing results, one may say.

4.2.1.1 Stockholm

Stockholm was awarded as the first “European Green Capital 2010”. It occupies a land of 209km² of which 21km² are water surface and its population is almost 800.000 people. For the last 20 years, the environment is the main concern of the local government declaring that by 2050 the city will be a “city without carbon”.

Following are presented some very interesting facts:

- The 68% of the city’s surface is covered by high quality greenery containing a national park (covering a space of 27km²), 8 natural oases, approximately 100 smaller parks and 40 gardens
- The 95% of the citizens live in a distance of 300m of a green space!
- The water of the city was systematically consolidated over time so that today this water is suitable for swimming or even fishing activities in the heart of the city
- The 2 sewage treatment plants produce biogas used by both the local transport and for the heat demands of the city
- All citizens live within a walking distance of 300m of any public transport stop. The public means of transport cover the 65% of the total transport within the city, and are powered mostly by renewable energy. Especially the mass percentage transferred during peak hours reaches a number between 64-77%

- It has 760km of bike lanes and cycling paths which will be doubled by 2020. More than the 80% of office buildings promote cycling through the integration of appropriate traffic and parking spaces, adequate incentives etc
- In residential areas the speed limit is between 30-50km/h avoiding by this way both possible accidents and also noise pollution
- The establishment of tolls into the city's center since 2007 decreased the use of car by 20%
- The CO2 emissions decreased between 1990-2005 from 5.3 to 4 tones, while the number of people exposed to noise greater than 35db declined over the years from 220.000 to just 20.000. This was succeeded by very good programming in the field of energy saving and sustainable movement.

Nowadays, the main goals of the local authorities are to qualitative upgrade open public spaces and also upgrade the buildings in terms of energy demands. It is estimated that the current energy demand of a building (158KWh/m²/year) will be decreased to 30-60KWh/m²/year.



Fig. 4.2.1.1.1

4.2.1.2 Hamburg

Hamburg was awarded with the title "European Green Capital 2011". It is a city "on the water" with a high quality of life. Its population is 4.3 million people, of which the 1.8 million people live in the city centre, making it the second largest in population city of Germany. In addition, more than 300.000 people enter the city daily in order to work. It houses more than 500 industries along with the fact that is the third largest port in Europe. That makes Hamburg a transport and trade centre and also a touristic attraction with really challenging demands in terms of environmental preservation.

Following are presented some very interesting facts:

- More than 16.7% of the urban area consists of forests, recreation areas and green spaces within an organized network for easier access to them for the residents
- It implemented measures to save energy in public buildings and the annual savings of the city in this field are 46.000MWh
- They estimate that by 2020 the CO2 emissions will have decreased by 40% and by 2050 80%
- All residents of Hamburg have access to public transport within 300m
- Programs for energy recovery of older buildings
- Use of environmentally friendly taxis with low emissions
- Renewal and renovation of the wind parks available for better efficiency

- Establishment of environmental routes that highlight the ecological aspects of Hamburg- on foot, by bicycle or public transport. On these routes the inhabitants of the city and its visitors have the opportunity to learn about the wide range of environmental programs conducted in the city and in the wider region

The detail that made the difference and helped Hamburg to stand out from the other candidates of that year was its proposal to launch a “train of ideas”, in which various cities “own a wagon” and promote green ideas, achievements and plans for the future. This train should visit Copenhagen, Malmo, Gothenburg, Oslo, Tallinn, Riga, Warsaw, Vienna, Munich, Zürich, Marseilles, Barcelona, Nantes, Paris, Brussels, Antwerp and Amsterdam transferring ideas for sustainable urban development and protection of the environment and its resources.

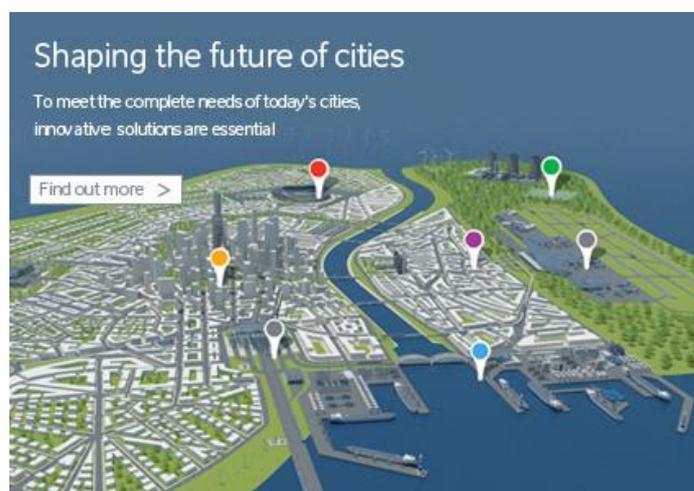


Fig. 4.2.1.2.1

4.2.1.3 Vitoria-Gasteiz

Vitoria-Gasteiz was awarded with the title “European Green Capital 2012”. It is located in Spain and is a medieval city, dating back to 1181. It is the capital of the historic area of Alava and in the city lives the 76% of the area’s population with most of the area’s industries and services located in the city. Generally it is a medium sized city consisting of an urban area and with a population of approximately 240.000 people plus 64 small, rural settlements nearby.

It is the result of 30 years of commitment to sustainability; it is one of the most environmentally friendly cities in Europe in many ways:

- Uses good practices in urban planning, green spaces, recycling, mobility and water consumption of greenery
- Its parks and green areas cover an area of more than 10.000km², with the 4.000km² approximately to be in the city centre and the rest in the wider region
- The strict strategies in urban planning, the broad citizen’s participation and the balanced environmental management allowed the city to harmonize with the natural landscape, creating its cultural identity and allowing it to be a model for urban sustainability
- In every citizen correspond 42m² of greenery

- Same as in the previous cities, all residents have access to public open green spaces within a distance of 300m or less
- The city has 130.000 trees on its streets
- There are two tram lines that complement the revamped bus network of its public transport
- 90km of bike lanes and cycling routes, planned to increase to 164km.
- Half of the total routes within the city are done on foot, because of the 33km extensive network of pedestrian routes
- 73% of the buildings have solar panels
- 210 plots for organic agriculture were created
- The water management program results in a decreasing consumption of it, despite the population growth. The goal is to decrease the daily domestic water consumption below 100 liters per person

One of the most important things about Vitoria-Gasteiz is that it represents the average of a medium sized European city. In that type of city lives the 84% of the European citizens, making Vitoria-Gasteiz the perfect model.



Fig. 4.2.1.3.1

4.2.1.4 Nantes

Nantes is the sixth largest city of France with a population of 285.000 people and was awarded with the title "European Green Capital 2013". It has managed to connect its green and blue areas, by addressing the urban challenges through a realistic program of water management as soon as the city is crossed by two major rivers. The city also borders with several protected areas of Natura 2000 and other protected natural areas, meaning that the conservation of the flora and fauna of the city is a key concern for its citizens.

It is a city that has devoted much time and energy to environmental projects and the fight against climate change:

- Focused on public transport using renewable energy
- Propelled to the city's citizens the use of bicycles by creating bike lanes and cycling routes
- 95% of the citizens live no further than 300m away from any public transport facility
- Any citizen has access to a green space within the walking distance of 300m or less
- The 60% of the land that the city takes is agricultural, green and natural areas
- The first city to bring back the electric tram

- The pesticides consumption in a period of 6 years was decreased by 85% due to good environmental management
- Introduces a new waste door-to-door collection system that will increase the public awareness
- Reduction into the CO2 emissions mainly due to its transport policy

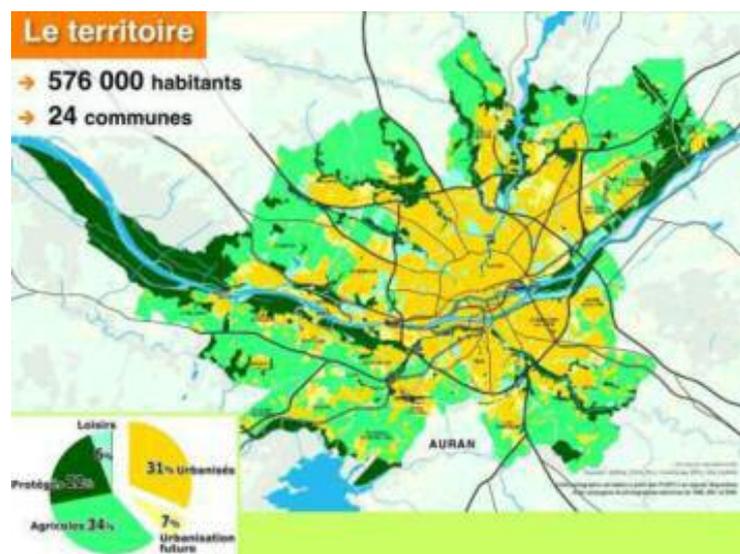


Fig. 4.2.1.4.1

4.2.1.5 Copenhagen

Copenhagen was awarded with the title “European Green Capital 2014”. It is the capital of Denmark with a population of approximately 530.000 people and covers an area of approximately 100.000 hectares. Its good street pattern, its innovative transport system and particularly the priority given to cycling was basically the factors that led the city to success.

- By 2015 the 50% of its citizens will use the bicycle for their transportation. It is characteristic that the government has spent more than 67 million of Euros for the construction of bike lanes and cycling routes
- By 2025 they are planning to have zero CO2 emissions (75% reduction of CO2 emissions will be achieved by radical changes in the city’s energy system, mainly by implementing renewable energy in the heating system of the city)
- Its green spaces cover an area of 23.000 hectares
- Its beaches cover an area of 15km, public to all
- For every citizen corresponds 42.4m² of green space
- By 2015 in the city 14 parks (under 5.000m² each) will have been created and 3.000 trees will have been planted aiming this number to have reach 100.000 by 2025
- Only 1,8% of the waste generated from the city end up in landfills. The rest is recycled or sent for incineration and energy recovery

- In its port there will be created a special office in order to study and advance in green techniques and technologies

Furthermore, Copenhagen has placed at the heart of the development model the public- private sector's partnerships in order to achieve eco-innovation and sustainable employment and growth. The city is cooperating with specialized businesses, universities and organizations in order to develop and achieve green growth. Finally, what made Copenhagen won the competition was mainly the fact that it aims to develop eco-innovation and sustainable mobility and committed itself to serve as a role model for sustainability both in European and global level.



Fig. 4.2.1.5.1

4.2.2 Interviews

In order to verify whether the proposals for Corfu Island are actually the answers to its problems, several interviews with the appropriate experienced and specialized personnel were conducted.

The analysis of the interviews is the following:

1. What is the significance of the environmental problems nowadays?

All the respondents agree that the environmental problems nowadays are very important and their significance is great for the survival of the nations and the earth. Respondent 2 highlights that we should aim to preserve both the structured and non-structured environment and respondent 5 points out that the environmental degradation results in climate change, environmental pollution, lack of clean water and global warming. Also she highlights that all these result in problems in the local economies and that sustainability is nowadays the main axis of the different government's policies. Finally respondent 4 highlights that great efforts have started to take place towards sustainability and the technological progress moves toward it.

2. What is the importance of the environmental consciousness in local communities?

The environmental consciousness in local communities is ranked by all the respondents as one of the top priorities. Respondents 1, 2 and 4 claim that especially in Greece there is environmental consciousness only in a theoretical level, and sadly not in a practical one. Respondents 3 and 5 claim that as soon as the citizens realize that by harming the environment they actually harm themselves, a very good start will have been made. Respondent 4 allocates the lack of environmental consciousness in the absolute lack or insufficient information of the public.

3. Which are the environmental problems of Corfu Island and which of them do you think is the most important one?

Corfu Island is a very green one with plenty of natural wealth. All the respondents agree that the building sector with its rapid growth mainly due to the high amount of tourists that Corfu Island attracts every year, has destroyed the environment and is ranked as the number one problem by respondents 1, 2, 3 and 4. Apart from that, there is the problem of water pollution in the island, which is ranked as the number one problem by respondent 5, and then there are the problems of waste disposal, and the noise and atmosphere pollution in the city centre due to the high traffic levels.

4. In which way do you think that these problems are faced both on the part of the state and the people?

All the respondents agree that the state faces these problems with statutes and crackdowns. Also they all agree though that these measures are not implemented properly. On the side of the citizens there is some action; not sufficient though. Respondent 5 claims that possibly smaller in scale measures might be proved more sufficient.

5. Do you think that extra measures towards these problems should be taken?

According to almost all the respondents no extra measures should be taken; the current ones should be properly implemented. Respondent 5 questions though the current measures as soon as no problem is solved far too now, something that in a way proves their insufficiency.

6. Do you think that more parks and public quality spaces should be created?

As stated earlier on, Corfu Island is a very green island full of natural wealth. All the respondents agree that no more parks and public spaces are needed; only better use of the already existing ones. Respondent 2 highlights that in

order to make the most out of the current ones, the citizens should be environmentally aware.

7. Do you think that the Public Transportation System needs to be improved?

Regarding this aspect respondents 1, 2 and 5 agree that the current Public Transportation System lacks of quality service and is aimed towards specific parts of the citizens; the minors and the elders. Something very interesting is that respondents 3 and 4 did not answer this question as soon as they claimed they have never used this system, something that in my opinion reveals the insufficiency of the system.

8. Do you think that the current traffic and parking network needs reformation?

Again all the respondents agree that the traffic and parking system needs a lot of improvement. The road network is badly maintained and poorly designed. There are no ring roads so the people travelling around the island have to cross the city centre. In the city centre there are no sufficient parking slots, having in mind that the 1/3 of the population of the island (approx. 35,000 people) leaves in the city centre and more than the 1 /2 (approx. 55,000

people) of the population visits the city centre frequently. All the respondents claim that the solution to these would be the creation of parking spaces in the surroundings of the city centre with appropriate connection with the Public Transportation System.

9. Do you think that the bike lanes and routes once existing in the city centre helped/ improved the everyday life of the citizens?

All the respondents agree that the bike lanes and routes once existing in the city centre helped the everyday life of the citizens and promoted the city. Respondents 1 and 3 claim that the most part of the project was well designed; however it could undertake some improvements. Respondents 2, 4 and 5 claim that the project was abolished because it did not have sufficient support from the local authorities when part of the local citizens believed (ostensibly) that the project did not help the economy and diminished the parking slots; respondents 4 and 5 claim that in reality the local economy was improved as soon as there was economic mobility in aspects related to bicycles (shops etc.) and the city managed again to 'breathe'.

10. To what extent do you think that the existing buildings can be considered as 'green'?

Unfortunately all the respondents claim that the current buildings are actually not at all 'green'. Lately there is some movement towards 'green' buildings but needs a lot of effort still, claim respondent 3. Also respondent 5 highlights that there are funds that should be used from the EU in this field.

11. Do you think that the existing recycling and composting programs are sufficient?

In Corfu Island there is no composting programme unfortunately. There is a recycling programme but, as all the respondents claim, is insufficient both because there are no proper facilities and mainly because there is no public awareness. Respondent 5 points out that a good solution and motive for the citizens would be to have some contributory benefits e.g. reduction to the taxes for the citizens that are active to the recycling programme.

12. Do you think that more environmental action should be taken?

All the respondents claim that definitely much more environmental action should be taken. As respondent 5 highlights, Greece generally is benefited from its environment and is much easier to be sustainable. As respondent 2 claims, this action should be precise, orientated and targeted to specific goals.

13. What do you think of the term 'Green Cities'? Is it only an idea or it can actually become a reality?

Almost all the respondents believe that green cities are a feasible goal as soon as there is a general effort and not a fragmentary one, and there is a good urban planning and ways to implement properly the measures. Only respondent 3 doubts whether the green city is feasible in a large scale; she claims that it would be possibly more feasible to smaller communities and maybe more difficult in the whole of a city.

14. Do you think that Corfu Island has sufficient 'green' facilities and infrastructure?

Unfortunately all the respondents state that there are no sufficient 'green' facilities in Corfu Island. The only 'green' facility existing is a biological waste treatment facility, which is old and insufficient. As respondents 4 and 5 claim, Corfu Island is lucky in this field as its climate contributes to not having major and substantial problems yet. However the citizens should not be reassured as soon as the climate changes and environmental problems will be presented if there is no environmental action.

15. Which forms of renewable energy do you think that would be appropriate for future use in Corfu Island?

Most of the respondents, apart from respondent 2, claim as the number one choice the wave and sea energy. In addition to that, the wind and solar energy could also be use and of course as respondent 3 claims, the building sector also should become more sustainable. Respondent 2 states that the best solution is the installation of PV panels on the roofs of the buildings, as soon as they do not cause any aesthetic problem in the landscape and Greece generally throughout the year has plenty of light. .

16. Do you think that there is sufficient public awareness and information? If not, how would you suggest informing the public?

Finally, all the respondents claim again that the public awareness plays a key role. Respondents 1 and 4 state that it should be succeeded through the educational system mainly, while respondent 2 states that each individual should care for his or her own education on the topic. Respondents 3 and 5 state that the main mean of information should be the different environmental clubs with their actions and also the local authorities with seminars and campaigns on the topic. Very interesting is the proposal from respondent 4, who suggests that there should be pilot project of 'greening' a local

neighbourhood so the citizens can observe on their own the benefits of turning green.

4.3 Conclusion

It is more than obvious that the Green City is not just an idea; it can become a reality.

As observed in the published questionnaires, 'green' alterations to the city not only help preserve the environment but also improve the health and the lifestyle of the citizens. They also contribute financially to the local communities, which is extremely important nowadays.

Unfortunately, while people worldwide understand the importance of sustainability and move towards it, even though in Greece people seem to understand the risks and the environmental problems they haven't yet developed their environmental consciousness. For that reason they do not take essential action. The key point is to manage to make people aware of the problem and motivate them to be a part of an environmental society. If this happen, the first and main step in order to preserve and rescue the environment will have been made.

Based on the interviews of the experienced professionals of Corfu Island, the proposed measures and alterations (presented in chapter 3) seem to face the major problems that the island has. Hopefully this paper provides a good

solution and a role model not only for this specific community but also for other cities that are in need of changes.

Concluding this chapter, I would like to highlight a key thesis one of the respondents (respondent 3) stated:

“As soon as people realize that by harming the environment they harm themselves, the first and major step towards sustainability will have been made.”

Chapter 5: A step further beyond- what more could we do if ideally a city was starting to be built from the beginning?

There are several methods, apart from the ones presented in chapter 3, which help improve the state of a city and can transform it into a green one.

5.1 Green Materials

A green project must start with consciousness from the beginning. This happens by considering priority issues such as the “naturalness” of the structure both in a case of a new building or a reconstruction. This means to work with as green as possible materials. Some of the materials that are considered green are austenitic stainless steel, raw clay, lime, adhesive rubber and coconut felt.



Fig. 5.1.1, 5.1.2, 5.1.3, 5.1.4, 5.1.5

Generally, green materials are the ones that:

- Demand less energy for their production
- Can be recycled after their use
- Do not emit harmful particles

5.2 Proper Urban Design

The cities are a place where the citizens live, study, work and entertain themselves.

Proper urban design leads to an "orderly" development that helps to create the community we want. It covers the areas of:

1. Proper land use

It is important to distinguish the areas of a city as the demands, advantages and disadvantages of each one are different:

- Residential areas In this area people want a quiet, healthy and safe environment
- Office area: This area should still be healthy and safe, however the noise levels and traffic rates are higher than the ones of a residential area, so if an office and residential area are mixed, this might cause disturbance in both parties
- Industrial area: This is the area of mass production, which are the less healthy and totally inappropriate to mix with the residential ones. Industrial parks are usually located on the edges of, or outside the main residential area of a city, and normally provided with good transportation access.

2. Sufficient green spaces

As observed in the case studies chapter, parks and gardens located in a grid of 600m, and connected with an organized access network, benefit the residents with healthy environment, as the green absorbs the CO2 emissions. Also people have the alternative to amuse, play, bike, socialize themselves in these areas, becoming more mentally and physically healthy. Green spaces must be connected with bike lanes and bus/tram routes.

3. Sufficient traffic and parking network

Sufficient road network in addition with adequate parking spaces, ensures the lack of traffic congestion, and less noise and atmosphere problems in the big cities.

4. Cycling routes and Bike lanes

Cycling routes and bike lanes should be created in order to disburden the public transport and also improve the citizens' health.

5. Equal Distribution of Public buildings

Buildings such as police stations, fire stations, elementary schools, high schools, colleges and universities, libraries, shopping centres,

government buildings etc. should be properly distributed throughout the city and not gathered all together in the same place, for the better service of residents.

6. Sufficient public transport

Also as observed in the case studies chapter, public transport plays a very important role as it is cheap, reduces the CO2 emissions in comparison with resident's vehicles, and decompresses the traffic congestion. The preferred public transportation is by tram or metro, or by anti-pollution technology busses. In order to suite the citizens the stops should be also in a grid of maximum 600m and the routes frequent.

7. Pedestrian roads

In the late years pedestrian roads have been developed mainly in the historic centre of the cities or in the traditional housing estates, enhancing by this way the local economy.

The pedestrian roads are planning for better function of the centre of the city, the shopping areas, the recreation areas and the residential areas.

Additionally, extra care is necessary in order to plan sufficient pedestrian lanes, which are usually built to separate heavy pedestrian and bicycle traffic from faster moving vehicles along a major road.

5.3 Water Reuse

Recycling and reuse of the water, which will undertake sewage treatment plans is also a key factor when planning to build a green city.

This works by promoting dual water supply; a network of clean, high quality, drinking water and a parallel network with lower quality water which will come from wastewater treatment and from the rainwater collection. This second network would be used to meet the needs of washing, watering the parks/greenery/gardens of the city, the use of cisterns of the toilets and so on.

In a home level we could recycle the wastewater generated from domestic activities such as laundry, dishwashing, and bathing. Greywater can be recycled directly within the home, garden or company, using a separate plumbing system.

Generally the water reuse and recycle will play a critical role in the green city of the future, having in mind that due to the global warming and the environmental degradation the rainfall rates are constantly decreasing.

5.4 Smart Energy Policies

Apart from renewable energy, several smart energy policies can contribute and make a city greener, such as:

1. District Heating

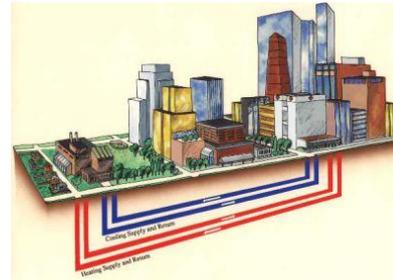


Fig. 5.4.1

District heating is defined as the transportation and distribution of thermal energy with the substance of heated or superheated water or steam through a closed network of insulated conductors. The heat is obtained from a cogeneration plant burning fossil fuels but increasingly biomass, waste combustion, biogas and geothermal energy.

The advantages are:

- Greater efficiency.
- Reduction of the environmental pollution.
- Usability of unconventional fuels.

- Applicability to systems that combine heat and power production.
- Cheaper heating and hot water as soon as it achieves energy savings.
- Better living standards.

2. Micro Wind Turbines

An interesting approach for either captive or sale of electricity is the small wind turbine. They use the wind energy in order to produce electricity. Their size varies depending on the size of the building in which they are installed. Their advantages are:

- Cheap both to be bought and installed
- Do the same thing with the normal wind turbines but as soon as their size is a lot smaller they do not cause any sound disturbance and they do not demand a big amount of land in order to be installed



Fig. 5.4.2

3. Energy storage

As time goes by and the worldwide energy demand will increase, it is inevitable that at some point the world will move faster and faster towards the renewable sources of energy.

The renewable energy sources with great potential are mainly the solar and wind energy. However, both of these go through considerable efficiency variations, making necessary to store them, aiming to balance the supply and demand of energy. A lot of modern technologies are available nowadays, in order to store energy for a reasonable cost.

Current Estimated Worldwide Installed Advanced Energy Storage Capacity (2128 MW as of 2010)

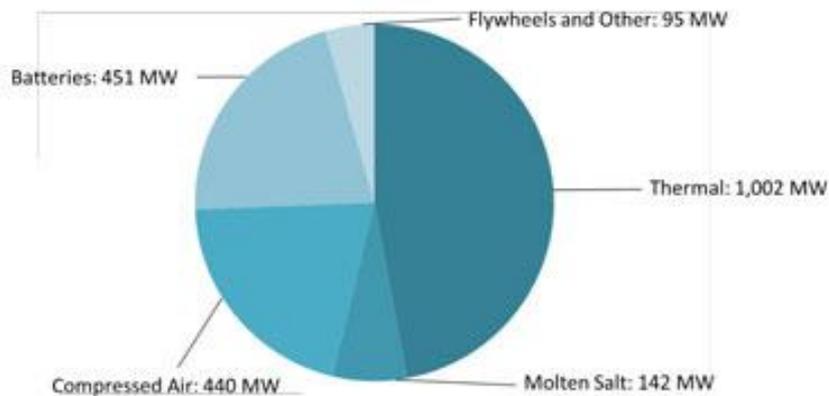


Fig. 5.4.3

Chapter 6: Conclusion

All parts of the environment interact with each other, creating relationships characterized by a very important balance. Under normal conditions, this balance is not disturbed and nature is unaffected by operating activities of people, animals and plants. If this relationship gets affected and the balance is lost, the habitat is dramatically affected with severe consequences for everyone. Climate change is one of the largest threats that nature and people face, and humanity is the one causing it.

As over 50% of the world's population now lives in cities and urban areas, we have to work towards the goal of sustainable cities. Urban systems can be more environmentally sustainable than rural or suburban living because people and resources density gives the opportunity to save energy combining feasible new technologies.

Nowadays we have the ability to protect and preserve the environmental quality in our cities and to recast them using the available techniques and experience gained. Also we have the obligation to assure the viability of societies living in areas with harsh climatology and the challenge to reclaim deserted areas of the planet.

Globally, a lot of cities have risen to the challenge and are setting ambitious goals, by promoting or applying programs, concepts and methods for reducing their impact on the environment.

The future is the green cities; sustainable, eco-friendly cities, designed with consideration to the environmental impact, inhabited by conscious people, dedicated to minimization of required inputs of energy, water and food, and waste output.

Green development is the concept of promoting sustainability while propelling strategies for development through environmental planning, city planning, architecture, landscape architecture, having by this way significant potential in the contemporary world.

Greece has a deficit in environmental policy in relation to European or other countries that have similar or sometimes less GDP (Gross Domestic Product). The environment for many years was not part of the social, economic and political modernization. Moreover, the Greek environmental movement often adopts extremely nihilistic positions and has not acquired considerable social bases. The political presence and growth prospects remain very low, even after attempts over two decades. While financial opportunities for green growth already exist (e.g. funds from the EU or the Greek government) some

cultural differences produce major obstacles to social and political growth in terms of environmentalism.

Not only Greece, but every country has to adopt the good practices, and with open mind move towards:

- **A future where the whole city will be able to be built in full compliance with environmental awareness and techniques**
- **A future with resilient cities, able to face the climate change and other environmental problems**
- **A future with cities promoting sustainable development**

Bibliography

Books:

- Bernatzky, A., 1974. Gardens for Stepped Terraced Housing, Urban Ecology, Cities in Competition: Productive and Sustainable Cities for the 21st Century. Melbourne: Longman
- Beatley, T., 2000. Green Urbanism: Learning from European Cities. Washington: Island Press
- Beatley, T., 2012, Green cities of Europe: global lessons on green urbanism, Island Press, Washington, DC
- Cohen, N., 2010, Green cities: an A to Я guide, SAGE, Thousand Oaks, CA
- Droege, P., 2010. Climate Design: Design and Planning for the Age of Climate Change. California: Pt Reyes Station
- Giannas, S., 2001. Bioclimatic Urban Design, Environmental Technology, Vol A, EAP
- Girardet, H., 1999. Creating Sustainable Cities. Totnes: Green Books for the Schumacher Society
- Haaren, C., Reich, M., 2004. The German way to greenways and habitat networks. Landscape and Urban Planning, University of Hannover
- Hallsmith, G., 2003. The Key to Sustainable Cities: Meeting Human Needs, Transforming Community Systems. Canada: New Society Publishers

- Hardoy, J.E., Mitlin, D. and Satterthwaite, D., 2001. Environmental Problems in an Urbanizing World. London: Earthscan Publications Ltd
- Ravetz, J., 2000. City Region 2020: Integrated Planning for a Sustainable Environment. London: Earthscan Publications Ltd
- Rodwell, D., 2007. Conservation and Sustainability in Historic Cities. Oxford: Blackwell Publishing
- Rudlin, D., 2009. Building the 21st Century Form: the Sustainable Urban Neighborhood. 2nd ed. Oxford: Architectural Press
- Sassi, P., 2012, Strategies for sustainable architecture, Taylor & Francis, New York City, NY
- Simpson, R., Zimmermann, M., 2012. The economy of green cities: world compendium on the green urban economy, Springer, Bonn
- Walton J., Carns D.E., 1977. Cities in Change: Studies on the Urban Condition. Massachusetts: Allyn and Bacon Inc.
- Williams, K., Burton, E. and Jenks, M., 2000. Achieving Sustainable Urban Form. London: E & FN Spon
- UNO Habitat 2004, State of the world's cities 2004/2005, UNO, Geneva, SZ
- UNO Habitat 2008. State of the world's cities 2008/2009, UNO, Geneva, SZ
- UNO Habitat 2010. State of the world's cities 2010/2011, UNO, Geneva, SZ
- UNO Habitat 2012. State of the world's cities 2012/2013, UNO, Geneva, SZ

Articles:

- Antrobus, D., 2011. *Urban Research & Practice*, Routledge, 4:2, 207-214, Article : '*Smart green cities: from modernization to resilience?*', [online] 02 July 2011. Available at: <http://dx.doi.org/10.1080/17535069.2011.579777>, [Accessed 03 December 2012])
- Charlesworth, S., 2011. *Green Places*, Issue 76, p 39-41: '*Different shades of green*', [online] 07 February 2011. Available through: Art Full Text [Accessed 01 December 2012]
- Cordero, M., 2011. GreenBusinessBureau: '*How City Officials can make Cities Green?*', [online] 07 October 2011. Available at: <http://www.gbb.org/news/how-city-officials-can-make-cities-green/> [Accessed 07 October 2012]
- Geraldo, C. S., Neumann, J. M., 2012. *Journal of Industrial Ecology*, Vol. 16, Issue 1, p142-152. : '*Green City*', [online] 23 February 2012. Available through: Academic Search Premier [Accessed 04 December 2012]
- Gulmanelli, S., 2009, *Domus*, Issue 922, p38-42, Abstract : '*Green Cities*', [online] 22 February 2009. Available through Art Full Text Database, [Accessed 30 November 2012]
- Hattam, J., 2009. *Treehugger*: '*10 Things That Make a Great Green City*', [online] 04 December 2009. Available at:

<http://www.treehugger.com/sustainable-product-design/10-things-that-make-a-great-green-city-slideshow.html>

[Accessed 04 December 2012]

- Pollock, N. R., 2010, Architectural Record, Vol. 198, Issue 10, p60-66: '*A Green City Rises*', [online] 22 October 2010. Available through Academic Search Premier

[Accessed 03 December 2012]

- Steffen, A., 2012, The Economy Issue; An FP Special Report : '*How to save the Global Economy: Build Green Cities*', [online] 05 January 2012. Available at:

http://www.foreignpolicy.com/articles/2012/01/03/12_build_green_cities

[Accessed 01 December 2012]

- Totty, M., 2011. The Wall Street Journal: '*How to Build a Greener City*', [online] 11 September 2011. Available at:

[http://online.wsj.com/article/SB10001424053111904009304576535113877346554.](http://online.wsj.com/article/SB10001424053111904009304576535113877346554.html)

html

[Accessed 05 December 2012]

- Newsbeast, 2010. '*The ecological city of the future will be underground*', [online] 28 November 2010. Available at:

<http://www.econews.gr/2010/11/28/th-oikologiki-poli-ypogeia/>

[Accessed 21 January 2013]

EU Documents:

- *European Green Capital, Will Your City be the European Green Capital 2012*. Available at:

<http://ec.europa.eu/environment/europeangreencapital/wp-content/uploads/2012/06/EGC-Will-Your-City -2012 EL WebRes.pdf>

- *European Habitat Directive*, 92/43 EEC of the European Parliament and of the Council on the Conservation of natural habitats and of wild fauna and flora, Journal L 206 of 22.07.1992, 92/43 EEC, 1992.

Available at:

<http://proaction.tripod.com/infoandlinks/id10.html>

Websites:

- European Green Capital Official Website,
http://ec.europa.eu/environment/europeangreencapital/index_en.htm
- Green Electricity in Europe,
<http://www.ge.com/europe/>
- Videos regarding Renewable Sources of Energy,
<http://science.discovery.com/video-topics/gadgets-and-tech/ecopolis.htm>
- Greek Ministry of Environment Energy and Climate Change Official Website,
<http://www.ypeka.gr/Default.aspx?tabid=285&locale=en-US&language=el-GR>
- Invest in Greece Agency's website,
<http://www.investingreece.gov.gr/default.asp?pid=36§orID=49&la=1>

PDF Publications Online:

- Boscoe, A., 2003. An Assessment of the Potential of Green Roofs to Act as a Mitigation Tool for Increased Urban Densities
Available at:
<http://www.livingroofs.org/NewFiles/DissertgreenroofAboscoe.pdf>
[Accessed 10 October 2012]
- Georgiou, N.J., Zafeiriadis, K., 2006. The impact of park trees on microclimate in urban areas, Urban Ecosystems
Available at:
<http://biology.duke.edu/wilson/EcoSysServices/papers/GeorgiZafiriadis2006.pdf>
[Accessed 10 October 2012]
- LSE Cities, 2012. Going Green; How cities are leading the next economy. Available at:
<http://lsecities.net/publications/reports/going-green-3gf-edition/>
[Accessed 27 December 2012]
- Research Paper of the Lyceum of Ithaki, 2011. Green Growth.
Available at:
http://lyk-ithak.kef.sch.gr/ergasia11_12/1.pdf
[Accessed 27 December 2012]
- Sarikou, S., 2005. Encouraging Nature in Urban Public parks: An evaluation of the results of the ecological approach of 70s, in UK's Urban Nature Parks, WSEAS, IASME Transactions, Vol.2
Available at:
https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&ved=0CD_AQFjAA&url=http%3A%2F%2Fwww.eng.auth.gr%2F%2FIHT%2FProc8th%2F099.doc&ei=uToFUYb

NMdKlhQf_hYDoCw&usg=AFQjCNGQe4JRwA6_OkIVYnEo-Ma-

djBK6Q&sig2=F0lvL5Xlh0TxwR1xH-7LXQ&bvm=bv.41524429,d.ZG4

[Accessed 10 October 2012]

- Southworth, M., 2005. Designing the walkable city, Journal of Urban Planning and Development, Vol.4

Available at:

[http://ascelibrary.org/doi/abs/10.1061/\(ASCE\)0733-9488\(2005\)131:4\(246\)](http://ascelibrary.org/doi/abs/10.1061/(ASCE)0733-9488(2005)131:4(246))

[Accessed 11 October 2012]

- U.N.E.S.C.O., 2007, Decisions adopted at the 31st session of the World Heritage Committee, (Christchurch 2007)

Available at:

<http://whc.unesco.org/archive/2007/whc07-31com-24e.pdf>

[Accessed 04 January 2013]

- VanWoert, D.N., 2005. Green Roof Stormwater Retention: Effects on Roof Surface, Slope and Media Depth

Available at:

<http://jeq.scijournals.org/cgi/content/abstract/34/3/1036>

[Accessed 12 October 2012]

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Appendix 1- The respondents of the interviews

The people interviewed are:

- Respondent 1: Civil Engineer, employ of the Technical Department of the Municipality of Corfu with Masters on Environmental Planning and Infrastructure and Environmental Planning and Design for Cities and Buildings
- Respondent 2: Architect, employ of the Technical Department of the Municipality of Corfu, one of the main consultants on the project on bicycle routes in the city centre of Corfu Island
- Respondent 3: Architect, president of the Architect's Club of Greece in the department of Corfu Island and also lecturer in seminars regarding the energy performance of the buildings
- Respondent 4: Architect and member of the Architect's Club in Corfu Island
- Respondent 5: Chemical Engineer, Head of the Technical Department of the Municipality of Corfu Island

Appendix 2- The questionnaire of the interviews

Ερωτηματολόγιο/ Questionnaire

1. Ποια η σημασία των περιβαλλοντολογικών προβλημάτων σήμερα;

What is the significance of the environmental problems nowadays?

2. Ποια ή σημασία της περιβαλλοντολογικής συνείδησης σε επίπεδο τοπικών κοινωνιών;

What is the importance of the environmental consciousness in local communities?

3. Ποιά τα περιβαλλοντολογικά προβλήματα της Κέρκυρας και ποιό το πιο σημαντικό;

Which are the (environmental) problems of Corfu and which of them do you think is the most important one?

4. Πως αντιμετωπίζονται από την πολιτεία και πως από τους πολίτες αυτά τα προβλήματα;

In which way do you think that these problems are faced both on the part of the state and the people?

5. Τι μέτρα πιστεύετε ότι θα πρέπει επιπλέον να ληφθούν;
Do you think that extra measures towards these problems should be taken?
6. Πρέπει να δημιουργηθούν περισσότερα πάρκα και ποιοτικοί δημόσιοι χώροι;
Do you think that more parks and quality public spaces should be created?
7. Το δίκτυο Μέσων Μαζικής Μεταφοράς, πρέπει να βελτιωθεί;
Do you think that the Public Transportation System needs to be improved?
8. Χρήζει αναμόρφωσης το υφιστάμενο δίκτυο κυκλοφορίας και στάθμευσης;
Do you think that the current traffic and parking network needs reformation?
9. Οι υπάρχοντες ποδηλατόδρομοι βελτιώνουν/ βοηθούν την καθημερινή ζωή των κατοίκων;
Do you think that the bike lanes and routes once existing in the city centre helped/ improved the everyday life of the citizens?

10. Τα υπάρχοντα κτίρια σε τι ποσοστό είναι 'πράσινα';

To what extent do you think that the existing buildings can be considered as 'green'?

11. Τα υπάρχοντα προγράμματα ανακύκλωσης και κομποστοποίησης είναι επαρκή;

Do you think that the existing recycling and composting programs are sufficient?

12. Πρέπει να υπάρξει περισσότερη περιβαλλοντολογική δράση;

Do you think that more environmental action should be taken?

13. Τι άποψη έχετε για τις 'πράσινες πόλεις'? Είναι απλά μια ιδέα ή μπορεί να γίνει πραγματικότητα;

What do you think of the term 'Green Cities'? Is it only an idea or it can actually become a reality?

14. Η Κέρκυρα έχει επαρκείς 'πράσινες' εγκαταστάσεις;

Do you think that Corfu Island has sufficient 'green' facilities and infrastructure?

15. Ποιες ανανεώσιμες πηγές ενέργειας θα μπορούσαν να χρησιμοποιηθούν στο μέλλον στην Πόλη της Κέρκυρας;

Which forms of renewable energy do you think that would be appropriate for future use in Corfu Island?

16. Πιστεύετε ότι υπάρχει επαρκής ενημέρωση και συμμετοχή του κοινού; Εάν όχι, τι μέθοδο θα προτείνατε για ενημέρωση του κοινού;

Do you think that there is sufficient public awareness and information? If not, how would you suggest informing the public?

Appendix 3- Turnitin Receipt



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Chapter 1: Introduction 1.1 Statement of the problem In recent years the environmental pollution because of the great technological process and rapid industrial development is getting more and more dangerous and in many cases catastrophic for the Earth's biosphere. It is divided into urban and industrial pollution and air, water and soil pollution and tends to destroy the fauna and flora of the earth; the fundamental conditions of life in our planet. For example, vast amounts of industrial waste pollute the sea, not only kill the plankton and eliminate many kinds of the animal kingdom but also endanger the health of the people. Factory chimneys emit thousands of tons of poisonous gases and...

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