Linking the Green and Brown Agendas: A Case Study on Cairo, Egypt

Anne Nicole Duquennois and Peter Newman

Case study prepared for
Revisiting Urban Planning:
Global Report on Human Settlements 2009

Available from http://www.unhabitat.org/grhs/2009

Anne N. Duquennois is a student in urban planning and film production with an emphasis in sustainable development and community outreach. She is currently working towards undergraduate degrees in the colleges of Environmental Design and Arts and Sciences at the University of Colorado in Boulder. Comments may be sent to the author at: anne.duquennois@colorado.edu.

Peter Newman is a Professor of Sustainability at Curtin University in Perth, Australia. He has recently been appointed to the Board of Infrastructure of Australia. From 2001 to 2003 Peter directed the production of Western Australia's Sustainability Strategy in the Department of the Premier and Cabinet. It was the first state sustainability strategy in the world. In 2004-5 he was a Sustainability Commissioner in Sydney advising the government on planning issues. In 2006/7 he was a Fulbright Senior Scholar at the University of Virginia Charlottesville where he completed two new books 'Resilient Cities: Responding to Peak Oil and Climate Change' and 'Cities as Sustainable Ecosystems'. In Perth, Peter is best known for his work in saving, reviving and extending the city's rail system. Peter invented the term 'automobile dependence' to describe the creation of cities where it is necessary to drive everywhere. For 30 years, since he attended Stanford University during the first oil crisis, he has been warning cities about preparing for peak oil. Peter's book with Jeff Kenworthy 'Sustainability and Cities: Overcoming Automobile Dependence' was launched in the White House in 1999. He was a Councillor in the City of Fremantle from 1976-80 where he still lives. Comments may be sent to the author at: P.Newman@curtin.edu.au.

Linking the Green and Brown Agendas: A Case Study on Cairo, Egypt

Anne Nicole Duquennois and Peter Newman

Introduction

The green agenda in cities is about ensuring the natural ecosystems of land, water and air are part of the city and its management. The brown agenda is about managing wastes, energy, transport and buildings. This paper uses the case study of Cairo to illustrate how these two agendas can be integrated and how town planning is necessary to facilitate this process.

There are few cities that have managed to bring both aspects of the environmental agenda into any kind of coherent set of policies. Cairo is by no means a shining example of success but it does show some promising signs. Cairo faces the very real struggles of a mega city to achieve a better future for its inhabitants in light of its many environmental challenges in both the green and brown agendas. Developing mega cities like Cairo may lag behind in providing many aspects of the "developed city", such as sufficient service provision, efficient infrastructure and adequate housing for the population, but they are linking the green and brown agendas in earlier stages of development. Indeed, in observing the successes and failures of Cairo, there are lessons to be learned by all cities.

Like many developing countries in the last half-century, Egypt has been faced with increasingly difficult urban planning challenges due to its economic and population explosions. Cities within Egypt have undergone massive urbanization due initially to the in-migration of rural populations and, currently, to escalating fertility rates, putting much strain on public service provision and quality of life. Cairo, as Egypt's largest city and economic capital, has been the primary victim of the problems arising from such rapid growth. Yet, with a booming population and economy also come opportunities for sustainable development provided appropriate measures are taken. Egypt has a history of environmental policy making and sustainability has become a primary concern for the country since the Rio de Janeiro Earth Summit in 1992. The globalization of environmental concerns has perhaps provided the extra incentives needed to synthesize the country's local environmental initiatives and link sustainability and development through the city's planning.

The Green and Brown Agendas

Natural systems in cities like Cairo are easily devoured by human systems, which take up space and consume the water, air and soil that are part of a bioregional ecosystem. The brown agenda in cities tries to manage the wastes, energy, transport and buildings so that quality of life can be improved and the green systems, which the city depends on, are not overwhelmed. Natural systems have real limits and capacity issues associated with their use. Human systems have no inherent limits but are part of a metabolic throughput, which has limits set by its interaction with the green ecological base of the city.

The goal of a sustainable city is to reduce the ecological footprint from its consumption of green natural systems (global, regional and local) thus keeping within natural limits, in order to enable the brown, human systems to be optimised for improving the quality of urban life. Thus, linking the green and brown agendas is about how a city can simultaneously conserve its natural environment whilst reducing its urban metabolism and impacts.

The need to join the green and brown agendas in Cairo is vital at the global level due to increased pressure on global environmental systems manifested for instance through climate change. However, this need is expressed at the local and bioregional levels where

environmental issues are constrained by the metabolism of the city. If this begins to exceed natural limits then the quality of the air and water in the Nile Delta will be threatened, impacting the future economic development of Egypt and the preservation of its cultural heritage. The geographical constraints of the North African region and the unique characteristics of the Nile valley provide sufficient reasons to make conservation of natural systems and reduction of urban metabolism a primary concern.

The Green Agenda for Cairo

Cairo is located at the junction of Upper and Lower Egypt at the apex of the Nile delta, a historically significant economic hub on the fertile land of the Nile. The green agenda is critical for Egypt since only 3% of its land is arable (Central Intelligence Agency, 2008) and the majority of the population lives in the Nile valley adjacent to these arable areas. This extraordinary band of green land, which has fed civilizations for thousands of years, must now provide green spaces, water, waste dispersion, clean air, food and fibre for 18 million people.

In 1998 Cairo was consuming 500 hectares of prime agricultural land every year as it expanded into lands to the north and west of the city (El-Batran and Arandel, 1998, 217). This gradual loss of limited natural resources due to urban expansion is a problem throughout the world, particularly in developing countries experiencing unprecedented growth. Cairo is a classic example of this trend. The loss of arable land could result in the inability of Egypt to sustain its basic agricultural production. The issue of fresh water consumption and waste water disposal is also a priority for the preservation of the bioregion. The extreme arid conditions of the surrounding desert further exacerbate the situation.

From a global perspective, Egypt contributes only 0.57% of the world's Greenhouse Gas (GHG) emissions and is, thus, a country with relatively little impact when compared to industrialized nations (Ministry of State for Environmental Affairs (MSEA), 2005). Yet, Egypt is one of the most vulnerable nations in the world to the detrimental effects of climate change. Geographical studies have determined that, if sea level rose by one meter, 4500 km2 of the Nile delta would be submerged affecting over 6 million inhabitants. Secondary impacts would include a higher risk of malaria and a loss of fresh water and irrigation potential from the Nile.

The immediacy of the unique green agenda in Cairo emphasizes the key role urban planning will have to play in order to bridge the gap between environmental impact and quality of life.

The Brown Agenda for Cairo

Like many developing countries, the prime city of Egypt has experienced rapid growth as the economic and social opportunities provided have brought people to the city. Each inhabitant needs a house and transport, consumes resources and produces wastes which must be dealt with by the city. The sheer quantity of people involved has placed enormous pressures on the surrounding natural environment. A sustainable city needs to find ways of reducing its metabolism and the impacts. It must also provide a good quality of life within the urban centre. The uncontrolled rapid growth rate of Cairo is symptomatic of many developing countries and has created difficult living conditions within the city. As one of the mega cities of the world, the levels of noise and air pollution have quickly become some of the worst. Toxins such as lead pollution raise international concern for human health standards. A booming manufacturing industry and growing metropolitan area are now impacting on the green agenda as they eat into the surrounding agricultural land and deplete water systems, but

also on the human agenda such as historical site preservation. Cairo is a place of priceless historical significance and worldwide cultural heritage. Its crucial preservation will depend on achieving harmony between the brown and green agendas. In achieving a sustainable city for its inhabitants as well as a sustainable approach to tourism, the city will keep its invaluable heritage for future generations of Cairo, Egypt and the world.

Understanding the Pressures on the Green and Brown Agendas

As one of the mega cities of the world, Cairo has the largest population of all urban settlements in both Africa and the Middle East. The scale of the challenges it faces as a city can in many regards only be compared to other massive developing cities in Asia and South America. However, many of the current issues in Egypt today are characteristic of the Middle East and North Africa (MENA) region (Nasser, 2008). Four of the key challenges faced by Cairo are outlined below.

Population Pressure

Similar to the demographic characteristics of many developing countries in South America, Egypt's population is highly concentrated in the large urban centres. Cairo harbours a disproportional amount of the urban population since even the second largest city of Egypt, Alexandria, is only 30% of its size. All other provincial cities range from approximately 200,000 to 400,000 inhabitants, none of which contain even 5% of Cairo's population (Sims, 2003). As shown in the table below, the population growth of the Greater Cairo Metropolitan Region (GCMR) since WWII has been phenomenal. Continually exceeding its projected figures and currently containing over a quarter of the Egyptian population, Cairo's population has surpassed the city's infrastructural growth capacity.

Table 1: Population Growth in GCMR, 1947-2006

Census Years	Greater Cairo Region Population (in millions)				% Egypt's Population	GCR annual growth rate (%)
	Cairo Gov.	Giza Gov.	Qalioubiya Gov.	Total		
1947	2.062	0.668	0.281	3.031	12.5	n/a
1960	3.358	1.118	0.434	4.91	15.7	1.82
1966	4.232	1.42	0.56	6.211	17.4	4.5
1976	5.074	2.137	0.879	8.09	18.5	2.68
1986	6.069	3.332	1.46	10.86	18.2	2.99
1996	6.789	4.273	2.081	13.144	17.3	1.93
2006	7.787	6.273	4.236	18.296	25.2	

Sources: Denis (1999, 19) and Arab Republic of Egypt Central Agency for Public Mobilization and Statistics (CAPMAS)(2006)

The infrastructural gap has caused the urban form to develop densely along axes of communication while many of the lower income areas of the city still lack basic services. Cairo is still growing but has possibly reached its maximum population capacity. The city has spread into areas that are too far from urban services (Newman and Kenworthy, 2007) as well

as expanding onto scarce arable land. The city can still expand in population by building upwards but is already characterized by high population density. Though the numbers vary widely, in 2001 it was estimated that the demographic density was about 400 inhabitants per hectare (Metge, 2000, 20) — approximately five times more dense than the average European city (Newman and Kenworthy, 1999).

The primary trait of large developing cities like Cairo is their rapid urbanization during the last half century. The modernization and industrialization of the city are catalysts for population growth as the urban centre becomes a locus of opportunity for jobs, education and lifestyle. Although Cairo's annual growth is now attributed to natural increase, past growth was primarily due to rural- urban migration. The urbanization of lifestyles on such a massive scale as indicated by Table 1, necessitates efficient transportation for commuting, provision of energy for modern life and industry, adequate solid waste and sewage management for high density living, sufficient employment and housing for the growing population, and access to affordable food for the non-agrarian urban communities.

The modernization of the Egyptian infrastructure and economy has at the same time increased the metabolic throughput of the city and hence catalysed sources of urban environmental degradation. This includes an increase in air pollution through daily commutes, an increase in solid waste through the use of manufactured goods and encroachment of developed areas onto agricultural land through insufficient control of urban growth. The Egyptian government has been continuously struggling to control and minimize the damage caused by the growth of Cairo but the infrastructure that would allow a better quality of life falls short. Yet, as discussed in this study, particularly in recent years, the government of Egypt has taken this gap as an opportunity to opt for more environmentally sustainable systems.

Economic Pressure

Egypt is facing many problems with its growing urbanization (Nasser, 2008). Though as a nation Egypt has achieved an economic growth rate of 7% in recent years, the internal structure of the economy is in crisis. Unemployment is nearing 20% in some regions due to a failure to produce sufficient and appropriate demand for the growing labour force. The unemployment in the GCMR is currently under 11% (See Table 2) but there are limited jobs available for the population with intermediate educational levels. This is the primary population suffering from unemployment. A continued increase in unemployment is likely as more and more youths reach the working age of 15. This discrepancy is partially due to the centralization of the economy and the infrastructure as well as an export-oriented growth. Overall, Egypt's GDP has been based on the globalization of the economy. The GCMR quickly became Egypt's economic centre-piece, particularly after the economic liberalization brought about by President Sadat's Open Door Economic Policy of 1973 (*Infitah)* which emphasized a market economy and an opening to Western markets.

Table 2: Economic statistics on Cairo and governorates compared to Egypt as a whole

Governorates	Sex	Population (15 years and above)	Labour force (15 years and above)	Employment Status 15 years and above)			Unemployment rate %
				Number of employed Individuals	Unemployment	Unemployed did not work before	
Egypt	Male	25320009	18116418	16723966	130500	1261952	7.69
	Female	24396384	3897642	3150125	21066	726451	19.18
	Total	49716393	22014060	19874091	151566	1988403	9.72
Cairo	Male	2549073	1667520	1512462	38315	116743	9.30
	Female	2485408	556472	471769	8472	76231	15.22
	Total	5034481	2223992	1984231	46787	192974	10.78
Kalyoubia	Male	1489863	1067995	988788	11027	68180	7.42
	Female	1406020	189221	152841	1129	35251	19.23
	Total	2895883	1257216	1141629	12156	103431	9.19
Giza	Male	1155758	784422	711909	14740	57773	9.24
	Female	1116256	240964	202701	2812	35451	15.88
	Total	2272014	1025386	914610	17552	93224	10.80

Source: Arab Republic of Egypt Central Agency for Public Mobilization and Statistics (CAPMAS) (2006). (Note: It is difficult to ascertain whether or not these figures include the informal market)

The Informal Sector Pressure

Approximately 50% of Cairo's inhabitants live and work in the informal sector thus creating much difficulty for the government to organize and control the city. The magnitude of the "dead capital" that the informal sector creates coupled with the widespread lack of security of tenure creates problems for both the government and the inhabitants to invest in simple environmental improvements without encouraging unsustainable growth. This is a problem faced by many of the MENA and other developing countries of the world, and, in the case of Cairo, it is an urgent dilemma that must be addressed holistically.

The informal market meets the needs of people wherever their demands cannot be met through normal formal markets. Flexibility and adaptability are its primary assets. With informal developers constructing housing (often brick and reinforced concrete buildings that are several stories high) and informal contractors connecting many of these structures to city services, the lack of sound overarching natural resource and waste management results in environmental problems. Although the market for informal housing may be widespread, the outcome is often that regional and metropolitan scale infrastructure is overstretched.

Governance Pressure

In terms of planning, the GCMR is divided into the governorates of Cairo, Giza and Qalioubiya with no macro-administrative structure that deals with Greater Cairo as a distinct planning entity. Governorates are essentially executive bodies that implement the decisions made by the national level General Organization for Physical Planning (GOPP) and are dependent on central government budget allocations. They are often considered ineffective

(Sims, 2003, 4). Their primary role as development agents is to approve development plans and budgets, and represent the public opinion in executive government deliberations.

Figure 1: Informal urban settlement on agricultural land in El-Minya

Source: Brigid Grund 2008

Urban planning in Cairo has to try and achieve environmentally sustainable outcomes whilst contending with the inadequacies and constraints created from the above population, economic, informal and governance pressures. However all cities face these issues in one way or another and have to find ways of turning the pressures into opportunities for change based on the harmonization of the green and brown agendas.

Linking the Brown and Green Agendas

The approach taken in this paper is to examine seven approaches to linking the green and brown agendas. Each of the 'seven cities' are assessed to see how Cairo is managing to adapt to this emerging agenda which aims to give substance to the idea of sustainable urban development.

Renewable City

Rapid urbanization, combined with population and economic growth, has dramatically increased the energy consumption of Egypt. In the period of 1982/83 – 1998/99, energy consumption grew from 20.5 Mtoe[1] to nearly 42.2 Mtoe with an average growth rate of 4.6%. The projected amount of energy needs submitted to the UN in 1999 was 96.3 Mtoe of primary energy by 2017 (MSEA, 2001, 35). This projection further emphasized the need to diversify the country's energy sources in order to meet the ambitious growth targets.

1. Million tonnes oil equivalent.

Renewable energy can ease the brown agenda by reducing the fossil fuel metabolism that pollutes air and water systems, and at the same time enabling the green agenda to be facilitated through bioregional systems that can include bio-plantations.

Developments in the renewable energy sectors have been the most recent additions to the Egyptian energy system. In April 2007 the Supreme Council of Energy ratified a plan to use renewable energy for 20% of the nation's needs by 2020. This plan relies mainly on the use of solar and wind energy, with 12% coming from wind mills and wind farms and 8% from hydro-power[2]. The use of renewable energy is seen as an opportunity to diversify the energy sector in order to provide sufficient energy for the projected economic and population growth. The Egyptian electricity sector recently drafted a new energy act that encourages private sector utilization and involvement in renewable energy. This was based on assessments of many potential sources.

Wind

In recent years much attention has been given to the development of wind energy in Egypt with the Gulf of Suez being recognized as one of the best locations for wind farms in the world. From 1991 to 2005, in an effort to encourage the use of wind energy, a joint project between the Egyptian New and Renewable Energy Authority (NREA) and Denmark's Risø National Laboratory created a Wind Atlas for Egypt pinpointing the prime locations for wind farms and wind mills (see Figure 2).

Currently the NREA has earmarked an 80 km2 area in the Gulf of Suez for the construction of a large-scale grid-connected wind farm. The infrastructure of the site has been completed, including substation 22/220 kV, residential buildings for the staff, workshops, warehouses and internal roads. In addition, an area of about 64 km2 to the west of the site was earmarked as an extension for the same site. Another area in the Gulf of El-Zayt of 656 km2 has been earmarked for researching the possibility of other wind power projects. This area was chosen for its excellent wind speed averaging 10.5 m/s. Further north, an area of 1200 km2 will be available for private investments.

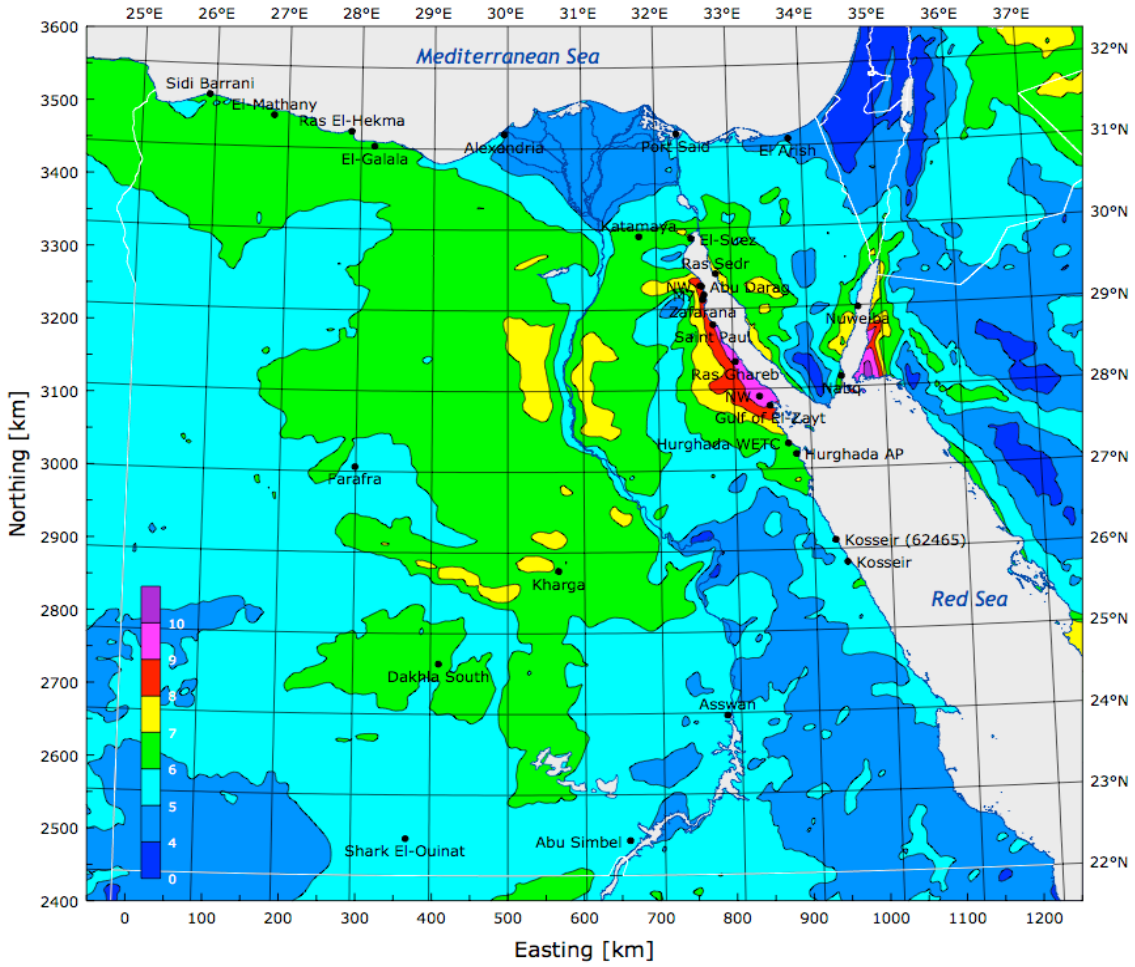
Although the potential of wind power in Egypt cannot be denied, the costs of its implementation remain high relative to the commonly used and heavily subsidized sources of fossil fuel energy. Approximately 70% of a large-scale windmill's components have to be imported at high prices. Thus, most of the development of wind power lies in foreign investments (El-Noshokaty, 2004) at the moment though this can be changed.

Solar

The Solar Atlas, issued in 1991, described Egypt as one of the sunbelt countries with a high intensity of direct solar radiation ranging between 1970 – 2600 kwh / m2 / year from north to south and 9 – 11 hours of sunshine a day. The Kuraymat Solar Thermal Power Plant, a current

2. New and Renewable Energy Authority, "New and Renewable Energy Authority." 21/03/2008. www.nrea.gov.eg/english1.html (17/08/2008).

Figure 2: Wind analysis of Egypt



Source: Mortensen et al (2006) Note: The black circles indicate ideal locations for wind farms.

project co-financed by the Global Environmental Facility[3], aims at the implementation of a new solar thermal power plant of 140 MW with a solar share of 20 MW connected to the national grid. It is expected to be operational by 2010. Another pilot project being implemented and commissioned at one of the pharmaceutical companies is a solar industrial heat processor with waste heat recovery system. This project is expected to save about 1120 t.o.e/ year with 70% of the materials used being manufactured locally. The NREA has also begun projects in solar water heating, including 33 station systems at the NREA headquarters and residential buildings in Hurgada and Zafarana. A solar water heating project for domestic purposes was commissioned in January 2008.

The NREA recognizes the potential uses of Photovoltaic solar energy (PV) particularly for removed rural communities and remote areas that are currently not connected to the energy grid. Though the cost for PV technology is high, it seems the most appropriate form of energy generation for remote settlements. The NREA has produced two pilot projects in the Matrouh Governorate which should be finalized by the end of 2008.

3. The Global Environment Facility (GEF) is a global partnership among 178 countries, international institutions, non-governmental organizations (NGOs), and the private sector to address global environmental issues while supporting national sustainable development initiatives.

The renewables being introduced to Cairo and its bioregion are beginning to demonstrate what distributed energy from the sun can provide. They are not yet competitive with a highly subsidized fossil fuel system but the city is poised to ramp up the renewables supply if technology and carbon pricing begin to make it competitive.

Carbon Neutral City

A carbon neutral city reduces the metabolic footprint of a city through various energy efficiency programs, enhances renewables and then offsets the rest of its fossil fuels. These offsets have the potential to substantially improve the green agenda of the city. Modern cities are beginning to compete as to how extensively they can demonstrate their level of carbon neutrality.

Clean Development Mechanisms

Egypt ratified the Kyoto Protocol in January 2005, joining 137 developing countries in attempting to reduce greenhouse gas emissions and climate change. As stipulated in the agreement, Egypt endorsed the Clean Development Mechanism (CDM) approach and established the National Committee for CDM. As of 2005, seven CDM projects were approved with total investments nearing US$ 750 million including electricity generation from wind and water, reduction of nitrous oxide emissions in the fertilizer industry, and conversion from liquid petroleum fuels to natural gas in the cement industry (MSEA, 2005, 52).

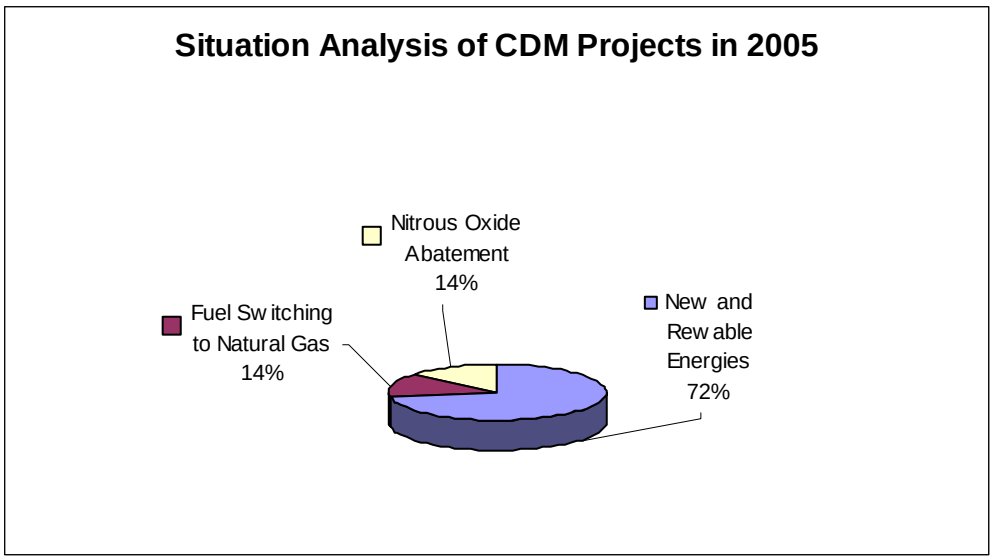
Other endeavours for the CDM include capacity building on the national, regional and international level in the form of information dissemination (websites, presentations to potential stakeholders, workshops, forums, lectures etc.). The objectives for 2007-2012 emphasize the creation of comprehensive data systems such as impact models and examples, as well as raising awareness of the dangers of climate change and mitigating the Green House Gas (GHG) emission by promoting the use of clean energy.

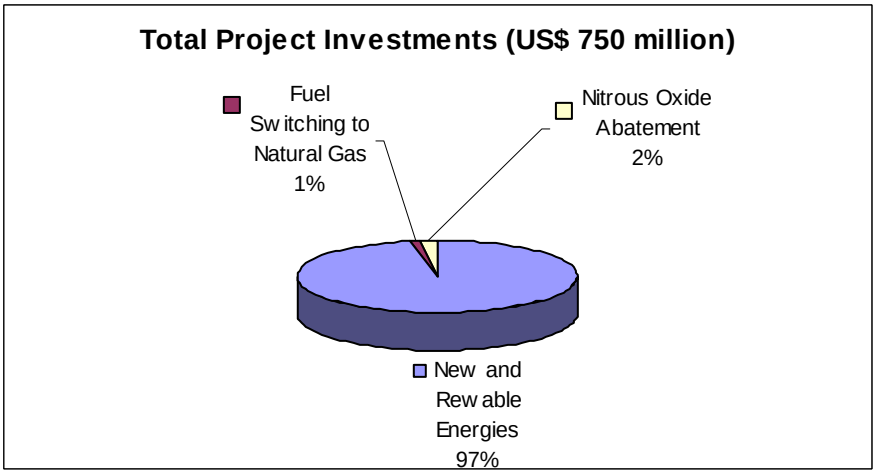
Energy Efficiency

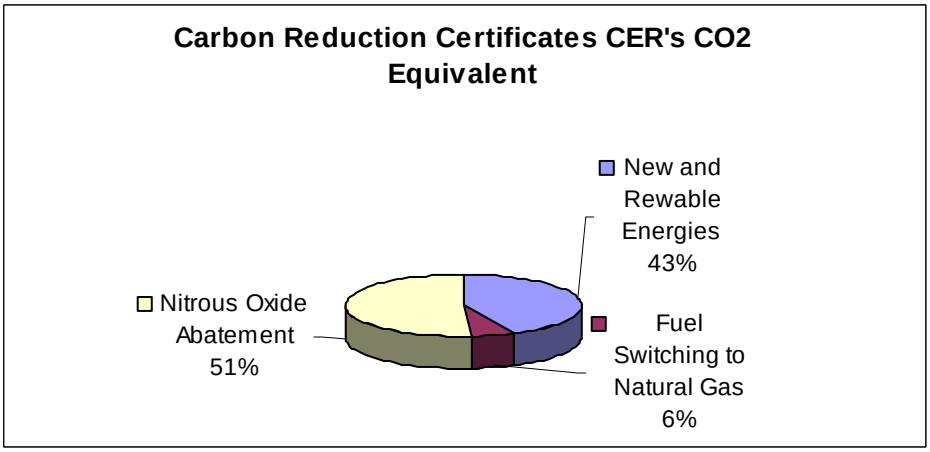
In order to achieve a sustainable approach to development in a world facing an oil crisis and encourage localization of consumer products, Egypt has begun to encourage energy efficiency through its National Environmental Action Plan (NEAP). The *NEAP* encourages Egypt to focus on training programs for technicians in order to support environmental policy making and actions as well as open up a labour demand for the unemployed population. The *NEAP* plans to develop the environmental sector to provide employment opportunities for the youthful population through energy efficiency, cleaner production technologies, environmentally friendly industries, an environment service sector in solid waste management and the cultivation of trees and nurseries (MSEA, 2001, 109).

For Cairo, the Government of Egypt (GOE) - in its efforts to reduce air pollution as well as become more environmentally sustainable- is emphasizing and promoting the use of Compressed Natural Gas (CNG) as a vehicle fuel. With the help of USAID, private sector investments into clean burning fuel are encouraged. More than 40,000 vehicles were operating on CNG by 2006 and 50 CNG buses were provided to the city (44 were operating

Figure 3: Breakdown of Clean Development Mechanism, Egypt







Source: MSEA (2005)

by 2006). Thirty CNG fuelling stations now exist in the GCA[4]. The *NEAP* also encourages the EEAA to make it compulsory for taxis and micro-buses to switch to CNG.

Offsetting Potential

In addition to decreasing carbon emissions, the GOE has also undertaken carbon off-setting projects using greenbelts and afforestation throughout Egypt. The plan includes a greenbelt outside the GCMR ring road and its major junctions along with greenbelts for the surrounding new cities. As of 2005, a greenbelt of about 500 000 trees using a highly efficient drip irrigation system was completed along the ring road (See Figure 4). These stretches of green-space will only use treated waste water with predominantly drip irrigation systems in order to efficiently disperse waste water while fertilizing the plants. Some of the afforestation projects also include the production of crops of high-economic yield (mainly Jatropha and Jojoba plants).

To off-set the current carbon emission in Cairo, the MSEA estimated 10.5 million medium-sized trees necessary (State of Environment Report, 2005, 115). The successful completion of this goal will depend on the establishment of new treatment plants and irrigations systems to meet the rising waste-water production. Besides reducing the carbon impact of Cairo, these forests provide a means to control urban expansion and generate many job opportunities while improving biodiversity and other natural environment outcomes. Thus, this program provides a clear example of how the green and brown agenda can be linked.

Distributed City

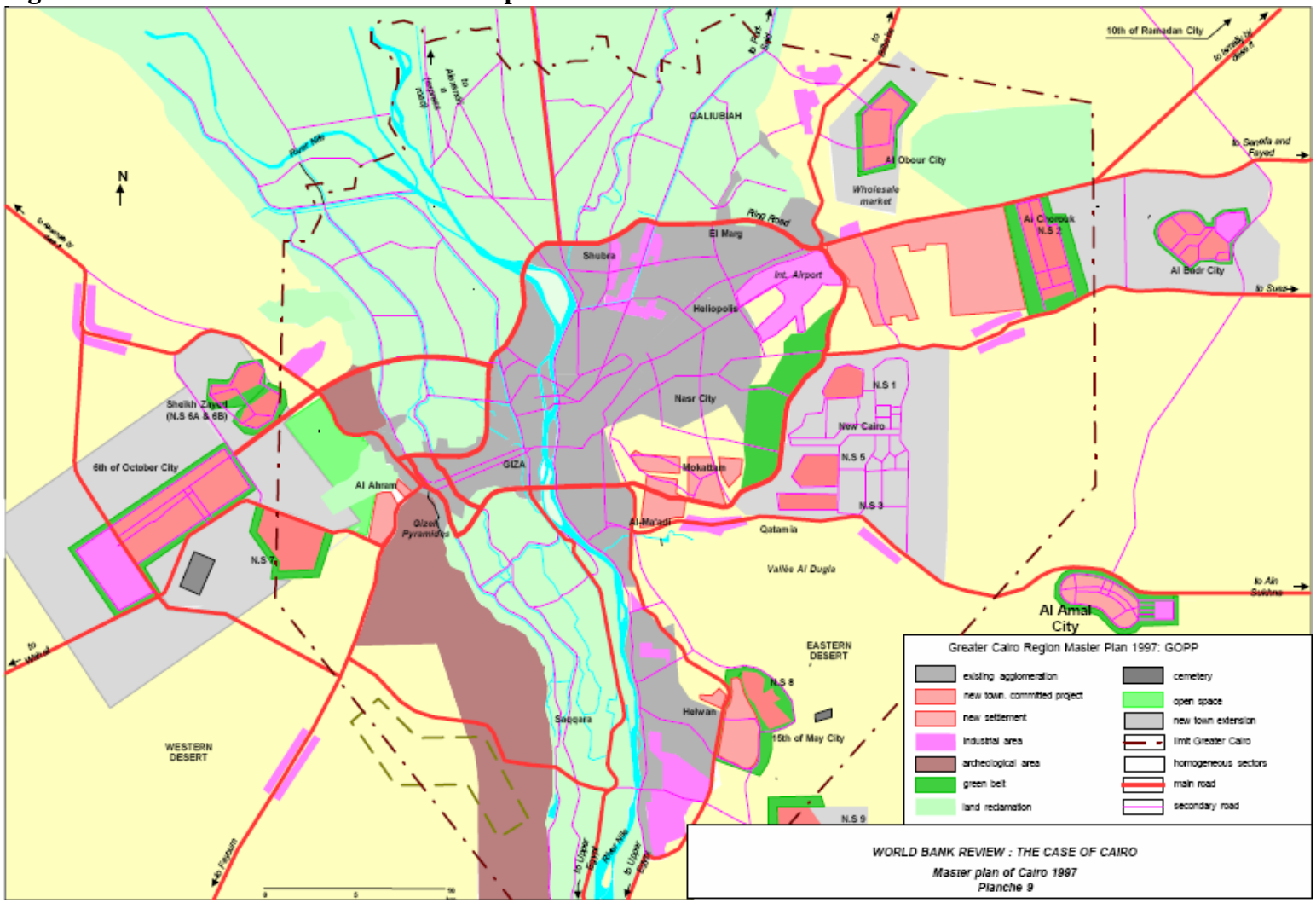
The urban form of a city is one of the determining factors of environmental sustainability. The spatial organization of infrastructure and services dictates the amount of mobility required for daily living and the physical quality and layout of the structures predispose the amount of resources needed to sustain an urban lifestyle.

The distributed city is one where the older, large scale, centralised solutions to infrastructure are being replaced by small scale systems that fit more directly into communities and bioregions, thus enabling technologies that more readily integrate the green and brown agendas like local water and energy systems. A distributed city allows its inhabitants to use the urban functions of the large city while containing smaller scale communities that have the ability to function with a degree of independence, providing inhabitants with local services, employment and daily necessities adapted to their needs. In many regards, Cairo's urban form presents qualities of the sustainable city such as higher density living, mixed use and strong social capital. Yet there remain obstacles common to many developing cities before Cairo can successfully transform itself into a stable distributed city. These obstacles can only be overcome through sound planning actions both on local and supra-local levels.

The original 1970's master plan for Cairo aimed to formally create a polycentric city that would divert future growth into the desert lands and stop agricultural land infringement. The new cities were planned to be independently functioning centres of industrial employment and provide needed residential housing for all levels of income. Yet, despite the planning and development of several of these projected cities, they continually fail to meet their projected

4. USAID Egypt, "USAID Egypt." 17/08/2008. http://egypt.usaid.gov/Default.aspx?PageID=0. (17/08/2008).

Figure 4: Greenbelts in the GCMR master plan of 1997



Source: Metge (2000)

population and function as independent entities (see Table 3). Much of the population that these new towns were planned for found the formal housing unaffordable and instead chose to inhabit informal settlements (See Nasser, 2008 for more detail).

Table 3: Lack of progress in Cairo's new towns

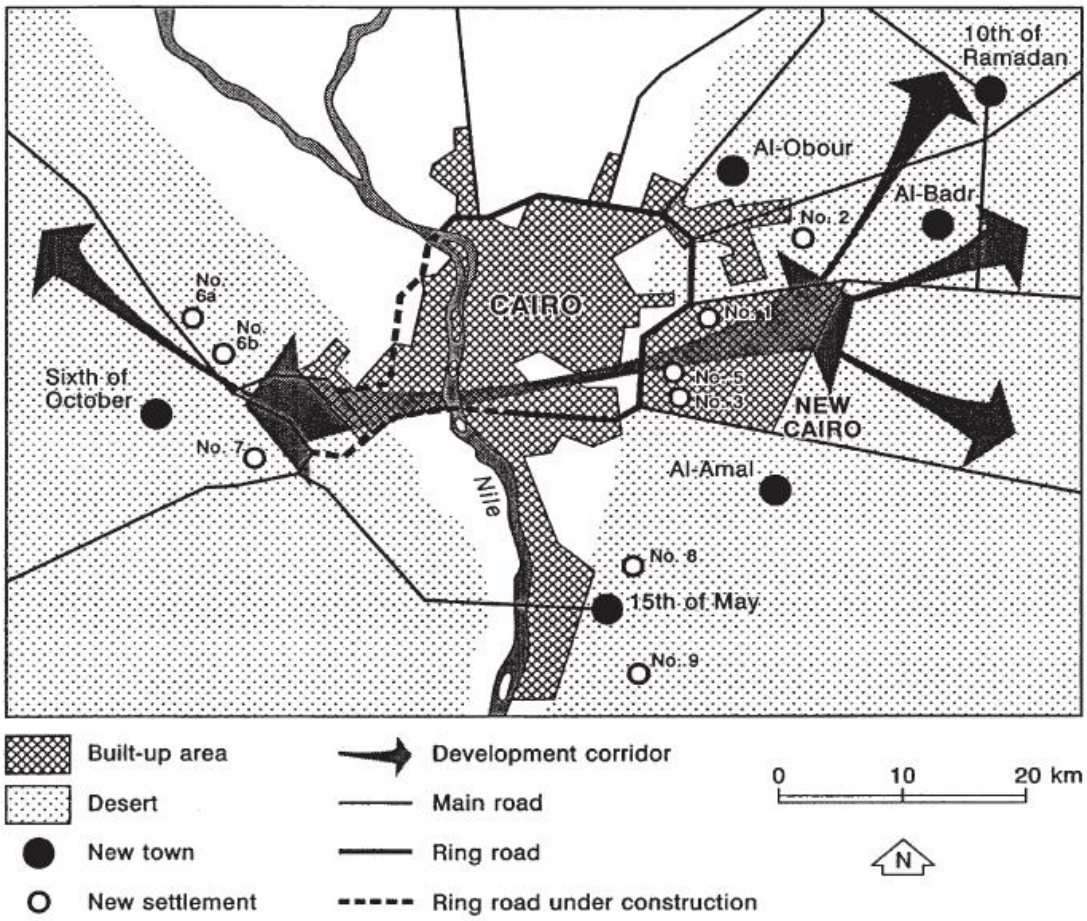
Town Name	Target Populations	1996 Population	Industrial Jobs in 1996
10th Ramadhan	500000	47839	64591
6th October	500000	35477	27809
15th May	100000	65865	222
Al-Badr	250000	248	176
Sadat City	500000	16312	8808
El Obour	250000	No data	No data

Source: Sutton and Fahmi (2001)

Ironically, the informal sector does present many of the desired qualities of the "distributed city". It functions on personal trust and is mediated by existing communities. It, has in a sense, developed the sought-after decentralized planning highly adapted to individual communities with tight networks of kinship and strong social capital. The spaces are put to mixed use and highly dense. The communities expand only based on direct necessity since purchase and construction of land are conveyed by word of mouth, bypassing official channels. The lack of rules and regulations also facilitate small local enterprises and makes local agricultural production easy and profitable. The informal sector also offers employment opportunities for the growing labour force. A 1998 analysis of the workforce estimated that approximately 54% of employment in Egypt was in the informal sector with a growing female presence (Radwan, 2002, 7). Particularly Small to Medium Enterprises (SME) are informal, with an estimated 83 % of these being informal in 2006 (Iskandar, 2008). This is mainly attributed to the added costs of running a formalized business and the time required to handle the many governmental regulations.

In order to cope with the growing unemployment and encourage SMEs, the government of Egypt is working on facilitating the formalizing process. Through programs like "*Ibni Beitak*" (Nasser, 2008), the GOE aims to create new systems that would allow the development of formalized housing through informal techniques. This would help fulfil the housing demand that the informal settlements cater to, while allowing the government to exercise more control over new developments. Bridging the gap between the informal and formal sector to meet the needs of the people while enforcing necessary rules and regulations to protect human and environmental health will be a necessary step towards sustainability. It is vital that a common ground is found between these two sectors to prevent further loss of agricultural land and ensure proper health standards for the worker while minimizing negative impacts on the environment.

Figure 5: 1970 and 1983 master plans for Cairo: new towns, ring road, and east-west axes of development



Source: Sutton and Fahmi (2001, 137)

Eco Efficient City

The eco-efficient city uses technology to dramatically minimise its metabolic footprint and at the same enable the advancement of the green agenda.

Water

One of the major challenges for Egypt's water sector today is to close the growing gap between the limited freshwater resources and the escalating demand caused by rapid development. Given that Egypt's limited share of the Nile, 55.5 Billion Cubic Meters (BCM), represents 96% of its renewable water resources, it is becoming imperative to protect available water from pollution and maximize the efficiency of its usage (MSEA, 2005, 65). In terms of providing potable water for its population, the GOE has been quite successful (see Table 4), yet the provision of sanitary sewerage systems lags significantly behind. Ironically, the construction of potable water networks has expanded consumption and the production of wastewater. It is therefore crucial to build the necessary sanitation system to complement the existing water network. Egypt also has an inadequate number of treatment plants, causing the existing plants to receive quantities of water larger than their treatment capacity. According to research on Cairo in the *Urban Management Series* of 2002, only 15% of wastewater was

treated, approximately 25% was partially treated; thus untreated domestic sewage and highly polluted industrial effluent is released directly into old irrigation canals (Romaya, 2002, 177).

Table 4: Statistics on water systems in Egypt

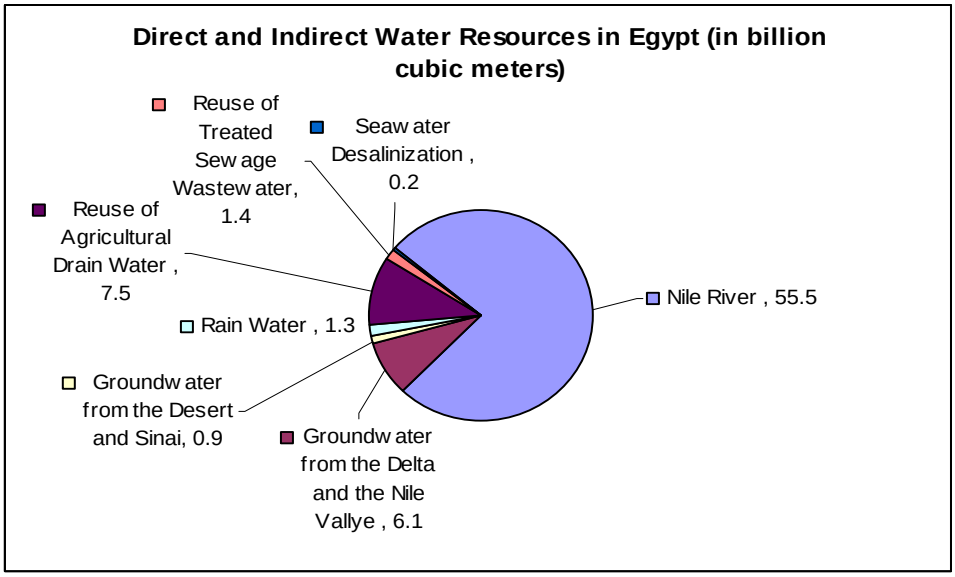
Improved drinking water coverage	**Egypt**	**1990**	**2004**
	Total (%)	94	98
	Urban (%)	97	99
	Rural (%)	92	97
Household connection to improved drinking water			
	Total (%)	61	85
	Urban (%)	89	99
	Rural (%)	40	74
Improved sanitation coverage			
	Total (%)	54	70
	Urban (%)	70	86
	Rural (%)	42	58

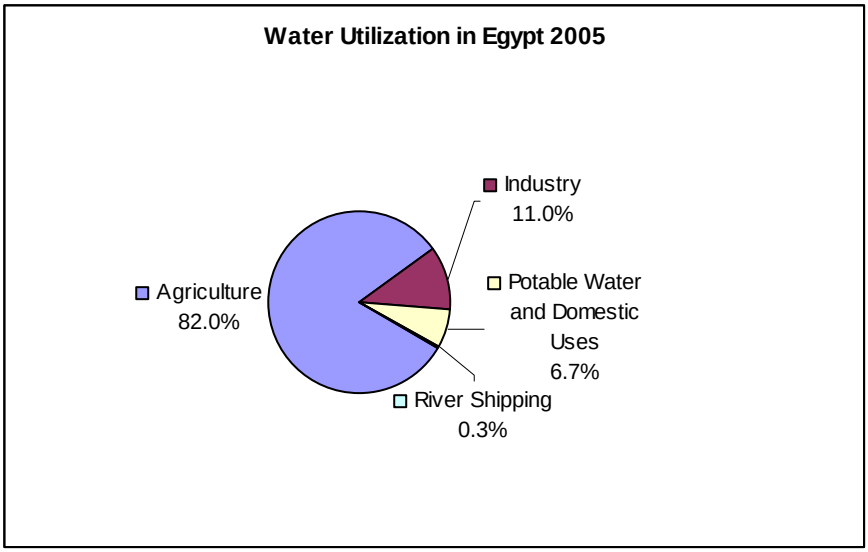
Source: UN-HABITAT (2007)

These estimates emphasize the potential for the reuse of treated sewage water as a means to alleviate unsanitary dumping while providing water for green spaces (such as the greenbelt) or certain agricultural crops. The NEAP outlines the need to separate the industrial wastewater from domestic sewage in order to facilitate treatment and reuse. The MSEA has allocated a large budget to coordinate projects between the Ministry of Housing and Urban Development (MHUD) and the Ministry of Water Resources and Irrigation (MWRI). In order to encourage foreign investments and PPPs, the MWRI, in compliance with the World Bank, launched the National Water Resource Plan 2004-2017 (NWRP) and the Integrated Water Resource Management (IWRM) plan in 2005 to help enforce the NWRP. These have considerable significance for Cairo as they enable far more efficient water use in the city's bioregion and are planned to enable greater population decentralization away from Cairo.

The NWRP has economic and social development objectives to increase employment, improve equity in water distribution and farmers' income and attain some minimum level of food self-sufficiency. The plan has the additional objectives of meeting water needs in all sectors in the future, protecting public health and the environment, recovering operational and maintenance costs to enable better services and institutional strengthening. The NWRP project also endeavours to create the necessary co-ordination mechanisms to develop consensus on the objectives and implementation of the NWRP between all stakeholders. It aims to develop the capacity to monitor and evaluate the implementation of the Water Sector

Figure 6: Water Resources and utilization in Egypt





Source: MSEA (2005, 65)

programs and provides inputs for the water component of the National Investments Plans (IWRM, 2005, 28). The first steps of this initiative are predominantly aimed at enhancing the infrastructure and decentralization of the MWIR, as well as upgrading the outdated irrigation techniques of open irrigation drains to closed underground pipelines in order to minimize contamination and evaporation. Programs like these are expected to help save 5-10 percent of irrigation water (*MSEA*, 2001, 50). The *NEAP* encourages the use of less water-hungry crops and engages local farmers in the development of the new systems in order to ensure durability and personal involvement.

The GOE has ambitious plans to utilize the benefits reaped from resource development and increased infrastructure efficiency to increase the amount of habitable land in Egypt from 5.5% to 25% (IWRM, 2005, 11) in order to alleviate the population concentration in the Nile valley. Some projects to reclaim arable land currently underway include the Toshka project in Upper Egypt and the West Delta Water Conservation and an Irrigation Rehabilitation Project

located northwest of Cairo. However, for these types of projects to be beneficial, a strong planning department both on national levels and local levels is required to control urban expansion in Cairo and at the same time provide a well planned alternative urban space in the new city-regions.

Solid Waste

The problems surrounding solid waste management are common to all cities but some of the solutions below are quite particular to Cairo which has an interesting history from its traditional garbage collecting communities called the *Zabaleen*. For over half a century, the *Zabaleen* have collected trash throughout the city and have created what could arguably be one of the world's most efficient resource recovery and waste recycling systems. With their roots based in agriculture, these communities use the collected waste to generate income by

Figure 7:"Garbage City" the largest *Zabaleen*, trash collecting, community

Source: Brigid Grund 2008

selling sorted secondary material (paper, plastic, rags, glass) and using organic waste as pig fodder (Fahmi, 2005, 156). It was estimated in 1997 that the *Zabaleen* collected 3000 tons of garbage every day which is about a third of the total trash produced by Cairo's 14 million inhabitants (Fahmi, 2005, 158). Almost 85% of this waste was successfully recycled and used by artisans or for agricultural uses, which is significantly higher than any industrialized trash collecting system. Yet, despite the incredible efficiency, many of the practices of the *Zabaleen* are considered environmentally unsound and the mixed use of the spaces in the communities is generally a threat to the health of their inhabitants (Fahmi, 2005, 157).

In recent years, the city of Cairo has begun contracting large international waste management companies in efforts to upgrade its organization and technical standards and meet the needs of its ever increasing population. Indeed the need for regulation is felt when the municipal solid waste collection efficiency ranges anywhere from 10% to 90% (MSEA, 2001, 25). The aim of this system was to provide a uniform collecting system that would dispose of the garbage into designated landfills according to standardized procedures that would limit health and environmental hazards. Because these systems are technology based, however, effective processing, recycling and disposing of waste depend on efficient management and training programs, which often do not meet required performance standards. This privatization of waste collection has also caused a series of negative repercussions manifested through public resistance to the new system and measures taken to implement it. Many prefer the informal methods used by the *Zabaleen* and the linkage of the trash collecting fees to the electricity bill has been the source of much complaint and resistance (El-Khashab, 2006). The trash collecting communities are threatened by the competition in a variety of ways (Fahmi, 2005). Instead of replacing the traditional methods, a complementary approach could prove to be more adequate.

Figure 8: Example of cleanup site

Source: MSEA (2005, 156)

Collection methods aside, much progress has been made with respect to the cleaning up of informal city dumpsites and the construction of several sanitary dumpsites for Cairo to replace existing public government landfills and open informal landfills. In 2004 the MSEA launched a plan for the removal of historic dumpsites in the city and in 2005 7.75 million m3 of trash was moved to designated landfills (MSEA, 2005, 155). The removal of the waste aims to prevent fire hazards, improve health standards, alleviate visual and olfactory blight while providing public open spaces, thus integrating the green and brown agendas.

Air

Air pollution from industrial activity is a major contributor to the degradation of air quality within the GCMR. Most industrial plants are located adjacent to human settlements and are the source of toxins harmful to human health. Many of the factories use outdated technology and do not abide by emissions standards, despite regulation efforts and sanctions from the government (Attiya, 2007). The most notorious examples were the 79 factories within the residential area of 610 000 inhabitants in Shoubra Al-Kheima in the Qualioubiya governorate. These have caused lead particulate levels which received international attention for being infamously high (Attiya, 2008).

Figure 9: Smog and Industrial Pollution in Giza

Source: Nikki Kilbride 2008

Though the success story of air quality improvement remains varied, some significant examples of positive achievements exist—notably the improvement in lead levels after the transfer of the Shoubra Al-Kheima lead smelters which produced 70% of the nation's lead to the Abou Zabal industrial zone (Attiya, 2007). Through their removal from the residential areas and improved technological standards coupled with the governments efforts for the use of lead-free benzene fuel, lead particulate levels have remarkably decreased from 1999 – 2005 (MSEA, 2005, 30). The quality of life of the residents and the overall environment have both benefited from these efforts.

With the gradual improvement of data collection and knowledge bases, the NEAP formulates that the existing large industrial facilities and power plants will be monitored through Environmental Impact Assessments 's (EIA) and, according to the agreement signed by the Ministry of Petroleum and the Ministry of Electricity, all power plants will function on natural gas (MSEA, 2001, 68). Tax incentives will be given to environmentally-friendly products and production methods thereby making them more competitive on the international

market. The NEAP also states that all scattered industrial activity located in human settlements will be moved to industrial zones on the outskirts of the city. Through this process, the technologies of these plants will be updated to proper environmental standards and their prior locations will be used as open space and parks to upgrade the quality of life for the residents (MSEA, 2001, 66). If successful, this project will reduce metabolic impacts and improve natural systems in the city.

Vehicle exhausts have also been identified as a major contributor to poor air quality in urban areas in Egypt and especially in Cairo. Besides the efforts being made toward switching to CNG, the city has established emissions testing in Cairo with varying amounts of success. In 1999 Cairo Air Improvement Project (CAIP), with the funding of USAID, completed the construction of the first emissions testing station in Africa which now serves as a model for future stations. As of January 2000, an average of 700 to 800 vehicles were being temporarily withdrawn daily due to emissions that exceeded the legal environmental standards. Yet, results of Vehicular Emission Testing (VET) are varied and enforcement of laws is often overlooked (El-Naqueeb, 2007).

Place-based City

The place-based city emphasizes the local identity and sense of place so that residents are likely to be more able to relate to local issues concerning the green and brown agendas and minimise their travel. Green space is an essential part of local sense of place.

Cultural and Historical Preservation

With the globalizing trends of the modern world and an intrinsic shift from production to consumption, much controversy has surrounded tourism. As it can be of benefit to the local economy, it can –particularly in places of extreme significance— transform local cultural and natural heritage into a product for tourist consumption. Yet tourism remains a vital source of income for the Egyptian economy; thus economic sustainability depends on the preservation of cultural heritage and natural environments. Cairo's role in the development of the tourism industry can provide a leading example for positively embedding tourism into the urban fabric, benefiting the local communities while catering to the tourist market.

Integrating tourism in historical districts without changing the culture of its inhabitants is a challenge faced by all cities. Districts such as Old Cairo are faced with the options of using tourism to upgrade low income historical areas at the risk of 'disneyfication' or allowing deterioration through use and overcrowding. Yet holistic plans exist for adaptive reuse and reconstruction of historical sites in order to meet changing social needs, as well as to insure that revenues generated from tourism are fed back into the local community through mechanisms of cross subsidisation. This approach to the rehabilitation of Old Cairo was presented in the 1997 UNDP plans for the historical conservation of the area. Though ratified, the successes in this area are debatable and for the most part rehabilitation remains piecemeal.

Box 2: Old Cairo Characteristics

Characteristics of a historic site	Characteristics of lower income neighbourhood
▪ Old Islamic city street pattern (dense configuration of contiguous enclosures and inward oriented houses thus difficult access by car and other vehicles) ▪ Similar development to other "medinas" in North African cities ▪ Extensive amount of vernacular architecture and historic buildings ▪ A place of extreme historic significance and cultural heritage	▪ Decaying housing stock ▪ A lack of public spaces ▪ Increased population densities ▪ Deteriorating urban fabric (partly attributed to traffic congestion) ▪ Inadequate infrastructure ▪ Insufficient service provision

Source: Sutton and Fahmi, 2002

Greening of the City

Currently, Cairo is notorious for its lack of greens pace per inhabitant. According to the World Health Organization (WHO) the minimum amount of green space per inhabitant should be approximately 12m2 but Cairo has less than 30 cm3. Increasing the amount of green space in the city could help to create a sense of attachment in its inhabitants. However,

Figure 10: View of the city from Al-Azhar park

Source: Nikki Killbride 2007

this needs to be designed carefully as the high density urban environment is both walkable and has a lot of shade due to the closeness of buildings which enables it to have less need for energy-hungry cooling technology. Thin strips of green spaces threaded throughout the city, especially along traffic arteries or the use of green rooftops could potentially help the city become more walkable and green by reducing the use of vehicular transport as well as improving the general quality of life.

Currently the *NEAP* calls for the transformation of inner Cairo industrial space into green spaces and the success of this undertaking would provide multiple sized green spaces interspersed within the city. Up to this date the greatest achievement in the creation of green spaces remains the impressive Al- Azhar park which was funded by the Aga Khan Trust for Culture and opened in March 2005. This 31 hectare park was built on an old open-informal landfill in some of the poorest districts of Cairo. 1.5 million tons of waste was cleared for the creation of the park. Its goal is not simply to provide a green lung for the city but it is also part of a greater project funded by the Aga Khan to revive the surrounding poor neighbourhoods (Doss, 2005).

Photosynthetic City

The photosynthetic city grows food and fibre in and around the city to minimise food-miles and fibre-miles thus reducing metabolic footprint and greening the city simultaneously.

Figure 11: Local products and urban agriculture

Source: Brigid Grund 2008

The fertile land of the Nile remains an important asset to Egypt with over 13% of its GDP being agriculturally based (Central Intelligence Agency, 2008). Once the breadbasket of

the Romans, Egypt's current agricultural exports are predominantly fruits and vegetables. Ironically most of its grain-based products are now import-dependent. In 2003, it was estimated that approximately 50% of the average Egyptian diet was based on imported products, mainly meat, wheat, oil, corn, sugar, beans and tea (Zayed and Moustafa, 2003). While attention is given to EU-bound crops of fresh produce, much remains to be done in building a local agriculture capable of sustaining the growing population of Egypt. Imported food prices have been rising while most wages in Egypt have stagnated. The price of basic sustenance is increasingly unaffordable.

Efforts have been made on the local scale to create a sustainable food market for the city through a general decentralization of the products and a continuation of the traditional weekly souks (open markets). The steady rise of product prices has created a reactionary proliferation of the informal open markets since a growing range of the population considers standardized prices too high. Souks have emerged around Cairo to match the demand, increasing from an estimated 60 in 1990 to 113 in 2006 (Darwich, 2006). Though many imported articles are sold (such as ready-to-wear clothing), these markets also sell local agricultural and artisanal products at lower prices. Prices are negotiable with products ranging from fruits, vegetables and dairy to clothing, fabric and even small household appliances. Some vendors in the informal markets are willing to sell on credit to accommodate their regular customers, creating a unique and more flexible system for lower income populations (Darwich, 2006).

One drawback to the informal market is a lack of quality control. Many people want to buy products that do not use the common pesticides but the standard price for organic produce is generally too high. In 2005, the UNDP, in collaboration with the Sekem society, helped fund a widely successful project to establish a weekly affordable organic market in the Mohandessine neighborhood (Gheith, 2005). This drive for organic products has also encouraged an interest in roof-top agriculture. Many innovative techniques to make it affordable and efficient (in terms of soil and water needed) are being developed. Though these green-roofs are not yet wide spread, their users have benefited from home grown products that are both sold and consumed personally, as well as more efficient climate control in their dwellings (Al-Mekkawi, 2008). Urban agriculture is already present in many communities of the GCMR, such as the *Zabaleen* and other informal settlements that have access to arable land, and is a productive practice. Making it available to inner urban areas by developing and disseminating rooftop gardening techniques could allow further local food generation while simultaneously creating inner-city green spaces. For areas with traditional North African or informally developed urban fabric of high density dwellings and small streets, rooftop gardens may be the only simple method to permeate inner-city communities with green spaces.

Sustainable Transport City

Sustainable transport helps shape the city into corridors rather than allowing sprawl into agricultural land, as well as creating clear benefits for the city in terms of reduced impact from cars and reduced overall metabolic input.

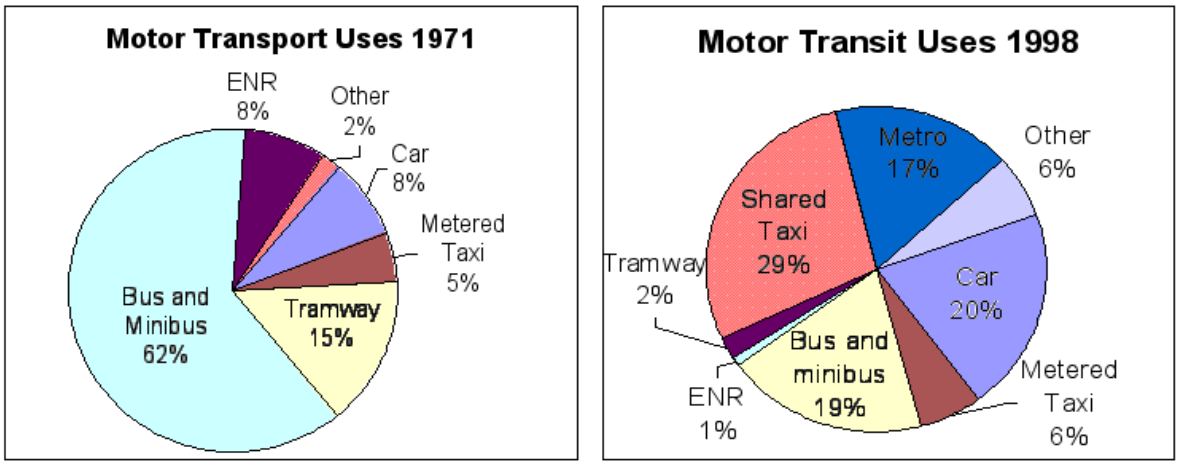
Figure 12: Daily traffic congestion on the streets of Cairo near Tahrir Square

Source: Brigid Grund 2008

Today, there exist many modes of transportation in Cairo: a shared jitney and taxi network, a state-owned bus and mini bus company (CTA), metro lines, micro buses, a tramway, and private cars. Though there has been a continual increase in private vehicle ownership, the majority of the population still depends on public transportation as their primary means of circulation. In December 1998, there were over 14 million registered trips per day with 70% of motor trips taken through public transport or taxis (Metge 2000, 20). Since the birth of the shared taxi (jitney) and microbus networks in the late seventies and the initialization of the metro system with the construction of the first line in 1989, the face of public transportation has changed dramatically (see Pie Chart). As listed in the "World Bank Urban Transport Strategy Review" characteristics that have shaped this change are:

- The construction of two heavy metro lines (Mass Rapid Transit)
- The inadequate development of the bus public network compared with the increase in demand
- The increased supply in shared taxis
- The dilapidation of the tramway network and the abandonment of the trolley-bus line
- The increased recourse to private cars
- The construction of major road infrastructures around as well as inside the city centre.

Figure 13: Changes in transport uses from 1971 to 1998



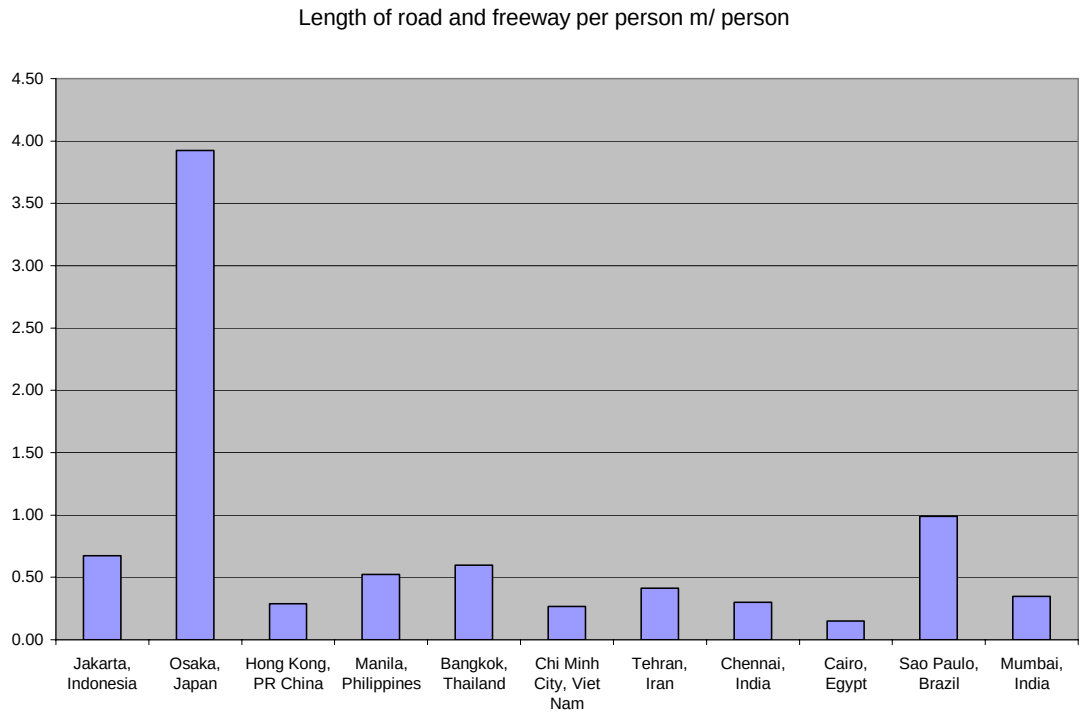
Source: Metge (2000). Note: ENR stands for Egyptian National Railway

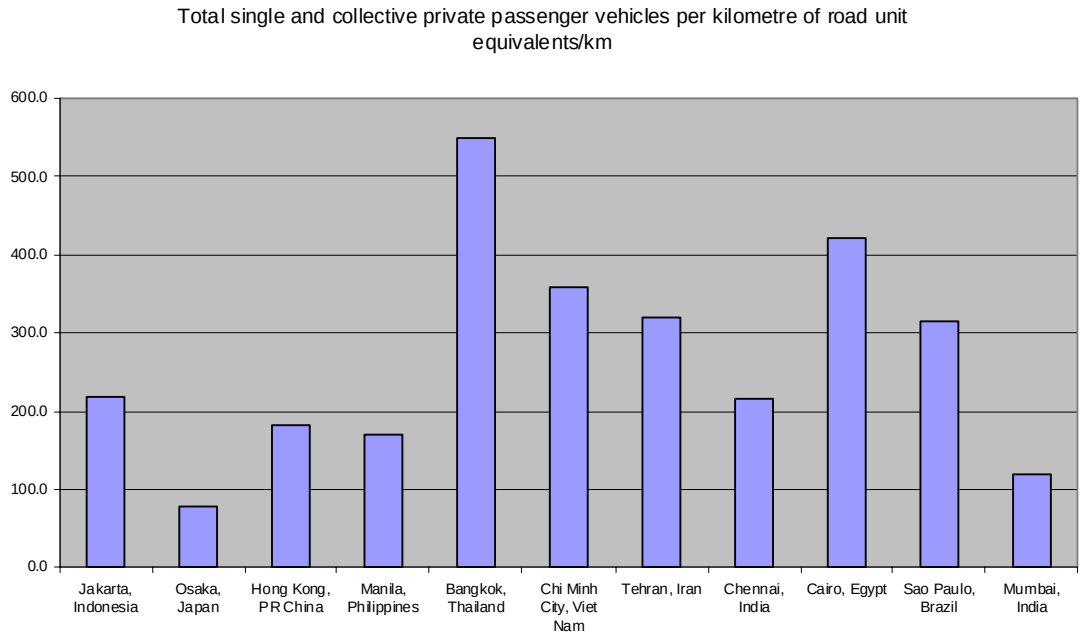
The popularization of the private vehicle in the last half of the century has been a source of many changes in the characteristics of the urban landscape. The time-space convergence due to modern transportation has allowed cities in developing countries to physically grow faster than ever before. Cairo is currently suffering from the effects of a boom in vehicle ownership both in the inner city, which is experiencing air and noise pollution and outward uncontrolled urban sprawl, and in the outer regions where the necessity of owning a car is only adding to the congestion within the city.

Indeed, the number of cars per household between 1971 and 1998 grew by 220%. In the same time period there was a 77% increase in transport mobility which, with population growth, meant a 213% increase in the number of trips (Metge 2000, 5). Establishing efficient modes of transportation to provide for this increase in mobility will be a key asset in improving quality of life in the city as well as an opportunity to reduce the environmental impact of vehicular pollutants. Yet despite Cairo's relatively low levels of private vehicular ownership on the global scale, the fundamental problem of cars is felt greatly in the streets of Cairo because it's a city that was not planned around the car. The existing roads and freeways are almost constantly saturated, and the construction of new roads and freeways cause severe ruptures in the urban fabric which was essentially made to be pedestrian. As indicated in the graphs below, Cairo has relatively little street spaces but very high traffic density—indicating the city's inability to cope with the influx of vehicles.

However, what has made Cairo excel as a developing city, particularly in the MENA and African context is its decision to invest in an extensive underground metro system. The metro is the current system with the greatest potential towards a healthy sustainable development for a city with such high density because it is efficient, democratic, and does not contribute to or become hindered by surface level traffic.

Figure 14: Comparison of traffic and road conditions in high density cities





Source: Kenworthy (1999)

Since the implementation of its first line in 1989, the second line completed in 2004 and a third line currently under construction it has proven to be widely successful. With its line 1 moving along the north-south axis on the east bank connecting Helwan and El Marg and line 2 connecting Shoubra El Kheima and El Mounib to the Central Business District (CBD), the metro is accessible to over 30% of the city's population and provides 20% of motorized

transports of the city (Metge, 2000, 25). It caters to the largest income group since it is both affordable and more efficient than taxis or private cars and it is used by men and women alike thanks to the car reserved for women on each train. Since the construction of the first line, the north-south corridor has experienced a densification of the lower to middle class, as the city centre is increasingly becoming the center of employment and activity. The densification of this axis has triggered much infill development including some informal expansion onto agricultural land to the north of El-Marg. This indicates that the placement of the future metro lines could be influential in directing the growth away from the agricultural areas by allowing easy access to the surrounding desert lands. The 3rd line planned to run from Imbaba to the International airport could encourage development into the desert east of the city between Heliopolis and the airport.

Developing attractive public transport systems is vital for linking the green and brown agenda because mobility shapes the relationship between the individual and the urban environment. Public transit systems can help Cairo control its urban form by facilitating access to the New Towns for lower and middle income population. As many examples in Europe have proven, it can provide a more pleasant urban environment by giving the city back to the people through traffic calming, and pedestrianization. The ambitious goals of creating an integrated network of 6 metro lines by 2020 in the GCMR, demonstrates Cairo's dedication to creating a more sustainable city.

Governance for integrating the Green and Brown Agendas

Urban Planning

Planning in Cairo has been a struggle since the beginning. As described in Sutton and Fahmi (2001):

> *'Indeed, it can be argued that, not only has Greater Cairo not been mastered or planned, but that the master plan of 1983, as revised in 1991–92, no longer really exists in an effective way. As Denis (1997) has observed, Cairo has "a population that routinely resists official designs for the organisation of the city". Rather Cairo's continued development has been carried out by private entrepreneurs and property speculators rather than by the city's planners. Private dynamics prevail as increasingly the planners have been forced to leave private developers to get on with things" (149).*

In order to implement the measures discussed above and become a sustainable city, there needs to be a strong system of urban planning. The issues of the green and brown agenda are not integrated unless outcomes common to both agendas' interests are specified in the land use and infrastructure priority process. Without this, the green and brown agendas are only possible to fulfil where wealthy land owners can demand they be provided. As addressed throughout this case study, there is an urgent discrepancy between planning goals and results particularly felt when discussing the proliferation of informal settlements where wealth is insufficient to solve these issues privately.

The GOE has a long history in planning for Cairo, beginning with the 1956 master plan with subsequent revisions in 1970, 1983, and 1991-2. The General Organization for Physical Planning (GOPP) has been working for many years in collaboration with the French planning organization Institut d'Aménagement et d'Urbanism de la Région d'Ile de France (IAURIF).

Yet the urban planning system remains inadequate and largely has been neglected in the governance system.

Strategic planning goals and developed projections are being created but they rarely translate into statutory processes to enable these to be fulfilled. The source of the issue could lie in the excessive centralization of planning in Egypt. The NEAP encourages the use of decentralizing techniques to empower smaller scale governments, alleviate the bureaucracy that currently exists and facilitate public participation (MSEA, 2001, 160). The first steps taken that deviate from the history of planning in Cairo are the gradual recognition of various established informal settlements, as well as a more strategic approach to planning that puts the emphasis on the process rather than the result. Ultimately this approach aims to embrace informal methods of development in order to better suit the needs of the local communities. These processes could be turned into urban planning that embraces the many issues of the green and brown agendas.

Governmental Infrastructure

One of the major challenges for developing nations, and perhaps the most vital to address, is the need for a strong institutional structure for the implementation of environmental policies in the green and brown agendas. Egypt is no exception and, although it has a long history of developing environmental policy, enforcement and compliance with the legislation is weak. This problem is continually addressed in the Egyptian NEAP with the importance of the country's ability to construct appropriate institutional structures with clear mandates and the necessary infrastructure to carry out those mandates being continually emphasized.

Since the protection and conservation of the environment and pollution abatement are issues that affect all levels of government and lifestyle, it is, therefore, particularly difficult to implement environmental policies. This would depend on the absorption of environmental agendas into the mandates declared by all 17 ministries of the central government. Yet most established sectoral interests have a set way of doing things and there is a general lack of knowledge of environmental concerns as well as a lack of human resources to change the existing patterns.

In spite of these difficulties, the existing and developing Egyptian infrastructure dedicated to environmental sustainability has made progress. The Ministry of State for Environmental Affairs (MSEA) was created in 1997 with the mandate to "achieve a balance between the needs of a developing nation while protecting her natural resources" and is "required to address the cumulative impact of environmental problems that have accumulated over the past 40 years, mobilize investments; and build human capacities (MSEA, 2001, 124). Prior to this, in 1982, the Presidential Decree No. 631 created the Egyptian Environmental Affairs Agency (EEAA) which became the highest authority in Egypt responsible for "promoting and protecting the environment and coordinating adequate responses to these issues" (MSEA, 2001, 124). Since the creation of MSEA, the EEAA has primarily served the role of central coordinating body, developing policies and overseeing their implementation, as well as monitoring progress of environmental action plans. In 2001 the EEAA implemented an Enforcement Unit responsible for monitoring compliance, performing inspections and generally enforcing Law 4/1994 and Law 102/1983.

The primary constraint of these bodies lies in the shortage of human resources, particularly a shortage of adequately experienced personnel. The need for more environmental specialists is difficult to fulfil due to the time required to gain sufficient knowledge and field experience in a relatively new specialty. As described by Nasser (2008), MENA countries often experience

a “brain drain” phenomenon as many people of higher education emigrate. Because of the shortage of experts and human resources, establishing strong regional branches has proven to be difficult as well. As of 2001 there were eight regional EEAA branches established but most were experiencing staffing deficiencies. Unfortunately this creates a centralized structure for the environmental agencies which are then strained to handle issues that would be more appropriately handled by local agencies.

These problems are all addressed in the NEAP of 2001, which stipulates that a priority of the MSEA and EEAA should be to raise awareness of environmental concerns amongst the public, private and governmental sectors. The plan calls for building the capacity of Environmental Management Units (EMU) in accordance to the UNPD Capacity 21 project proposals. The EMU work within the Governorate offices (reporting to the governor). By strengthening their infrastructure and capabilities they would serve as local administrations and would be key in creating and supervising the updating and maintenance of a database on local resources and environmental conditions.

Lack of enforcement incentives

Another problem in establishing eco-friendly patterns in Egypt and particularly Cairo is the lack of enforcement incentives and a general shortcoming in the application of the laws. Many of the major problems of the city today, such as air pollution, solid waste management and informal expansion, have been identified. Short and long term solutions have been provided for but often improvements seem minor if not negligible. As mentioned previously, the GOE is know for its inefficient, bloated bureaucracy—herein may lie the first obstacle towards successful sustainability. Without sound and effective governmental planning, it will be virtually impossible to achieve the delicate balance between social, economic and environmental needs necessary for a sustainable system.

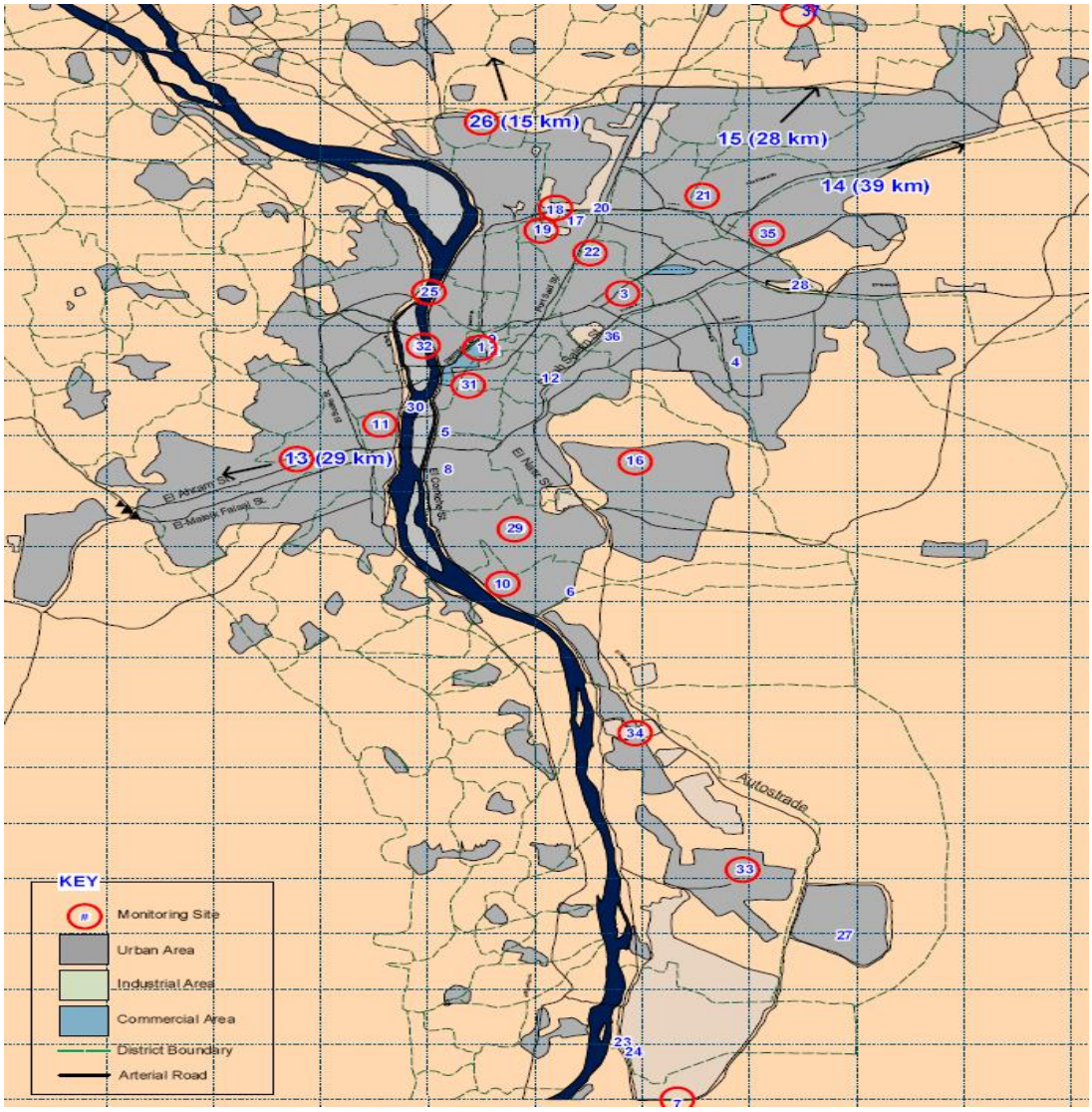
Data Collection

One of the major challenges faced by environmental policy-making and enforcement in developing countries is a lack of coherent information and consistent data. The EEAA has made great efforts in this domain and created in 1995 the Environmental Information Monitoring Program (EIMP) with the help of Danish Development Assistance (DANIDA). Projects within this program includes the Cairo Air Improvement Program (CAIP), designed to monitor ambient air particulate levels, particularly lead levels in the Greater Cairo Region, and to help form a comprehensive strategy to control the air pollution in Egypt.

Since its formation in 1995 the EIMP, with the funding of DANIDA, has successfully established 42 air monitoring stations in the governorates throughout the country. CAIP has established 36 stations within Cairo through USAID funding. Both programs have successfully produced high quality comprehensive data that can be used to establish adapted air pollution control strategies.

The MWRI has also established an extensive water-monitoring network to observe and control the quality of water of all water systems in Egypt. This includes 18 monitoring points in the Greater Cairo region covering the intakes of potable water purification plants in that region and the inlets to the Damietta and the Rosetta branches. These monitoring projects have successfully produced quality data, and will provide the scientific basis needed for environmentalist endeavours.

Figure 16: Air monitoring sites in the GCMR



Source: Environmental Information and Monitoring Program (2006)

However, the social statistics on Cairo's demographics are not yet as reliable and vary widely. It is important for this data to be made available for research in order to better understand the urban dynamics and provide more holistic solutions to existing problems.

Public Education and Involvement

Education is a means to catalyse progress for environmental and planning concerns, particularly in developing cities where many inhabitants are not exposed to vast information sources like the Internet. The *NEAP* continually underscores the importance of educating the general population about simple environmental issues and providing them with enough knowledge to begin change. Special educational and training programs for sub-population groups (e.g.: children, youth, women, physically disabled and marginalized population) are outlined, with the goals of disseminating information to the general population through these groups. These programs aim to offer opportunities of training and employment for these groups while creating a bottom-up movement for environmental concerns. Though it is difficult to determine how effective the MSEA and EEAA are at enacting these programs, it

could galvanize a greater sense of environmental responsibility in each individual, which would facilitate enforcement of environmental rules and regulations. It has been proven by many cases historically and worldwide that many detrimental practices for the environment and health could be solved with basic practical education. In this context, NGO's could provide the needed link to engage the stakeholders.

Conclusion

The mega city of Cairo has enormous problems as the sheer size of its population and the metabolism of the city consumes so much of the green arable land, open space, water and air. Yet it is a city with a highly significant regional role, a history that is second to none in terms of its heritage significance and is obviously a city with a high quality of life for many of its inhabitants. The joining of the green agenda and the brown agendas so that the city can become more sustainable remains a major challenge. In particular the process of urban planning is not adequately addressing these issues. In this, Cairo is not alone. However the one thing that appears certain in terms of governance for the green and brown agendas is that urban planning must be enhanced to enable these matters to be adequately addressed. The provision of infrastructure in an orderly and equitable fashion, the location of land uses in ways that minimises travel and reduces metabolic impacts, and optimises the use of green space, can only be done through the regulatory and participatory approaches of urban planning.

In light of this case study, the areas that will require the most attention to encourage sustainable development through a more active form of urban planning in Cairo are:

- Bridging the gap between the formal and informal sector to encourage individual investment in the environment by granting security of tenure in development applications as well as meeting the changing needs of the population through a more flexible and accessible system of planning and community development.

- Stimulate the development of new and renewable energies by encouraging investment from the private sector and locating it across the city in appropriate places that can enhance the green and brown agendas.

- Reduce dependency on cars by pedestrianizing the city and providing effective means of public transport through the development of metro and other systems.

- Provide greenspace by recycling misused spaces such as informal landfills and moving hazardous industrial plants to designated industrial spaces.

- Improve living conditions by formalizing the existing informal settlements and granting security of tenure, thereby improving environmental impact of these settlements by providing adequate sanitation facilities and waste disposal methods.

- Encourage the use of public private partnerships to create controllable and economically viable service systems for the city but ensuring through the urban planning system that common good outcomes are achieved.

- Implement education and training programs to encourage grassroots movements for improvement of local neighbourhoods through participatory urban planning processes.

References

Arab Republic of Egypt Central Agency for Public Mobilization and Statistics (CAPMAS) (2006) *Census 2006*, http://www.msrintranet.capmas.gov.eg, accessed 19 February 2008

El Araby, M. (2002) "Urban Growth and Environmental Degradation - the Case of Cairo, Egypt" *Cities*, **19**: 389-400

El-Batran, M., and Arandel, C. (1998) "A Shelter of Their Own: Informal Settlement Expansion in Greater Cairo and Government Responses" *Environment and Urbanization*, **10**: 217-232

Bayat, A., and Denis, E. (2000) "Who is Afraid of Ashwaiyyat? Urban Change and Politics in Egypt" *Environment and Urbanization*, **12**: 185-199

Central Intelligence Agency (2008) "Egypt", CIA World Factbook, Central Intelligence Agency: https://www.cia.gov/library/publications/the-world-factbook/geos/eg.html, accessed 19 February 2008

Denis, E. (1999) "Le Caire à l'orée du XXIe siècle: Une métropole stabilisée dans un contexte dedéploiement de la croissance urbaine", in Lettre d'information de l'Observatoire Urbain du Caire Contemporainn 48, CEDEJ, Cairo

Environmental Information and Monitoring Program (EIMP) Website, http://www.eeaa.gov.eg/eimp, accessed 30 April 2008

Fahmi, W. (2005) "The Impact of Privatization of Solid Waste Management on the *Zabaleen* Garbage Collectors of Cairo" *Environment and Urbanization*, **17**: 155-170

Integrated Water Resources Management Plan (IWRM), Ministry of Water Resources and Irrigation, http://www.mwri.gov.eg/, accessed 5 July 2008

Kenworthy J., Laube F., Newman P., Barter P., Raad T., Poboon C. and Guia B. (1999) *An International Sourcebook of Automobile Dependence in Cities, 1960-1990*, University Press of Colorado, Boulder, Colorado

Metge, H. (2000) *World Bank Urban Transport Strategy Review: the Case of Cairo, Egypt*, 3rd ed. Avenel, A (ed.), World Bank http://siteresources.worldbank.org/INTURBANTRANSPORT/Resources/land_use_cairo_catram.pdf, accessed 4 May 2008

Ministry of State for Environmental Affairs (MSEA) (2001) *National Environmental Action Plan of Egypt 2002/17*, http://www.eeaa.gov.eg/English/info/report_search.asp, accessed 16 May 2008

Ministry of State for Environmental Affairs (2005) *Egypt State of Environment Report 2005*, http://www.eeaa.gov.eg/English/info/report_search.asp, accessed 16 May 2008

Mortensen, N.G., U. Said Said and J. Badger (2006) *Wind Atlas for Egypt. Proceedings of the Third Middle East*, North Africa Renewable Energy Conference (MENAREC 3), Cairo, Egypt, June 12-14, http://www.windatlas.dk/Egypt/About.html, accessed 17 August 2008

Nasser, M. M. (2008) 'Urban Planning in the Middle East and North African Region', Unpublished study prepared for the Global Report on Human Settlements 2009

Newman, P. (2006) "The Environmental Impact of Cities" *Environment and Urbanization*, **18**: (2): 275-295

Newman, P. and Kenworthy, J. (2007) *Greening Urban Transport in State of the World, 2007*, World Watch Institute, Washington DC

Newman P. and Kenworthy J. (1999) *Sustainability and Cities*, Island Press, Washington, DC.

Radwan, S. (2002) "Employment and Unemployment in Egypt: Conventional Problems Unconventional Remedies", Egyptian Center for Economic Studies, www.worldbank.org/wbi/mdf/mdf4/papers/radwan.pdf, 16 July 2008

Romaya, S. (2002) "Incremental transformations for sustainable urban settlements" in Romaya, S. and Rakodi, C. (eds.) *Building Sustainable Urban Settlements: Approaches and Case Studies in the Developing World*, Urban Management Series, London

Sims, D. (2003) "Understanding Slums: the Case of Cairo, Egypt" Case study prepared for the *Global Report on Human Settlements*, Earthscan, London

Sutton, K., and Fahmi, W. (2001) "Cairo's Urban Growth and Strategic Master Plans in the Light of Egypt's 1996 Population Census Results" *Cities*, **18**: 135-149

Sutton, K., and Fahmi, W. (2002) "The Rehabilitation of Old Cairo" *Habitat International*, **26**: 73-93

UN-HABITAT (United Nations Human Settlements Programme) (2007), *Enhancing Urban Safety and Security*, Global Report on Human Settlements 2007, Earthscan, London: 359

Newspaper Articles

Al-Mekkawi, H. "Les Toits Se Mettent Au Vert." Al-Ahram Hebdo. 16 Jan. 2008. http://hebdo.ahram.org.eg/Arab/Ahram/2008/1/16/null0.htm. (17 June 2008).

Attiya, M. "Choubra Al-Kheima S'Essouffle." Al-Ahram Hebdo. 27 Feb. 2008. http://hebdo.ahram.org.eg/arab/ahram/2008/2/27/envp0.htm. (17 June 2008).

Attiya, M. "Pollution, Ma Déprime." Al-Ahram Hebdo. 10 Jan. 2007. http://hebdo.ahram.org.eg/arab/ahram/2007/1/10/envi0.htm. (17 June 2008).

Attiya, M. "Une Page est Tournée a Choubra Al-Kheima." Al-Ahram Hebdo. 23 May 2007. http://hebdo.ahram.org.eg/Arab/Ahram/2007/5/23/envi0.htm. (17 June 2008).

Darwich, D. "L'échappatoire Des Petites Gens." Al-Ahram Hebdo. 10 May 2006. http://hebdo.ahram.org.eg/arab/ahram/2006/5/10/soci0.htm. (17 June 2008)

Doss, A. "L'incroyable ilot d'Al Azhar" Al-Ahram Hebdo 27 April 2005. http://hebdo.ahram.org.eg/arab/ahram/2005/4/27/null0.htm. (17 June 2008).

El-Khashab, K. "Disposal Problem Lingers." Al Ahram Weekly. 13 Dec. 2006. http://weekly.ahram.org.eg/2006/823/eg8.htm. (3 June 2008).

El-Naqueeb, A. "Inhaling CO2." Al Ahram Weekly. 7 Feb. 2007. http://weekly.ahram.org.eg/2007/830/en1.htm. (18 May 2008)

El-Noshokaty, A. "Blowing in the Wind." Al-Ahram Weekly. 16 June 2004. http://weekly.ahram.org.eg/2004/694/sc9.htm. (16 July 2008).

Gheith, C. "Le Souk Du Bio." Al-Ahram Hebdo. 17 Aug. 2005. http://hebdo.ahram.org.eg/arab/ahram/2005/8/17/null0.htm. (15 June 2008).

Iskandar, L. "Formalising the Informal." Al Ahram Weekly. 27 Mar. 2008. http://weekly.ahram.org.eg/2008/890/ec2.htm. (3 June 2008)

Zayed, I, and Moustafa, R. "La Facture Indigeste Des Importation." Al-Ahram Hebdo. 15 Oct. 2003. http://hebdo.ahram.org.eg/arab/ahram/2003/10/15/doss0.htm. (17 June 2008).