



An Approach Towards Green City Concept in Masdar City: A Case Study

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ABSTRACT

As towns and cities are growing at an alarming rate, with an increasing trend of urbanization, which in turn increases greater demand for urban infrastructure and urban land for accommodating the future urban growth and development. At the same time these aspects became a very significant component to redefine their planning approach by the concerned authorities of the city, such as the urban local bodies like City Corporation which are taking care of urban growth and development in most of the compactly developed areas of the city or town. The urban areas beyond local body's jurisdiction are generally taken care by urban planning and development authorities to accommodate future urban growth and development with a comprehensive approach through proper urban planning processes. In spite of the comprehensive approach in urban planning most of the urban problems remained as irresolvable and becoming beyond the control of planners which in-turn bring down both quality of life and the natural environment. On the other hand a green city planning concept, not a new concept, but it is a new approach in the urban planning processes to overcome existing inabilities in handling the urban problems which were treated as complex and un-resolvable to make urban planning more sustainable without damaging the urban ecology and environment.

Keywords: Ecology; Environment; Green City Concept; Urban Planning.

1.1INTRODUCTION

Green cities are already beginning to emerge. The emergence of more and more green buildings and the transformation of old buildings into green ones is definitely a positive sign. However, few things in this regard need a serious attention. These are:

1. The integrated approach.
2. The rate of green development.
3. The implementation of principles of 'One Planet Living' (OPL). These 10 'One planet living' principles are :

- Zero carbon.
- Zero waste.
- Sustainable transport.
- Local and sustainable materials.
- Local and sustainable food.
- Sustainable water.
- Natural habitats and wild life.
- Culture and heritage.
- Equity and fair trade.
- Health and happiness.

Our study is towards the attainment of zero carbon and zero waste principles.

1.2 OBJECTIVE

To provide an integrated approach for fulfilling the energy requirements of an entire city with the help of renewable sources, in an aligned and planned manner.

1.3 METHODOLOGY

The objective of the study is to provide an integrated approach for fulfilling the energy requirements of an entire green city with the help of renewable sources, in an aligned and planned manner.

Its scope is vast as the methods involved are from renewable sources and environment friendly. The need of environment friendly methods and techniques are in huge demand due to global issues arising out of use of non-renewable and carbon emitting sources.

The methods adopted for the work are literature review through various journals, books and papers, analytical approach and using formulas for estimation, cost calculation and valuation.

A case study is done on MASDAR city.

A proposed model city is included and its energy demands are worked out through renewable measures.

The economic analysis is then carried out showing the cost effectiveness of the method.

Finally, challenges and recommendations are mentioned and the conclusion of whole study is inferred.

1.4 SCOPE

Renewable energy is critical to our fight against climate change. We simply must shift our world to a low-carbon economy and away from oil and coal. Experts agree we need a substantial reduction in CO₂ over the next 40-50 years and this means we need renewable energy. Therefore, there is lot more scope of the work.

2. CASE STUDY - MASDAR CITY

2.1 INTRODUCTION

Since we are concentrating on developing the model green city based on Indian scenario, we have made a thorough study and understandings of the world's first green city which is known as a 'zero carbon and zero waste' city called Masdar city by taken it as our case study.

3.2 PROJECT DETAILS

Project name	: Masdar City
Client	: Masdar
Location	: Abu Dhabi, United Arab Emirates
Participants	
Design of renewable energy	: ETA
Environmental design guidance	: Transsolar
Cost consultancy	: Cyril Sweett
Transportation consultancy	: Systematica

2.2.1 ORIENTATION OF THE PROJECT



Fig 3.1: Orientation of the project

(Source: www.masdarcity.com)

Masdar City's masterplan design meshes the century-old learnings of traditional Arabic urban planning and architecture with leading-edge technologies to create a sustainable, high-quality living environment for all residents. The City will be built in seven carefully designed phases, incorporating the latest technological advances generated in its cleantech cluster and globally.

The passive design element incorporated into the Master plan is of vital importance. Low-rise, high-density

neighbourhood's increases shading which reduces our dependency on our energy systems. The City's Northeast/Southwest orientation maximizes cool breezes flowing from the gulf during the day and the cool airs flowing from the desert at night. Natural wind towers and day shading on the roofs are heavily incorporated into the overall design.

2.3 SUMMARY OF THE PROJECT

Setting new global standards in sustainable development with the world's first zero carbon, zero waste city. WSP has been commissioned by the architects Foster and Partners to develop the sustainable infrastructure strategies for the detailed master plan of the Masdar initiative in Abu Dhabi, UAE. This initiative is being led by 'Masdar', part of the Abu Dhabi Future Energy Company (ADFEC). The Masdar Development will be the world's first zero carbon, zero waste city setting new global standards in sustainable development. WSP is developing strategies for many aspects of the design to support the zero carbon, zero waste ambition of the project.

2.4 MASDAR - OBJECTIVE

- 1) With an estimated completion date of 2015, Masdar will not only be the world's first operationally zero carbon city but it will also be the first city to be built using zero carbon energy. Masdar is a 6 million square metre sustainable city designed to use low carbon technologies to achieve a car-free, zero waste, and carbon neutral community.
- 2) It has been designed using the principals of 'One Planet Living' (OPL), a set of ten guiding principles of sustainability, proposed in a joint initiative by WWF and Bioregional Development, whereby everyone lives within their fair share of the Earth's resources
- 3) With expansion carefully planned, the surrounding land will contain energy farms, research fields, plantations and dense green spaces so that the city will be entirely self-sustaining, following the principals of OPL.
- 4) The waste-to- energy strategy involves the implementation of on-site recycling facilities for municipal solid waste and the conversion of organic waste material into gas which then runs an engine which generates electricity. This supports the OPL principal of zero waste by cutting the amount of waste going into landfill to minimum and generating electricity from the diverted waste.
- 5) Masdar's stone-and-mud walls, built in the tradition of an Arab walled village, will be covered in photovoltaic panels capable of generating 130 megawatts.

“Get ready for the world's first carbon-free city – smack-dab in the center of the oil-rich Middle East.” – CNN

2.5 CARBON MANAGEMENT

Masdar’s Carbon Management Unit develops greenhouse gas emissions reduction projects. It creates value by monetizing greenhouse gas emission reductions under the provisions of the United Nations’ led Clean Development Mechanism (CDM) framework of the Kyoto Protocol. The unit also develops sustainable technologies, including large-scale projects that generate sizeable carbon emission reductions, with a particular focus on CO₂ Capture and Storage.

3.6 POWER GENERATION SYSTEM

Energy services in Masdar City will be provided to City residents and tenant companies under a framework that is competitive, financially sound and sustainable in nature. Creating a carbon neutral city relies on sustainability practices that promote and motivate changes to customer behaviour.

2.6.1 Energy Assets that will be Developed in the City Include

- 1) Photovoltaic Power Generation
- 2) Concentrated Solar Power
- 3) Evacuated Thermal Tube Collectors (ETC)
- 4) Geothermal
- 5) Grid Management (Electrical Power and Water Distribution)
- 6) Waste to Energy (W2E)

2.7 WATER MANAGEMENT SYSTEM

The water that will be provided to City residents will be:

- 1) Safe, cleaned to the highest levels, and reliable for drinking, irrigation, and reuse
- 2) Managed on-site using advanced water and wastewater treatment schemes
- 3) Predominantly supplied (>60%) by recycled water

2.7.1 Water Related Assets that will be Developed in the City

- 1) Water Desalination / Potable water network
- 2) Grey Water & Sewerage Treatment Wet Utility Distribution (Grey, Black and Recycled Water)

2.8 WASTE MANAGEMENT SYSTEM

Strict guidelines have been followed when handling waste generated in the city:

2.8.1 Waste will be managed through an integrated, user-friendly, invisible and odourless system

- 1) Less than 2% of the waste generated will end in landfills
- 2) Energy will be recovered from materials that have reached the end of their useful life
- 3) Composting systems will be used for biodegradable waste

2.8.2 Waste related assets developed in the city include:

- 1) Waste Collection, Waste Handling & Recycling
- 2) Waste to Energy (W2E)

2.9 TRANSPORT MANAGEMENT SYSTEM

To achieve sustainability and carbon neutrality objectives, Masdar City will adopt modern and reliable modes of transport that promote limited use of personal cars by commuters and visitors.

- 1) An LRT (Light Rail Transit) system passing through the city as part of the main planned Abu Dhabi LRT system to transport almost all commuters and visitors.
- 2) A PRT (Personal Rapid Transit) system that will guarantee passenger privacy in a way similar to a car by ensuring that, once boarded, no other passengers will board a vehicle along the route.
- 3) Special parking spaces that would be dedicated to external commuters and visitors as well as to internal residents.
- 4) Logistics network composed of discrete logistic components that are required to ensure availability of goods and materials in the city (desire to excellent delivery logistics services within Masdar city while balancing quality of services delivered).



Fig 3.2: Personal and Light Rapid transport.

(Source : www.masdarcity.com)

Unlike many cities that are built primarily around the accommodation of automotive traffic, Masdar City will offer transportation solutions which will significantly reduce environmental impact without sacrificing ease of movement. As potential transportation solutions Masdar is considering light rail transit (LRT), personal rapid transit (PRT), car parking (at the edge of Masdar City), and associated logistics. Masdar will also consider developing a logistics centre at the edge of Masdar City that will act as the receiving centre for inbound and outbound goods, and distribute these to residents via energy-efficient means.

2.9.1 Potential Examples Include

- 1) A PRT system that will guarantee passenger privacy in a way similar to a car by ensuring that, once boarded, no other passengers will board a vehicle along the route.
- 2) An LRT system passing through the city as part of the main planned Abu Dhabi LRT system. This system would play a key role in transporting commuters and visitors to Masdar City and would enhance the link between its main boundaries.
- 3) Parking spaces that would be dedicated to commuters (external) and visitors as well as to residents (internal).
- 4) Logistics network composed of discrete logistic components that are required to ensure availability of goods and materials in the city. This network would deliver best in class logistics services within Masdar city while balancing quality of services delivered.

2.10 ICT CONCEPT

ICT (Information & Communication Technologies) initiatives are

- 1) Sustainability Management
- 2) City Management Applications
- 3) Electronic Wallet
- 4) Smart home/Smart office and facility management solutions
- 5) Computer Equipment Utility computing
- 6) ICT Infrastructure Services, Telecommunications (voice, video & data) & Data centers

The ICT services in Masdar City will therefore need to make a significant contribution to the daily lives of its residents. ICT should add tangible value through enabling more efficient deployment of services (e.g. demand-managed scheduling of PRTs, recipient-based scheduling of logistics deliveries and enhanced monitoring of facilities to reduce consumption), and intangible value (e.g. providing relevant and accurate information to citizens, enhancing entertainment and keeping citizens informed about the environmental progress agenda). It also needs to be highly interconnected thereby enhancing the experience of living in Masdar City.

3 CONCLUSION

Masdar City has been designed to achieve three goals:

- 1) Maximize the efficiency and effectiveness of City management services.
- 2) Enrich the daily experience of residents, businesses and visitors through provision of a vast array of technology services.
- 3) Enable residents and businesses to interact with Masdar City in the most effective manner.

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