



Masdar City Development Programme

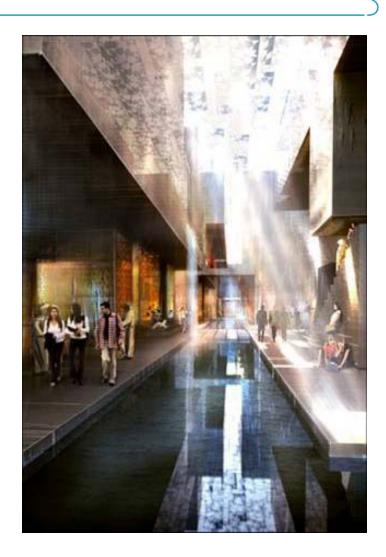
Using GIS Technologies to Help Plan and Build a Sustainable City

Presented by Shannon McElvaney, CH2M HILL Co-Author Derek Gliddon, Masdar Content provided by David Dettloff, Jitka Kotelenska, and Ziad Obeid, CH2M HILL

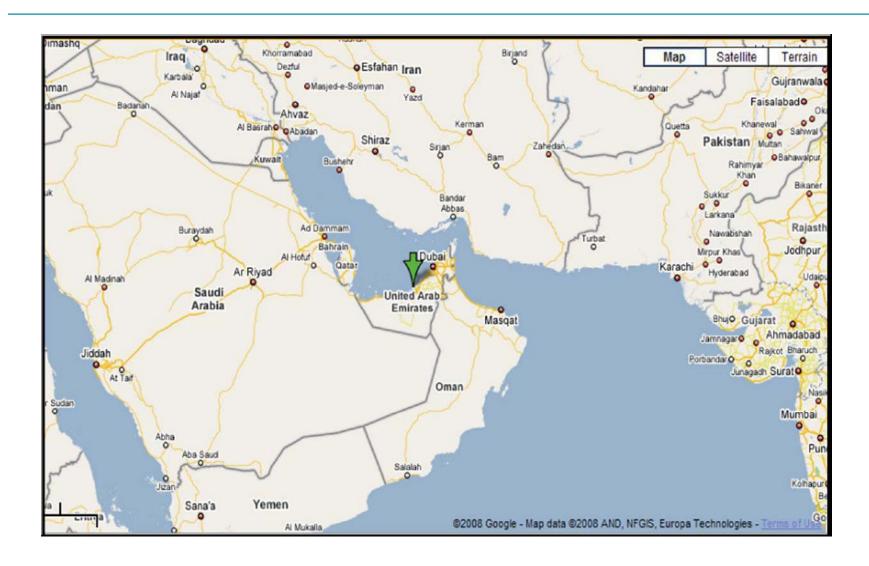
July 13, 2009

Agenda

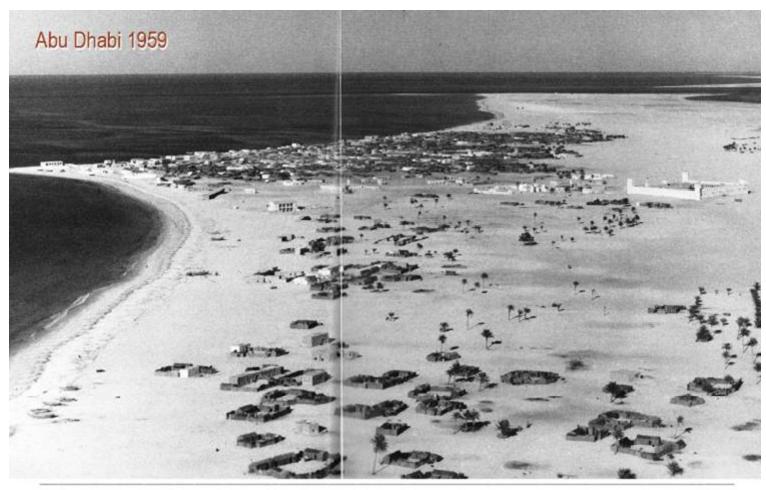
- Background
- Approach
- Construction Sequence
- Site Control & GIS
- Transportation
- Energy Use and Production
- Carbon



United Arab Emirates - General



Abu Dhabi - 1959



Measured Growth



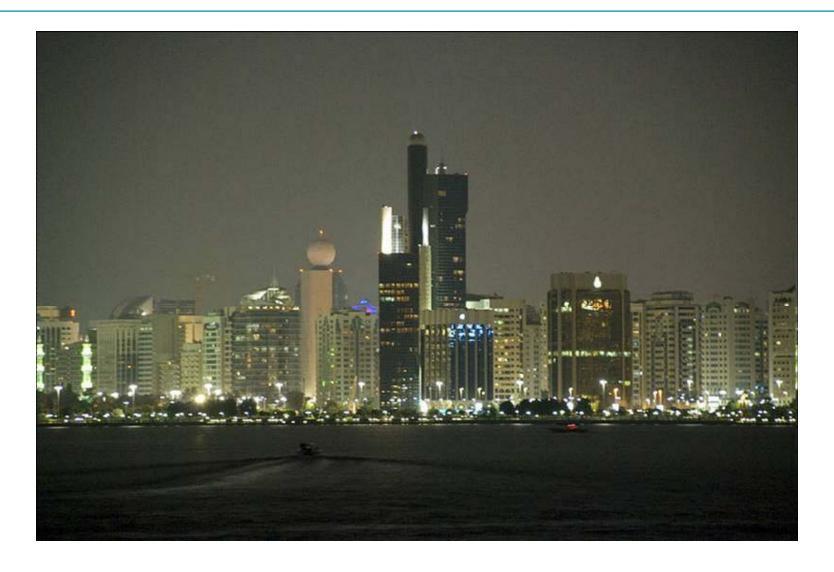
Abu Dhabi - 1990s



Measured Growth

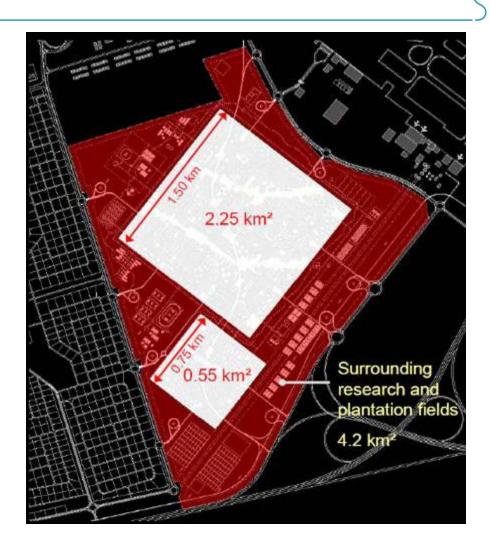


Abu Dhabi - 2008

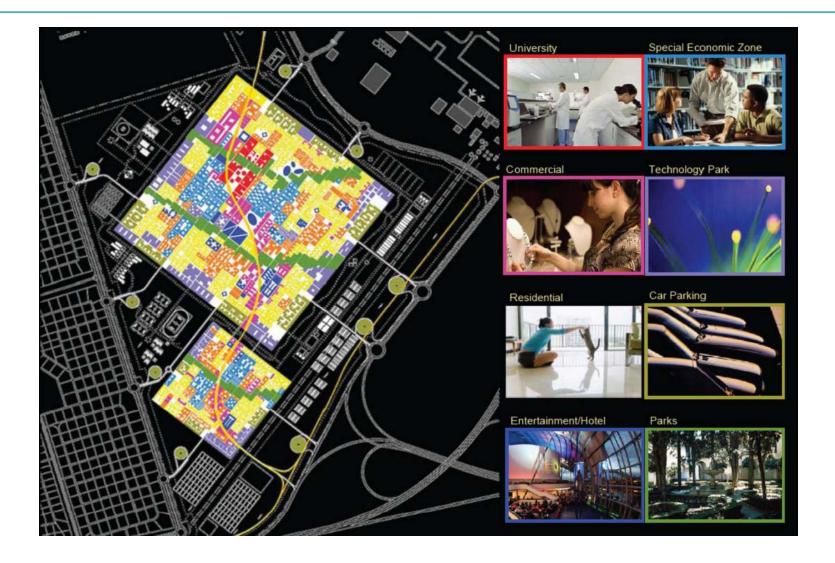


Masdar City - Big Square - Small Square

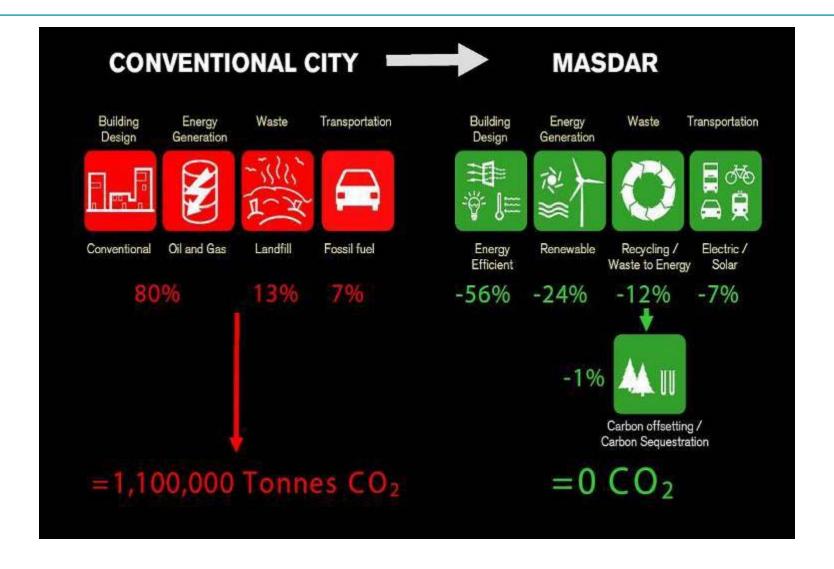
- 7 square kilometers
- 40,000 residents
- 50,000 commuters
- Residential Density
 - 140 People/Hectare
- Peak Daily Density
 - 245 People/Hectare



Proposed Land Use as per the Master Plan

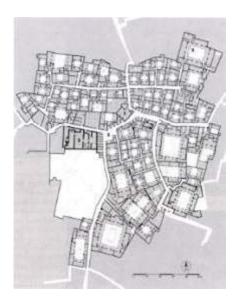


Achieve Zero Carbon & Zero Waste Lifestyle



Traditional City Approach

- Narrow streets
- Natural shading
- High Density/Low Rise Living
- Public spaces
- Mixed Use
- Walkable









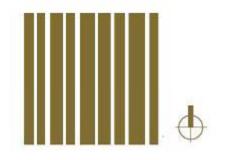


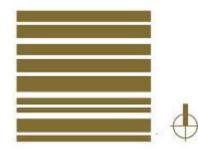


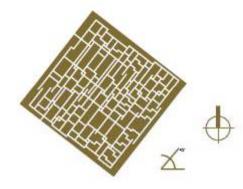


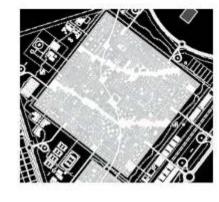


Orientation- use shade & wind for natural cooling









North/South

The North-South orientation of streets allows sunlight penetration of the urban structure with a subsequent increase in cooling loads requirements.

East/West

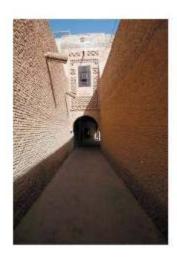
An East/West allignment also results in an increase in cooling load requirement due to the street exposure of external walls to sunlight.

Northeast/Southwest

The diagonal grid provides optimal shading

Northeast/Southwest

The northeast/southwest orientation of the city fabric provides optimal shading

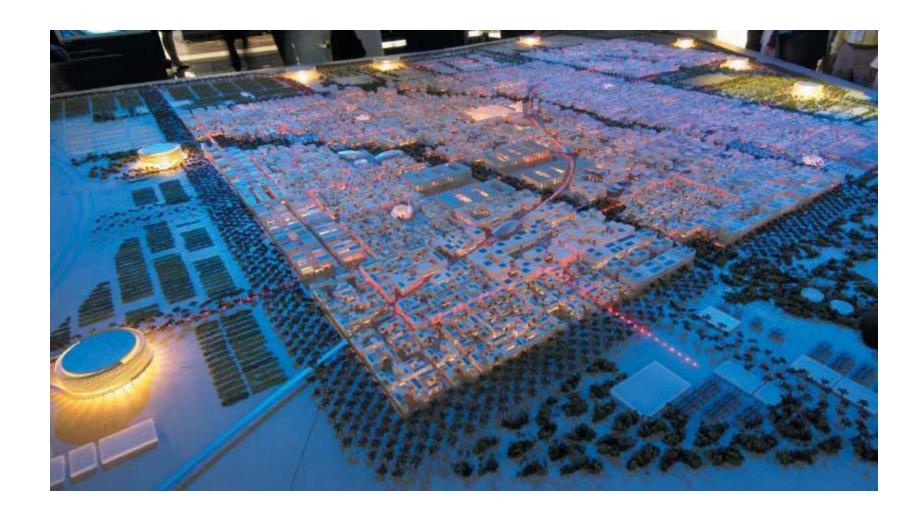




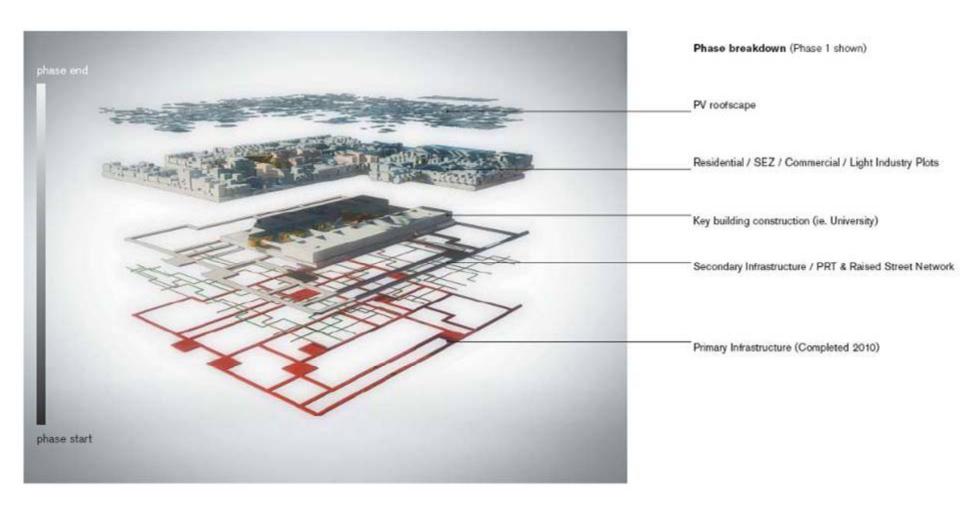




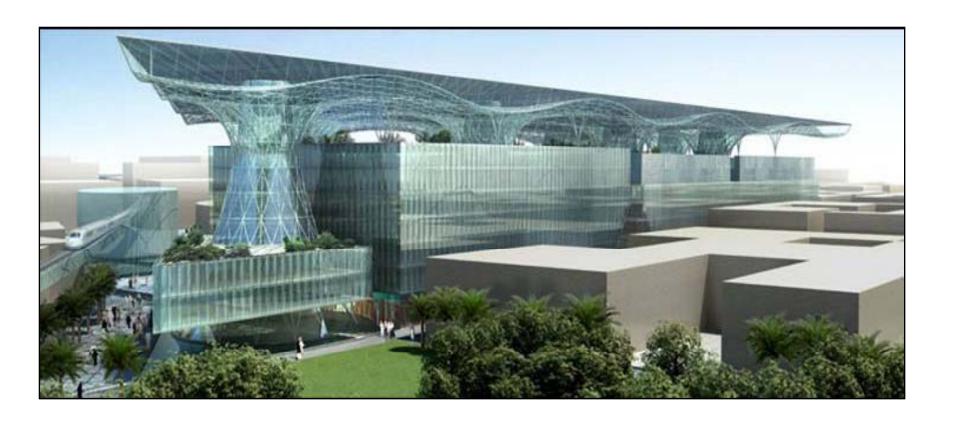
Masdar City – 3D model



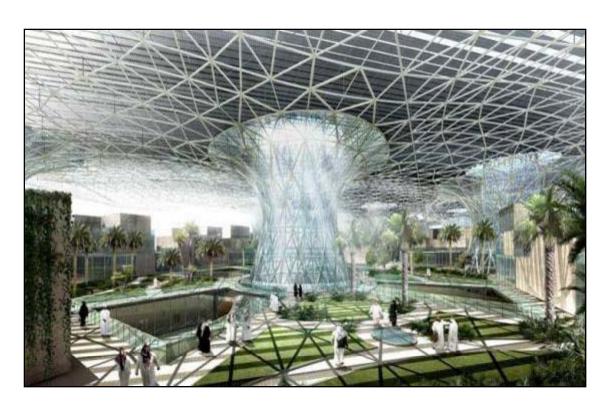
Masdar City – Infrastructure Layers



Life in Masdar City – Masdar HQ Exterior



Life in Masdar City – Masdar HQ Interior

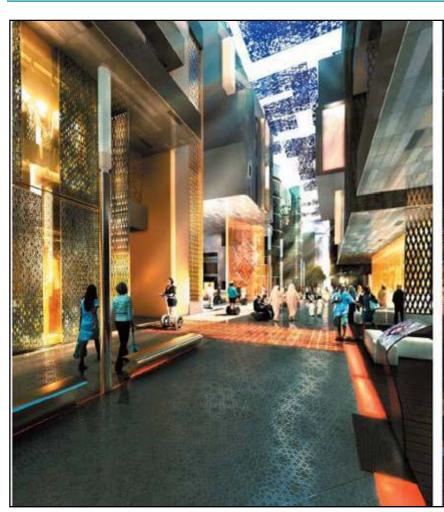




Life in Masdar City - Civic Square



Masdar City – Streetscapes









Importance of GIS at Masdar

Site Control and GIS Objectives

- Manage the overall spatial information needs of the Masdar programme
 - Ensure use of common coordinate system and datum
 - Build common base map to support planning, design, construction, and ultimately, operations and maintenance of Masdar City
 - Oversee and integrate all survey work
 - Develop analysis tools for decision support (desktop and web)
 - Spatially enable business processes (e.g., sustainability, asset management, real estate management, etc.)
 - Conduct technical evaluations of spatial technologies
 - Provide training for spatial technologies such as GPS, Web-based map services, and other tools

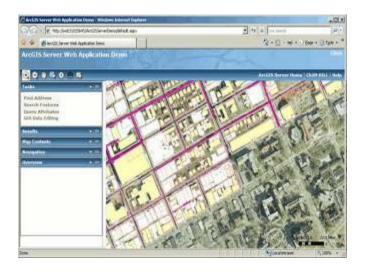
Geographic Information System (GIS)

- Communicate more effectively using data visualization
- Support decision making
- Model construction sequencing
- Perform spatial analysis
- Search using spatial criteria
- 'Birds-eye' view on projects
- Link cost, schedule, and carbon data

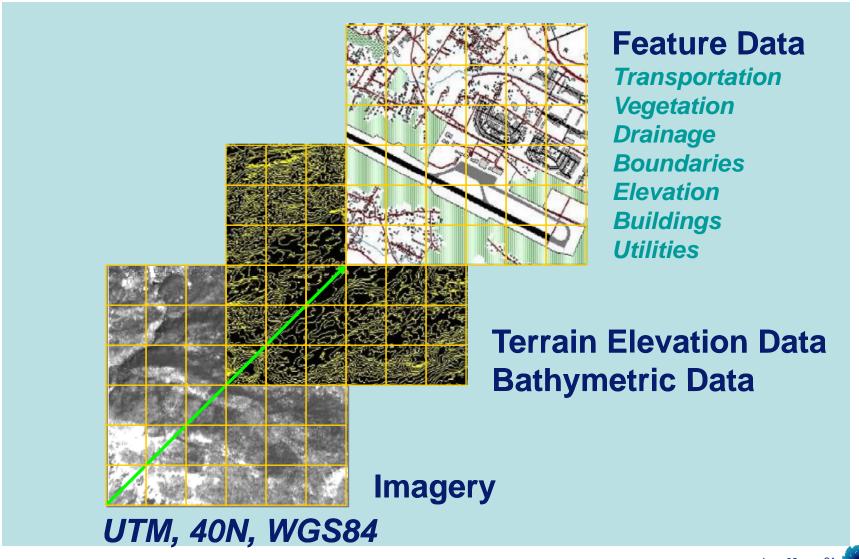
Advantages

- Real-life positioning of designs
- Valuable data for operations and maintenance of the city





Common Shared Map



Why proper data capture is important

- Capturing data right, the first time, is key to creating a rich and reliable GIS dataset that will improve the efficiency and effectiveness of the entire Masdar Programme.
- Scheduling and Phasing
- Clash Detection
- Design Analysis
- Buildability and Access

NIST GCR 04-867



U.S. Department of Commerce Technology Administration National institute of Standards and Technology

Advanced Technology Program Information Technology and Electronics Office Gaithersburg, Maryland 20899

Cost Analysis of Inadequate Interoperability in the U.S. Capital Facilities Industry

Michael P. Gallaher, Alan C. O'Connor, John L. Dettbarn, Jr., and Linda T. Gilday

40% of engineering time is spent locating and validating information

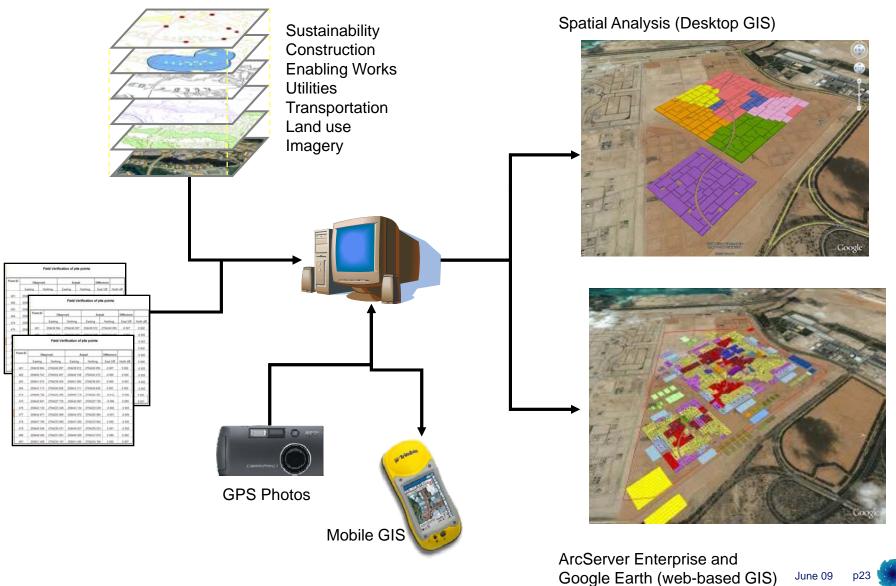
Data entered once and used by all reduces delivery time by up to 50%

Poor communications between systems wastes up to **30%** of project costs

Operations & Maintenance will save up to 14% in project costs

Capture Once, Use Many Times!

GIS Workflow







Transportation

Spatial Analysis of pedestrian walk time to a PRT station

Transport Grid



Car Free City



LRT



PRT

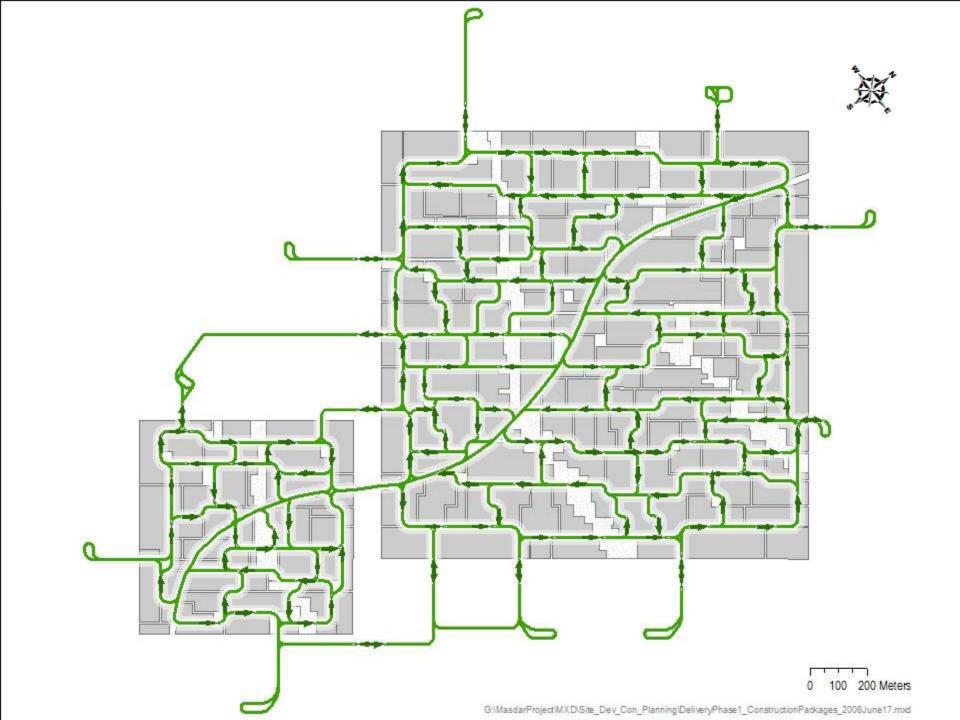


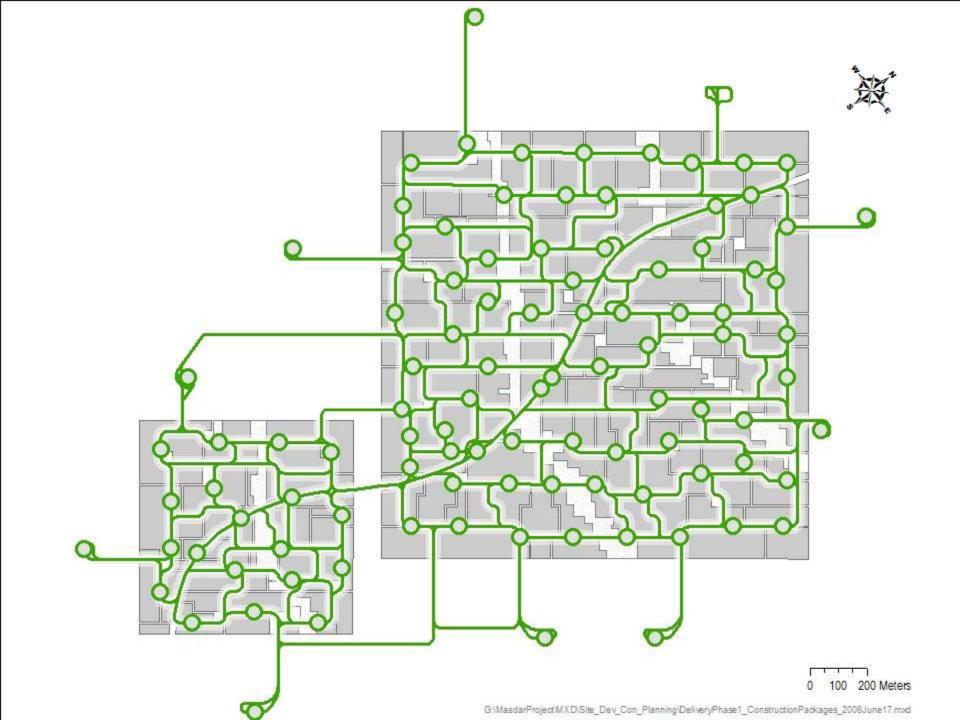
Transportation Implementation

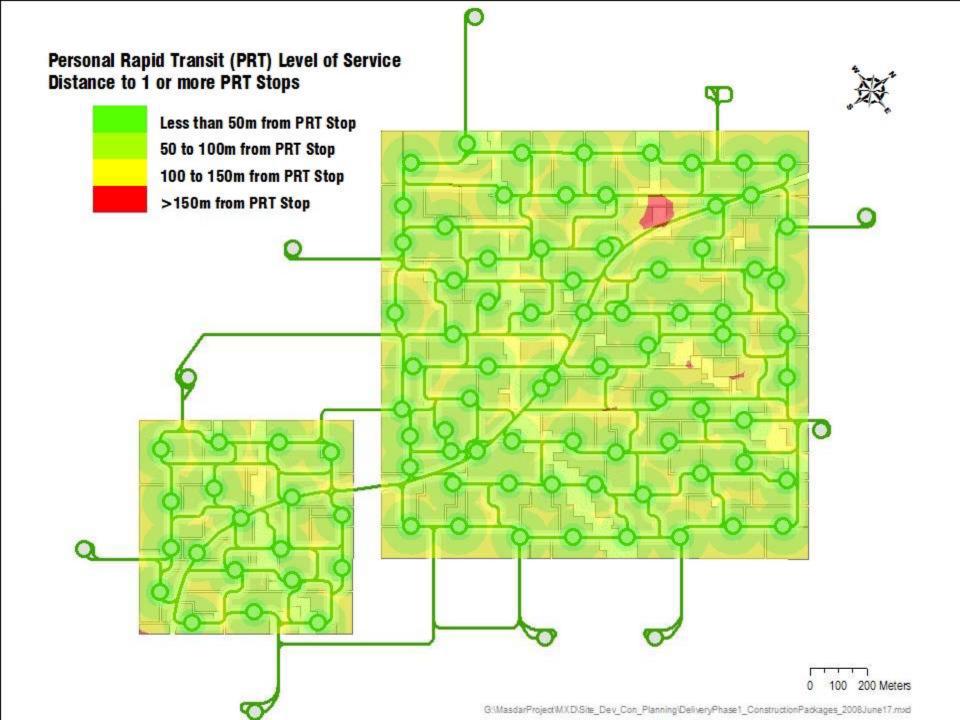
Masdar Personal Rapid Transit System

- "Driverless" personal transportation of passengers and freight
- Sophisticated automated control system for vehicular guidance
- City wide system will consist of 85 passenger stations and approximately 1,700 vehicles to support the expected 90,000 residents and workers
- GIS is an instrumental tool in creating the system-wide simulation











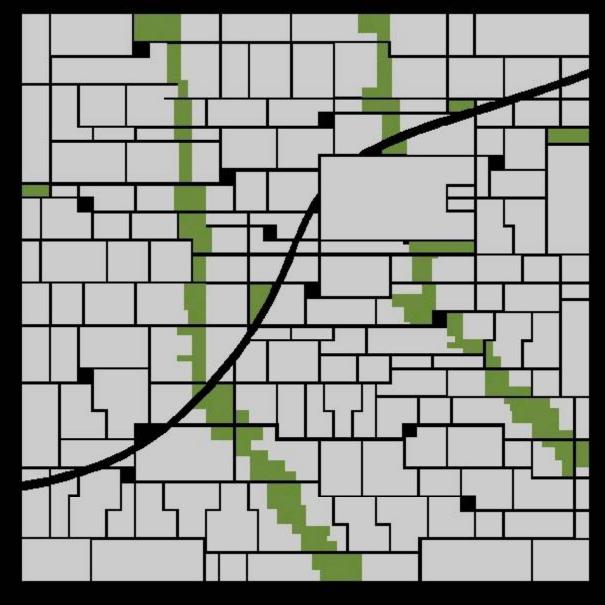


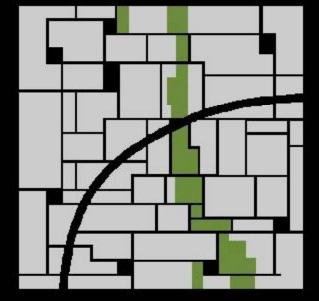
Energy Use and Production

Renewable Energy

- Photo voltaic
- Concentrated Solar Power
- Waste to Energy
- Geothermal





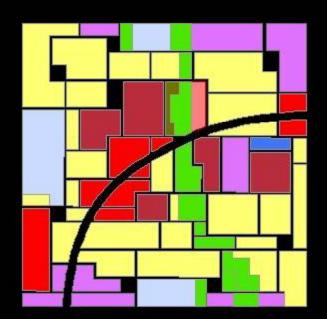


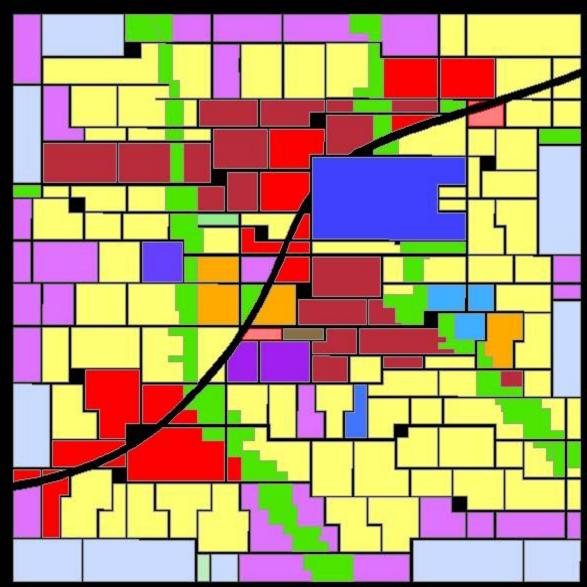


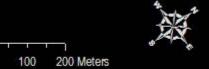


Carpark - Depot

Open Space







Generation Potential 68% Roof MP (MWh/Y)

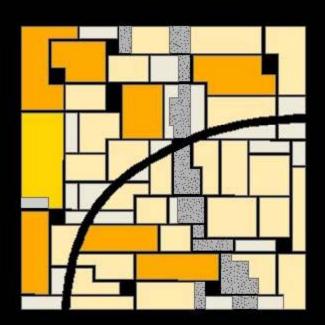
0 - 500

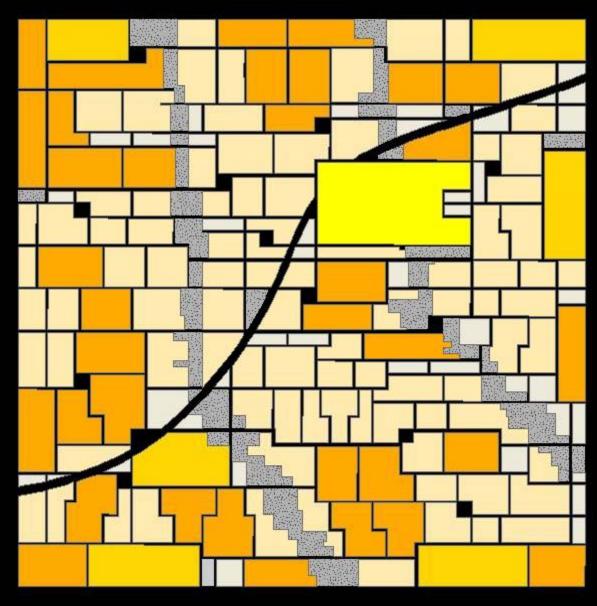
501 - 1500

1501 - 3000

3001 - 6000

6001 - 12000







Electrical Consumption (MWh/Y)

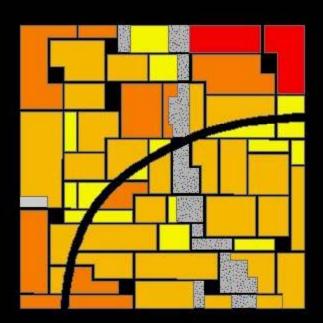
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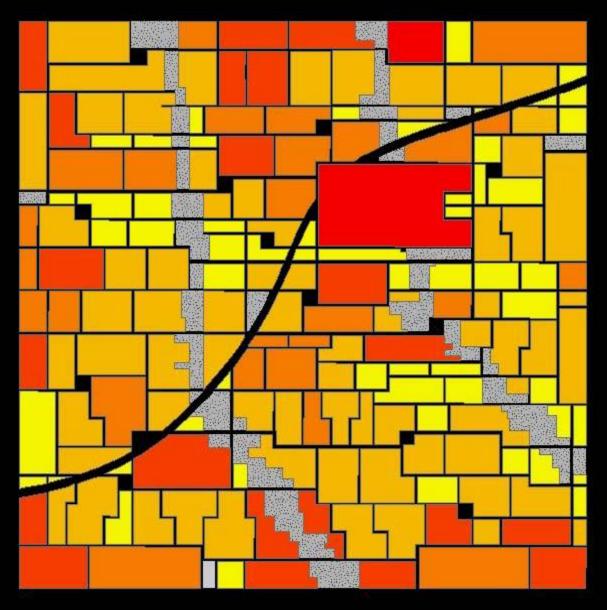
501 - 1500

1501 - 3000

3001 - 6000

6001 - 16481







Power Balance 68% Roof (MWh/Y)

4001 - 4000

2001 - 4000

1001 - 2000

1-1000

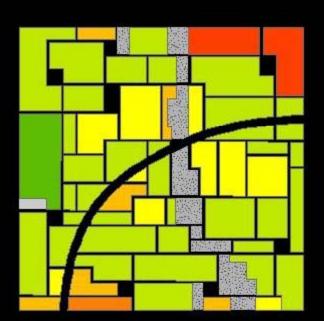
0 - -999

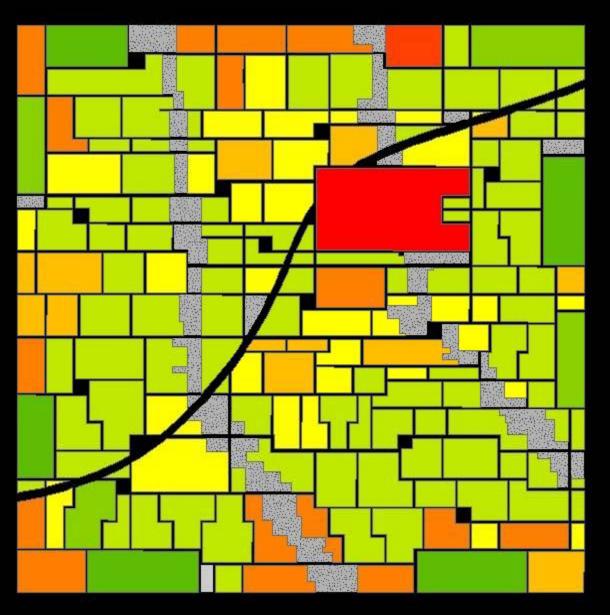
1000 - -1999

2000 - -3999

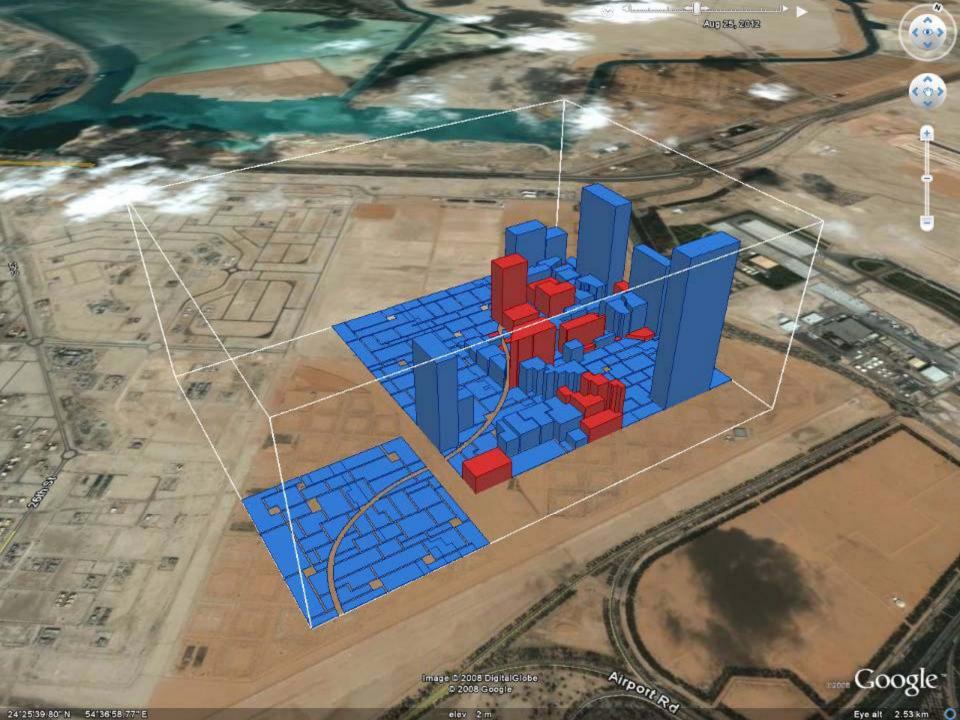
-4000 - -7999

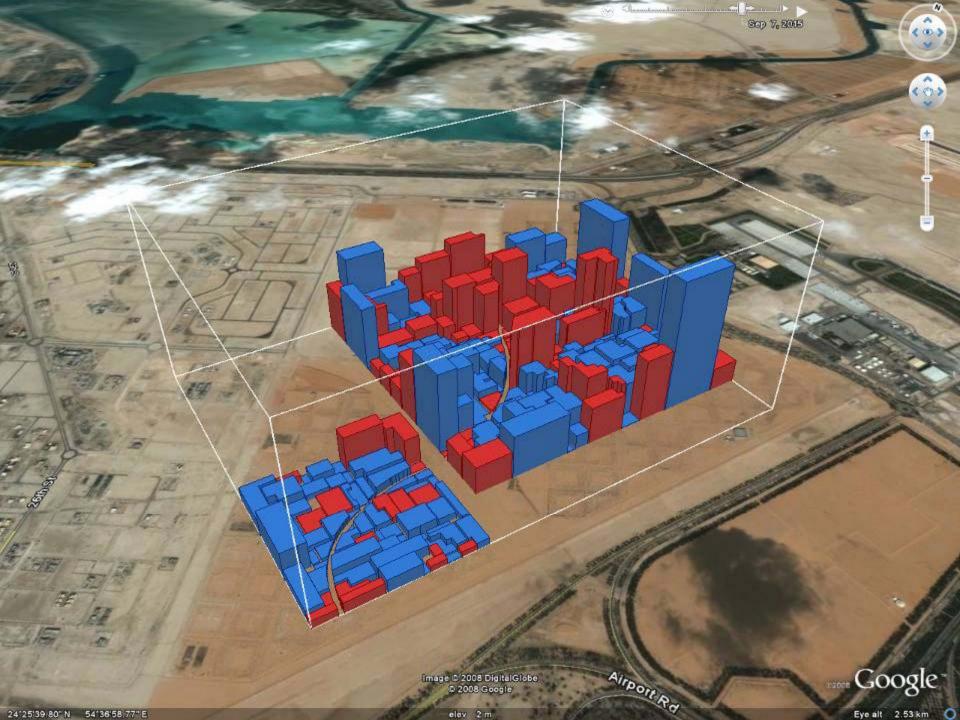
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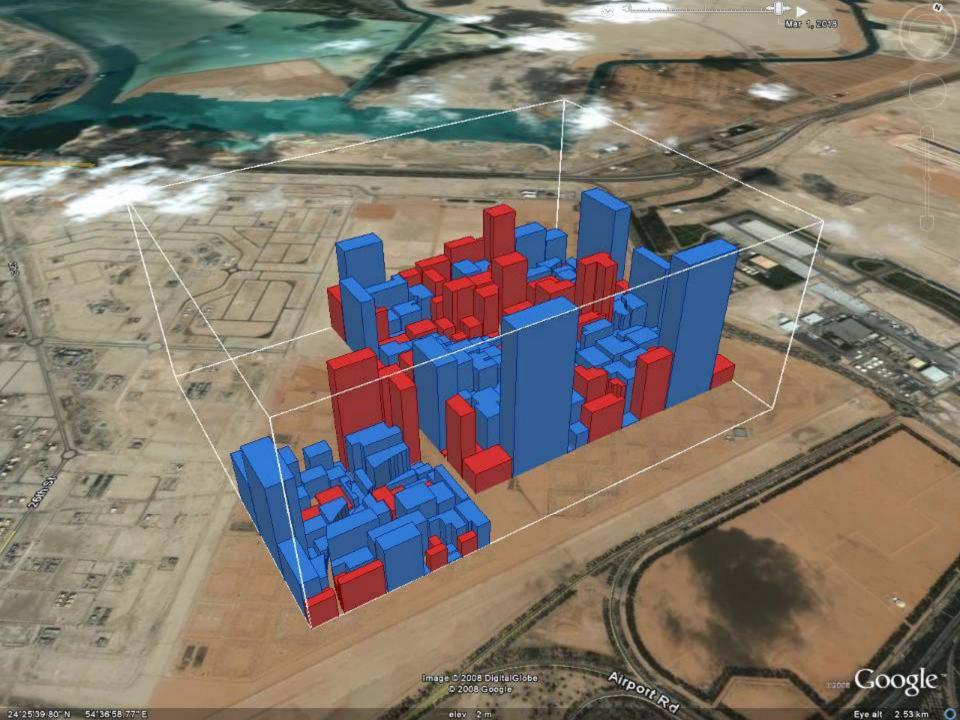












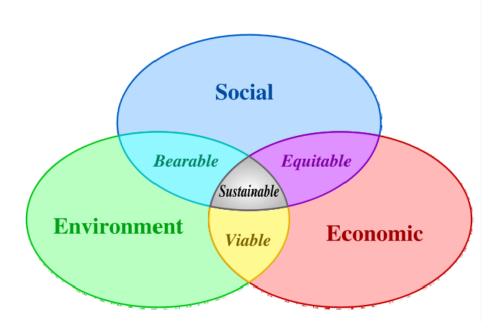




Embodied Carbon

Three Aspects of Sustainability

- Social Sustainability
 - Is it Livable and Desirable
- Economic Sustainability
 - Is it Cost Effective to O&M
- Environmental Sustainability
 - Is It Carbon Neutral











Avinash Patwardhan - 24 Jan 09 | Logoff

SMS Dashboard

SMS Dashboard

10 MWh PV

Enabling Works

MASDAR HO

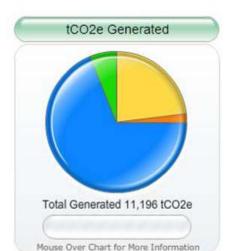
MIST 1a

MIST 1b

Project 1

Site Office

Site-wide Projects

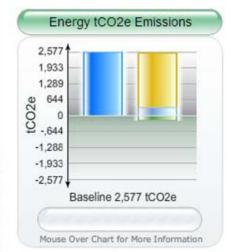


Cumulative Summary of Construction and Operation CO2 (e) Emissions from MASDAR City Programme

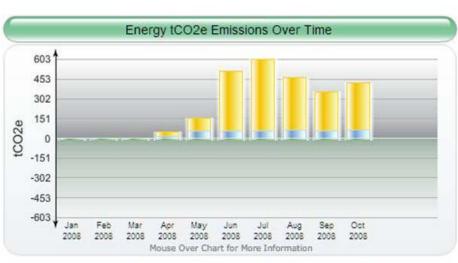
SMS Dashboard



Monthly Summary of Construction and Operation CO2(e) Emissions from MASDAR City Programme



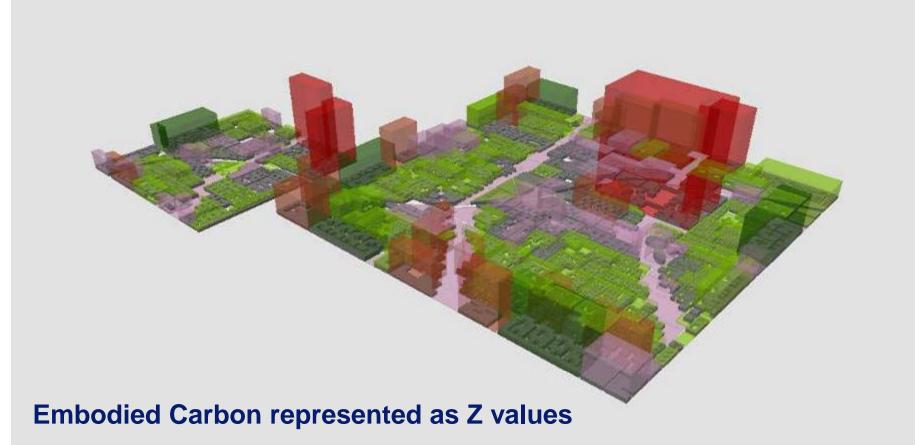
Cumulative Summary of CO2(e) Emissions from Energy



Monthly Summary of CO2(e) Emissions from Energy Used during Operations of MASDAR City Programme



Spatially Enabling the Sustainability Management System



- The red is negative
- The green is positive







Welcome to the Sustainable Future

