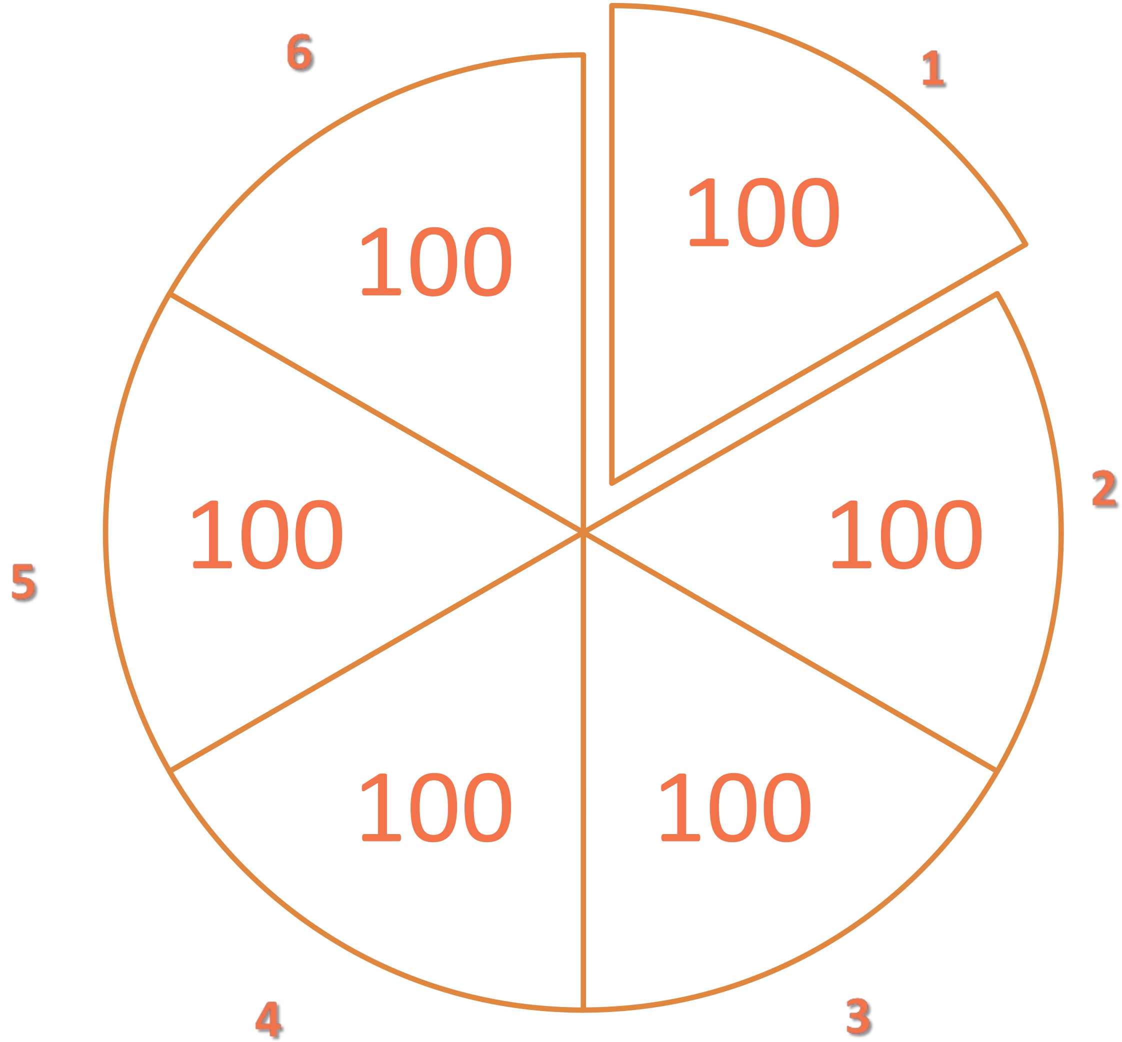
SCORE WEIGHTAGE

Energy & Green Buildings
1. Electricity Consumption in the City
2. Total Electrical Energy in the City Derived from Renewable Sources
3. Fossil Fuel Consumption in the City
4. Energy efficient street lighting in the city
5. Promotion of green buildings
6. Green Building Adoption



M. ARCH. in SUSTAINABLE HABITAT

Energy & Green Buildings

1. Electricity Consumption in the City

(Unit: kWh per capita)

Rationale

Growing urban areas and urban population increase electricity consumption in cities. Electricity generation is primarily dependent on fossil fuels, leading to higher GHG emissions. Controlling the per capita consumption of electricity will lead to lower GHG emissions.

Description

The indicator assesses the amount of electricity that is used by the city and encourages lower consumption in comparison to the best performing cities.

Methodology

Total electricity consumption (kWh) in the city is calculated. The population data of city is used for per capita calculations.

$$\text{Formula} = \frac{\text{Total electricity consumption (in kWh) in the city for the assessment year}}{\text{Population of the city}}$$

Energy & Green Buildings

1. Electricity Consumption in the City

Evaluation Score Levels

Level 1

0

> 10X compared to the city with lowest electricity consumption per capita

Level 2

25

> 4X & < 10X as compared to the city with the lowest electricity consumption per capita

Level 3

50

> 2X & < 4X as compared to the city with the lowest electricity consumption per capita

Level 4

75

> 1.1 X & < 2X as compared to the city with the lowest electricity consumption per capita

Level 5

100

Up to 1.1X as compared to the city with the lowest electricity consumption per capita

Energy & Green Buildings

1. Electricity Consumption in the City

Evidence Requirements

Total electricity consumption of the city from DISCOMs

Census of India population figures indexed with average annual growth rate for the year 2019

Data Evidence Available

Type	Value	Unit	Source
Total electricity consumption of the city from DISCOMs	12x3050980	KWhr	Electricity Dept, Panaji
Census of India population figures indexed with average annual growth rate for the year 2019	4733	Persons	Solar City Master Plan, Corporation of City of Panaji

Energy & Green Buildings

1. Electricity Consumption in the City

(Unit: kWh per capita)

Calculation

$$\text{Value} = \frac{36611760}{4733} = 7735.42 \text{ KWhPc}$$

Result

Per capita consumption of electricity in ward 19, 20, 28 of Panaji is 23.3 times more than that of Bihar which has lowest per capita electricity consumption of 332 KWPhPc

Current Progression Level

Score	0

1	2	3	4	5
> 10X compared to the city with lowest electricity consumption per capita	> 4X & < 10X	> 2X & < 4X	> 1.1 X & < 2X	Up to 1.1X

Energy & Green Buildings

1. Electricity Consumption in the City

Indicator Analysis

- Indicator does not take into account large number of floating population in Ward 28(Patto) which uses high amount of electricity in their offices
- Indicator encourages resident population to diversify energy usage and increase efficiency.
- Electricity supply zone can share power with area beyond city limits. Grid network not necessarily follows administrative boundaries.

Possible Scenarios

- Energy in the form of streetlights, inverters etc is gets wasted at night when offices are closed at Patto
- Lobbies of the buildings are lit up at night for security reasons
- Other safety equipment like Camera, Motion Sensors, Fire Alarms use continuos energy supply
- Branding Signs on top of the building or around use power
- Parking lot and accent lighting are always lit
- Possibly computer servers and other appliances are left on at night

Energy & Green Buildings

1. Electricity Consumption in the City

Energy Wasting Habits

Energy & Green Buildings

1. Electricity Consumption in the City

Best Practices & Studies

Energy Efficiency Strategies in Urban Planning of Cites
Heba Allah E.E. Khalil , Cairo University, Giza, Cairo, Egypt.

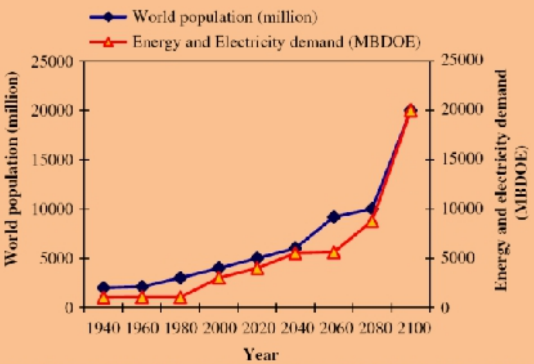


Figure 1 Annual and estimated world population and energy demand. Million of barrels per day of oil equivalent (MBDOE).[4]

Cities and Energy Consumption: The micro level

Mainly there are four distinct consumption categories: energy use for cooling/heating and operating the house; energy use for everyday travel; energy use for long leisure-time travel by plane; and, energy use for long leisure-time travel by car

Energy & Green Buildings

1. Electricity Consumption in the City

Compact Vs Dispersed development

Following characteristics are favorable for reducing energy use per capita: high population density for the city as a whole; high density within each residential area; centralized settlement within cities and towns (i.e.higher density in the inner part than on the fringe); centralized workplace location; low parking capacity at workplaces; decentralized concentration at the regional level; and, a high population for each city.

Density

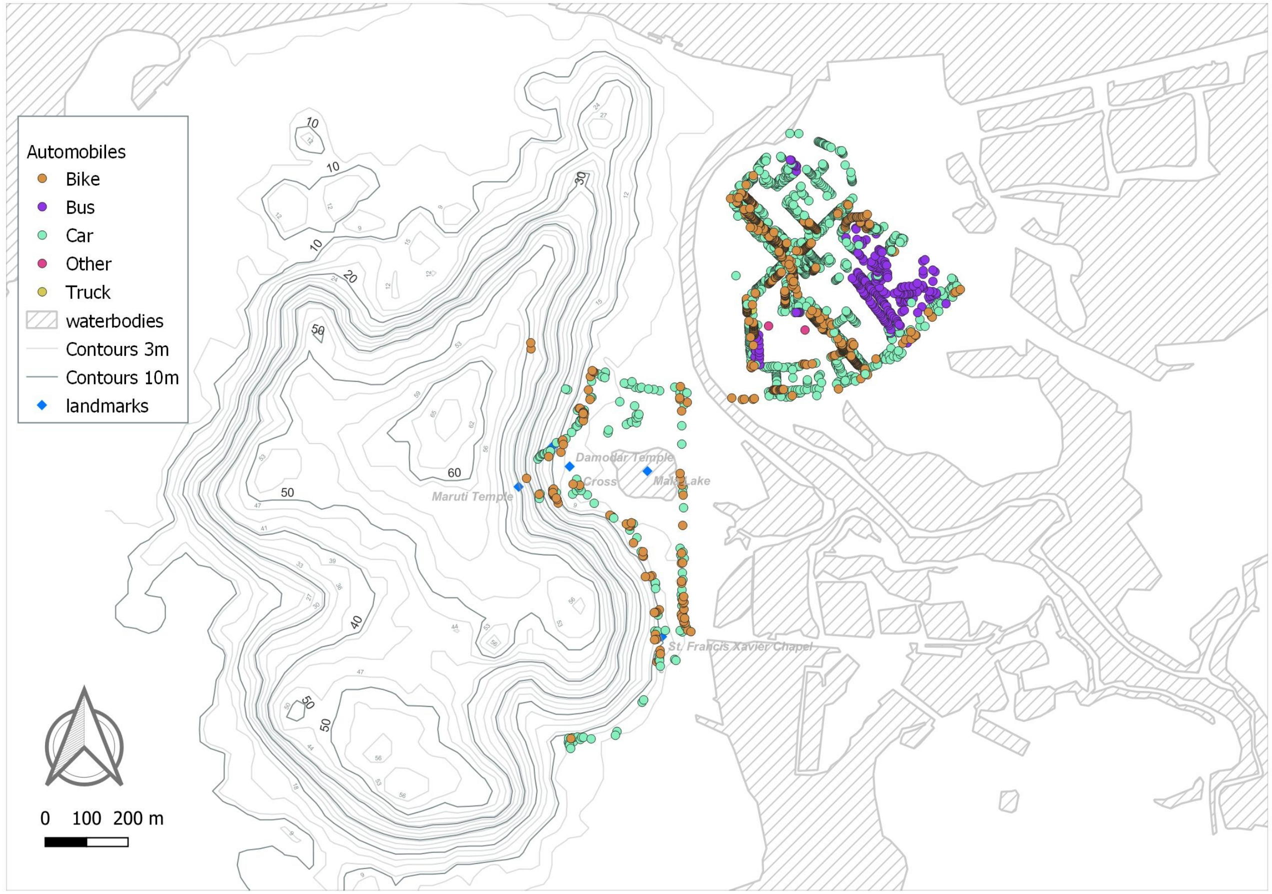
It can help protect agricultural land from urbanization

Built forms that facilitate higher net densities may result in significant reductions in energy demands

Energy use within buildings can be reduced by passive solar architecture, superior insulation, and energy-saving technology

Decreased pollution from vehicle exhausts can be achieved as a result of a decline in the use of cars, the mixing of land uses, the provision of efficient and accessible public transportation, and walking

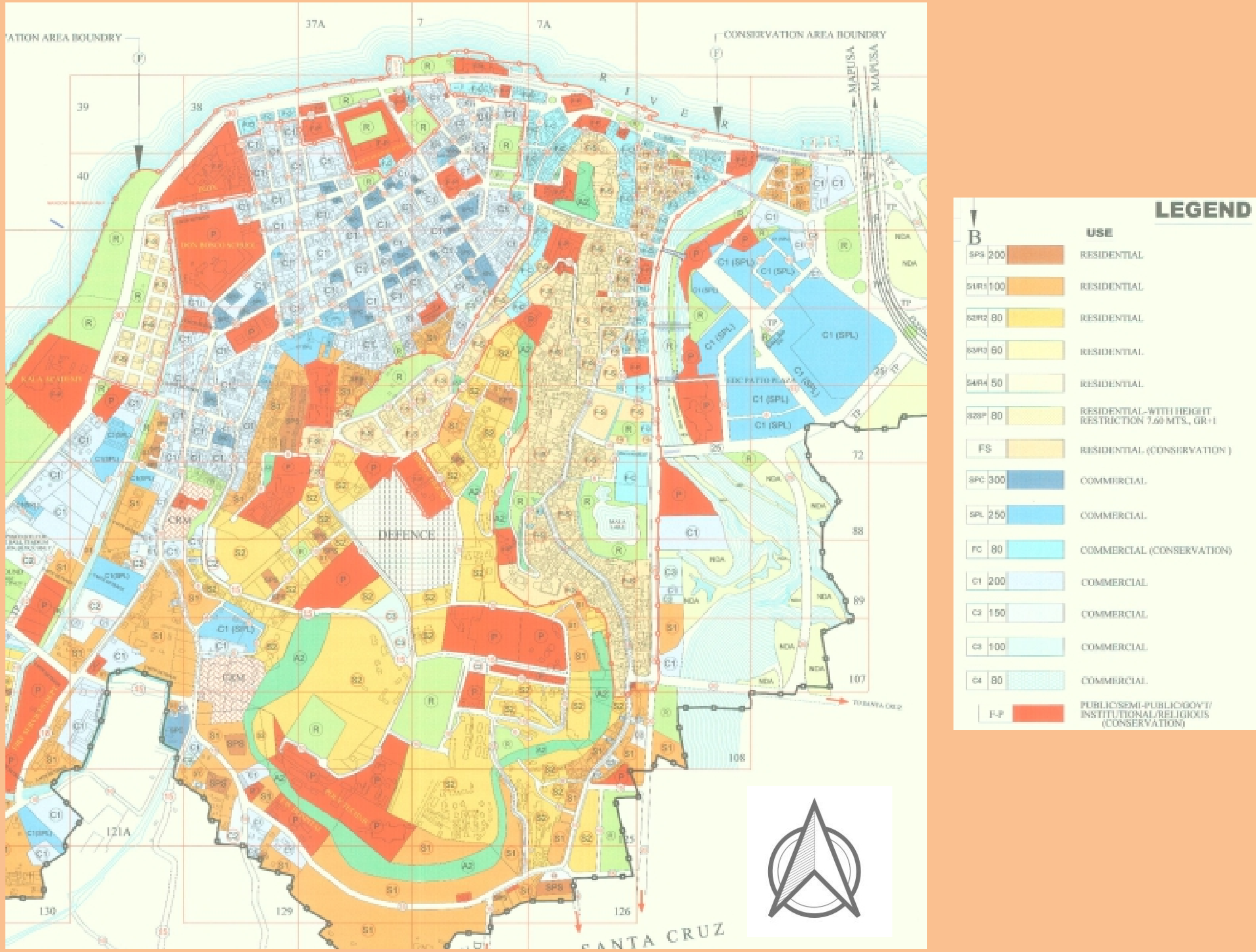
Vehicle presence at a given point of time



Energy & Green Buildings

1. Electricity Consumption in the City

Land Use



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Energy & Green Buildings

1. Electricity Consumption in the City

Public Transportation & Walking

Ward 28(Patto)

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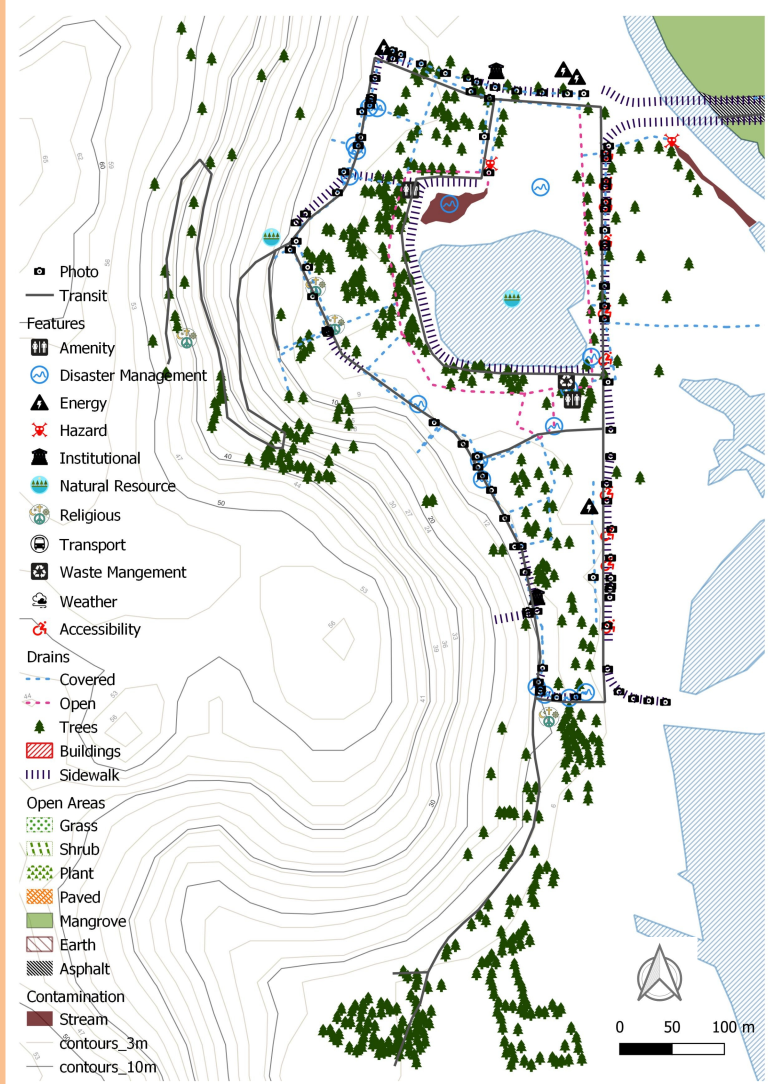
Energy & Green Buildings

1. Electricity Consumption in the City

Public Transportation & Walking



Ward 19, 20

M. ARCH. in SUSTAINABLE HABITAT

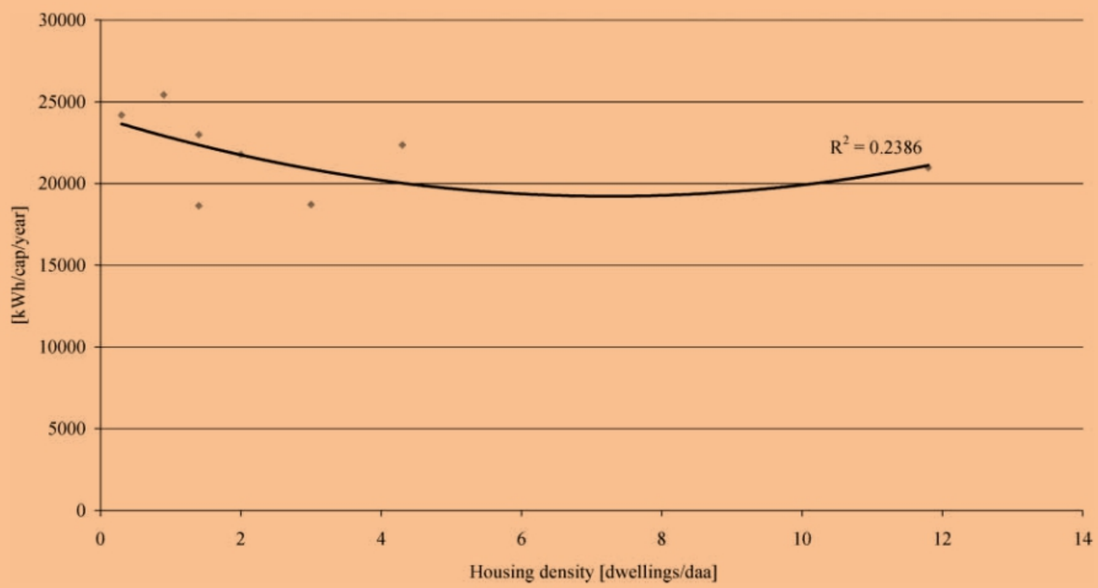
Energy & Green Buildings

1. Electricity Consumption in the City

High density brings the development of public transportation systems to the thresholds of profitability and efficiency.

17 to 75 dwelling units per net hectare are necessary to sustain significant transit use, and 150 dwelling units result in a modal split of different transportation types in which more than 50 percent is public transit (Berridge Lewinberg Greenberg, Ltd. ,1991b)

High densities may result in economies of scale that facilitate the use of better quality and more attractive building materials



Energy & Green Buildings

1. Electricity Consumption in the City

Roads, Transportation Network & Parking

It attributes to the efficiency of the city

A compact city strategy is recommended to be adopted

A trend towards reduction of parking standards

Buildings: Forms, Heights and Facades Treatment

Buildings are responsible for approximately 40% of the total world annual energy consumption. Most of this energy is for the provision of lighting, heating, cooling, and air conditioning

Achieving energy and cost-efficient operation of the heating, ventilating and airconditioning (HVAC) plants in buildings

Objective is to provide a high level of building performance (BP), which can be defined as indoor environmental quality (IEQ), energy efficiency (EE) and cost efficiency (CE)

Urban planning has a considerable impact on the future energy efficiency of buildings

Energy & Green Buildings

1. Electricity Consumption in the City

Urban Planning

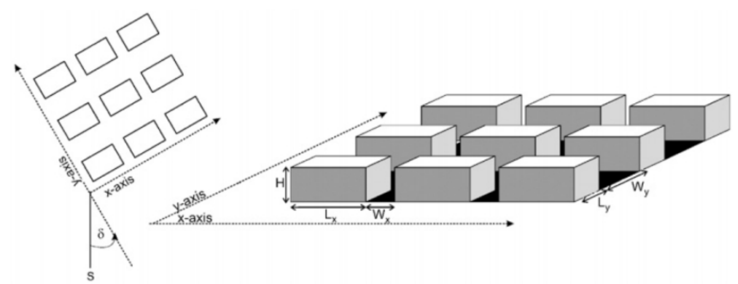


Figure 6 Definition of urban form parameters: grid azimuth (anti-clockwise angle from South, d); building height (H), width (Lx) and depth (Ly); building spacing in x-direction (Wx) and y-direction (Wy).

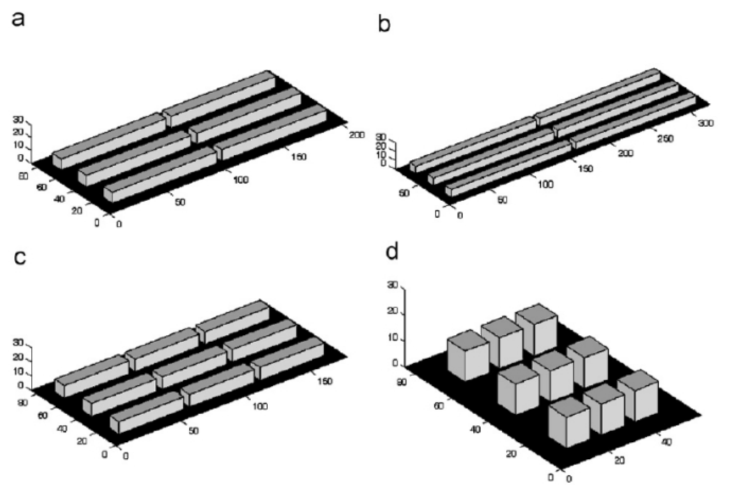


Figure 7 The varios alternatives of urban forms studied: (a) long slabs, (b) terraces, (c) short slabs, and (d) pavilions.

The results obtained show that adequate urban planning, based on the consideration of the local radiation conditions as a function of latitude, may result in significantly better building thermal performance

Pavilions (cross-sectional square blocks) are best solutions for latitude of 50° and terraces (blocks infinite in length) are preferred for 45°

Energy & Green Buildings

1. Electricity Consumption in the City

In terms of grid angle with the cardinal direction, it is concluded that the angle should stay between -15° and +15°, except for the latitude of 50° where it can ranges from -45° to +45

Building-height-to-street-width (aspect) ratio which decreases with the increase of latitude, ranging from 0.6 for a latitude of 35°, to 0.4 for a latitude of 45°

Legislation

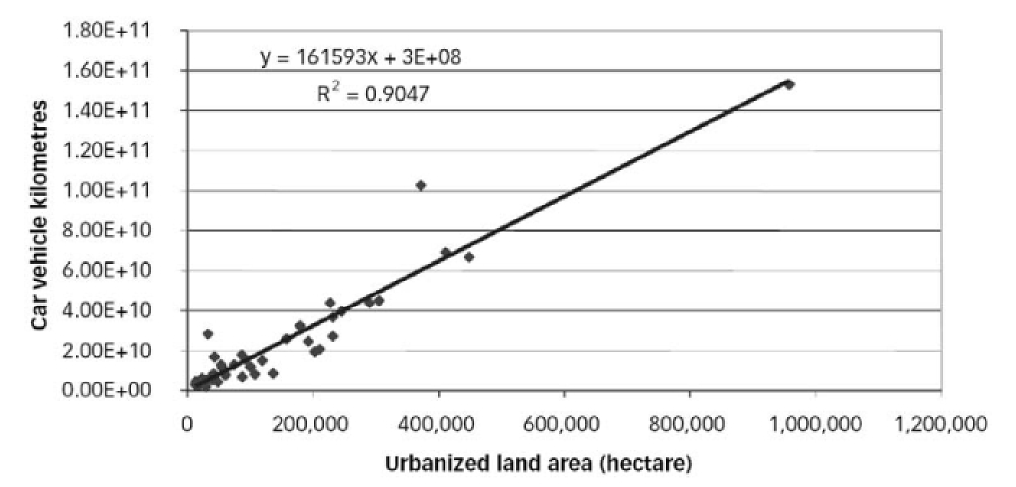
In 2000, the city of Barcelona introduced its mandatory ‘Solar Ordinance’. All new housing, offices, restaurants and public buildings there have to install solar hot water systems if they use substantial amounts of hot water. Old buildings also have to be fitted with solar hot water systems when they are refurbished.

German government’s ‘feed-in’ legislation which has fixed both subsidies and favorable tariffs for owners of PV roofs. They are paid about 50 cents/kWh for selling their electricity back to the electricity grid, which is about four times the price paid to conventional electricity generators

Energy & Green Buildings

1. Electricity Consumption in the City

Ecological Footprint



Measures city's impact versus its consumption

EF translates consumption of various types into the common metric: total area of productive land and water ecosystems required to produce the resources that the population consumes and assimilate the wastes that the population produces

Conclusions

Preserving city boundaries with minimal increase just to accommodate future needed services and the preservation of agricultural land.

Energy & Green Buildings

1. Electricity Consumption in the City

The need to build a ring road to increase transportation efficiency and decrease energy consumption and pollution. Thus densifying existing urban areas instead of horizontal spread of the city

Advocating mixed uses as commercial/ residential uses

Wise location of needed services, appropriate rates per capita of services and facilities, and their concentration in single location central to community

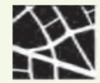
Energy efficient Strategies

New Cities	Existing Cities: Mega cities	Existing Cities: Small and medium cities
- Mixed Uses - Mixed Housing - Renewable energy stations - Energy code - Building materials - Recycling facilities - Adequate transportation system - Self sufficient cities with jobs and services - Increasing walkability - Increasing density	- Minimizing sprawling - Public transportation -Monorails, subways - Energy code - Recycling facilities - Decentralization of investments - Increasing walkability and pedestrenisation	- Preserving the narrow street pattern - Compact urban mass - Recycling and energy - Renewable energy stations - Improving infrastructure networks to minimize loss - Local building materials -Generating jobs within the local context - Transportation system efficiency - Finding vacant land innovatively and locating needed housing and services - Introduction of appropriate technologies

Energy Efficient Cities - ESMAP Knowlegde Series

Box 1 | The Absence of Connectivity and Fine Grain in Chinese Urban Developments

The following pictures illustrate the size of blocks and impacts on connectivity of a series of cities in Europe, Japan, and China. It shows the absence of connectivity and the increase of average distances between intersections in recent urban developments in China.

	Turi, Estonia	Barcelona, Spain	Paris, France	Ginza, Tokyo	Pudong in Shanghai, China	Towers North in Beijing, China
						
Intersections per km²	152	103	133	211	17	14
Distance between intersections (m)	80	130	150	43	280	400

Source | Authors.

Table 1 | Comparison of Urban Density for Three Typical Urban Fabrics (800 m²)

	Low Rise Suburban Area (villas)	Medium Rise Continuous Small Block Area	High Rise Large Blocks Area
			
Location	Shanghai	Paris	Shanghai Lianyang
Building Footprint (%)	17%	55%	12%
Average Number of Floors	2	7	31
Gross FAR	0.4	3.8	3.7

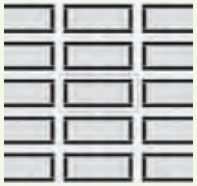
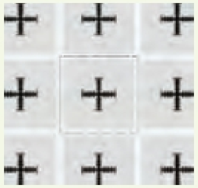
Source | Salat 2011.

Energy & Green Buildings

1. Electricity Consumption in the City

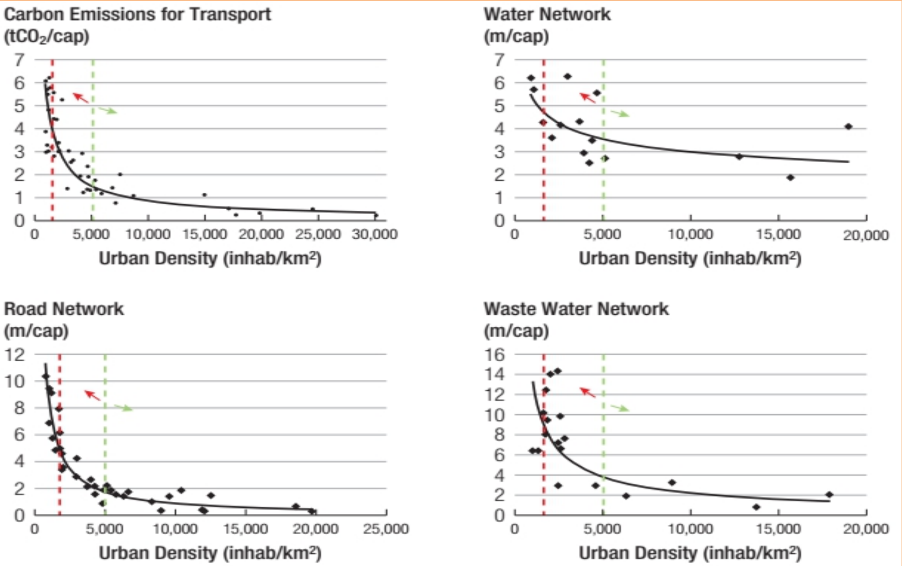
Energy Efficient Cities - ESMAP Knowlegde Series

Table 2 | Energy Consumption for Space Heating in Three Urban Textures (1,200 m²)

Urban Setting, in European Temperate Climate	Continuous Texture, with Small Blocks	Large Blocks	Towers, 110 m High
			
Heating needs (kWh/(m².yr) with average U-value=0.87 W/(m².K))	39	50	102

Note I Heating needs is defined as kWh per m² floor area per year. 110 m high towers need 2.5 times more energy for heating than a 21 m high continuous fabric of urban blocks.

Source I *Salat, 2011.*



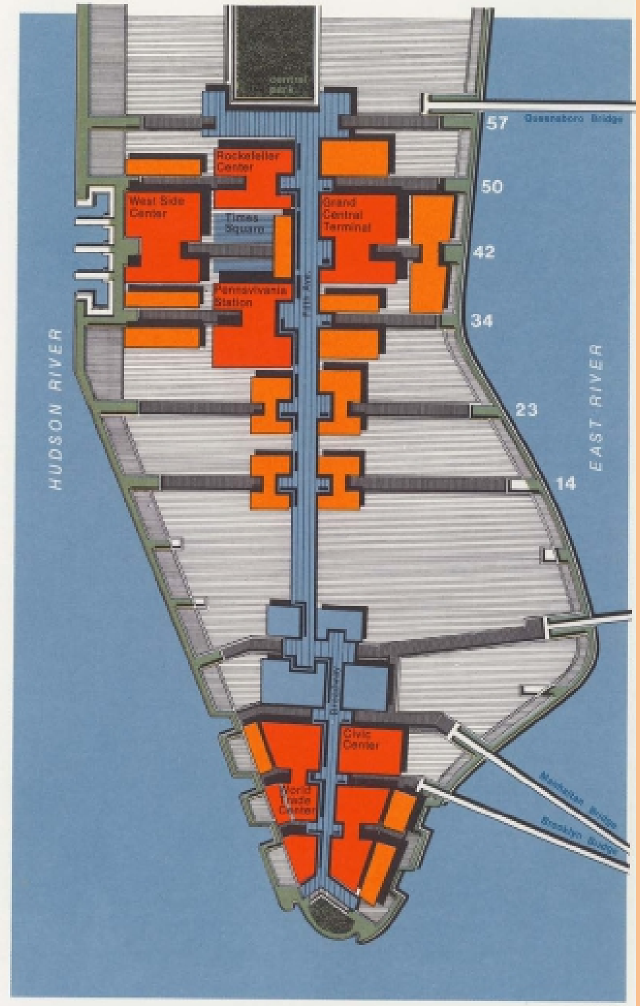
Land Use Flexibility in Manhattan

EMPLOYMENT DENSITY
(left)

This model by Ernst Hacker, New York City Planning Commission, portrays job density in the Manhattan Central Business District. The model (60th Street, the northern boundary of the CBD, is at right) clearly shows the twin Wall Street and Midtown peaks and the "industrial valley" between.

CONCEPTUAL DIAGRAM

Reinforcement of the distinctive "highs" of the Midtown and Downtown office centers is shown diagramatically, by the present and future office clusters within these two centers. The Valley in between should remain low, retaining some of its present economic activities, mainly light manufacturing and warehousing, and increasing its housing and institutional use. Housing best fits the transportation situation of the Valley because subways going in both directions have delivered their main load of passengers by the time they arrive there, so residents would have uncrowded trains either to Midtown or to Lower Manhattan. The Fifth Avenue spine of Midtown and the Broadway spine of Lower Manhattan (light blue) are conceptualized as primarily for pedestrian enjoyment, with lower buildings providing shops, restaurants and other services. The waterfronts (light green) would be reclaimed for public recreational use.



HIGHS
major office clusters
secondary office clusters
LOWS
mixed commercial activities (shops, restaurants, hotels, theaters, etc.)
public open space

**CONCEPTUAL DIAGRAM
MANHATTAN CENTRAL BUSINESS DISTRICT**

It has a fine-grain urban fabric, consisting of small street blocks with buildings aligned on the street side. Floor areas are easily changed from industrial to commercial, from offices to housing, etc.

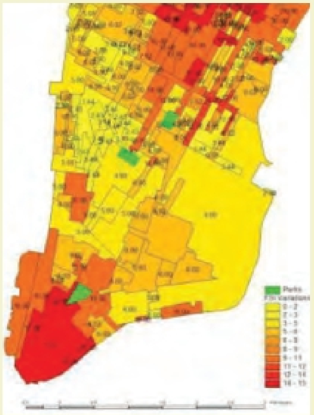
Energy & Green Buildings

1. Electricity Consumption in the City

FAR

Box 7 | FAR and Urban Infrastructure in Manhattan and Mumbai

Manhattan's density zones are typically small and vary with street width, infrastructure capacity, and land use (commercial office districts have higher FAR than residential ones). In contrast, Mumbai's density zones are large, uniform across the city, and generally low. Local urban planners justify such low densities for not overwhelming infrastructure. Rather than increasing densities, new urban developments have been pushed out to new towns and suburban industrial estates. But this strategy ignores the opportunity to increase FAR to finance better and higher capacity infrastructures (World Bank 2013a).



Left: South-side of Manhattan

Right: Mumbai

Prescribing FAR and building heights according to street width

Establish Mixed Use Development

Fine grain texture of plot subdivisions, buildings & building group

Continuous landscaped public space inside and outside the block

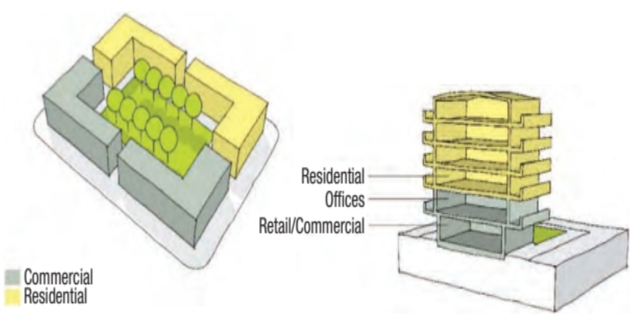
Ratio of office, commercial, and residential floors to building scale

Energy & Green Buildings

1. Electricity Consumption in the City

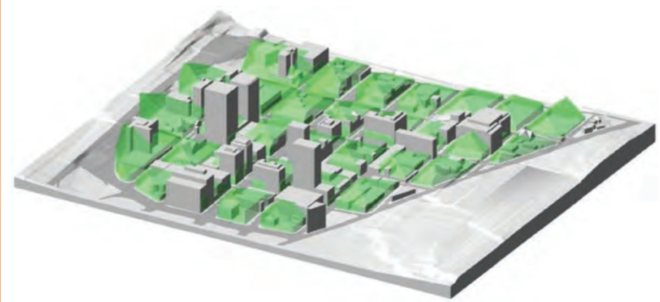
Building Scale

Figure 7 | Mixed Use on the Block and Building Scale



Source I North Shore City 2005.

Figure 9 | Example of Bioclimate Retrofit



Composite climatic envelopes in Chattanooga, USA, overlaid on existing building volumes, view from southeast and section looking north.

Source I DeKay 2012.

Bioclimatic design

- Different vernacular types of urban fabric
- Cooling intermediary spaces between indoors and outdoors by passive techniques
- Designs are permeable, combining open plans and sections
- Depth, form, and orientation of buildings to local climate
- Planning dense built-up areas while allowing a high level of sun penetration on the façades and in the cores of buildings
- Shaping tall buildings in relationship to other buildings and to the wind to create favorable street and open-space microclimates

Energy & Green Buildings

2. Total Electrical Energy in the City Derived from Renewable Sources

Rationale

Fossil fuels such as coal, natural gas and oil are the major sources of energy generation in our country. Production of energy from cleaner renewable energy sources (solar PV, solar thermal, wind energy, hybrid-hydel power, small hydro, geo-thermal energy, tidal energy, biogas, waste to energy) would minimize GHG emissions.

Description

The indicator encourages the replacement of existing electricity generation from fossil fuels with cleaner renewable energy sources

Methodology

Total electrical energy in the city is calculated by adding 80% of the ratio of total electrical energy consumption from all grid connected renewable energy sources (kWh) to total electricity consumption (in kWh) in the city and 20% of the ratio of installed capacity of off grid renewable energy sources for self-consumption (kW) to total connected load (kW) in the city

Energy & Green Buildings

2. Total Electrical Energy in the City Derived from Renewable Sources

Evaluation Score Levels

Level 1

0

No electrical energy generated from renewable sources

Level 2

25

Renewable Energy contribution of less than 5%

Level 3

50

Renewable Energy contribution of 5- 10%

Level 4

75

Renewable Energy contribution of 10-15%

Level 5

100

Renewable Energy contribution of > 15%

Energy & Green Buildings

2. Total Electrical Energy in the City Derived from Renewable Sources

Evidence Requirements
Data on total electricity consumption and connected electrical load can be obtained from DISCOMs
Data of installed capacity of all off-grid renewable energy sources used for self-consumption

Data Evidence Available			
Type	Value	Unit	Source
Total electrical energy consumption (in kWh) from all on-grid renewable energy sources	86390	KWhr	Electricity Dept, Panaji
Total Electricity Consumption of the area	36611760	Kwhr	Electricity Dept, Panaji

Energy & Green Buildings

2. Total Electrical Energy in the City Derived from Renewable Sources

(Unit: %)

Total electricity consumption from all renewable sources of the area	158004	KW	Electricity Dept, Panaji
Total connected electrical load in the area	709386.5	KW	Electricity Dept, Panaji

$$\text{Formula} = \left[0.8 \times \frac{\text{Total electrical energy consumption (in kWh) from all on-grid renewable energy sources}}{\text{Total electricity consumption (in kWh) in the city}} \right] + \left[0.2 \times \frac{\text{Cumulative installed capacity (in KW) of off grid renewable energy sources}}{\text{Total connected electrical load (in KW) in the city}} \right] \times 100$$

Energy & Green Buildings

2. Total Electrical Energy in the City Derived from Renewable Sources

(Unit: %)

Calculation

100 x {[0.8 x (86390/36611760)] + 0.2 x [(158004-86390) / 709386.5]} = 2.20 %

Result

Total Electrical Energy in the City Derived from Renewable Sources is 2.20%

Current Progression Level

Score	25

Renewable Energy contribution of less than 5%

1	2	3	4	5
		5- 10%	10-15%	> 15%

Energy & Green Buildings

2. Total Electrical Energy in the City Derived from Renewable Sources

Indicator Analysis

- Low amount of Renewable Energy generated in the city
- City has plan in place to incentivize for on-grid solar power generation
- 4.7 Rs per unit of generation of power(Source: Goa Electricity dept)
- CPWD signed MOU with Solar Energy Corporation of India to PV panels on Govt buildings maintained by CPWD

Possible Scenarios

- Cheaper Grid energy alternative
- Non establishment of renewable energy infra-structure
- Initial Cost of installation is high
- Efficiency of solar system varying according to weather
- Cost of Li-Ion batteries is high
- It needs large area
- Wind energy is not explored

Energy & Green Buildings

2. Total Electrical Energy in the City Derived from Renewable Sources

Best Practices & Studies

CIty of Dezhou, China by IRENA

120 solar energy enterprises which generate an annual turnover of USD 3.46 billion

Encouraging entrepreneuship in products and services used for the generation of solar, wind, hydro, geothermal and bioenergy

City espoused the role of an incubator developing a viable industry cluster and that of multiplier by drawing upon the existing local solar business

Solar Valley Micro E Hotel, a landmark of Dezhou, and a solar energy, micro-emission hotel

Energy & Green Buildings

2. Total Electrical Energy in the City Derived from Renewable Sources

Dezhou Economic Development Zone

1997, the Municipal Party Committee of Dezhou, together with the local government of Dezhou, elaborated the Development Plan

Hard and soft infrastructure on a piece of previously unused land

Any company can invest and build in the Zone, as long as it does not pollute, and has high growth potential

e.g. solar energy, biomedicine, environmental conservation equipment manufacturing, and new materials

20 MW Solar PV Power Station developed by China Energy Conservation and Environmental Protection Group in Dezhou, among the largest in Asia

A special Solar Industry Promotion Committee was established using the National Renewable Energy Law

comprised of the mayor, the party secretary, and officers from the departments of reform and development, urban planning, finance, and new technologies

Energy & Green Buildings

2. Total Electrical Energy in the City Derived from Renewable Sources

Incentive to Business

Foreign companies, export-oriented companies or high-tech companies received a two-year tax waiver, followed by a three-year tax reduction

if the company remained in the high-tech sector, it would receive a 50% tax rebate

Lowered the barriers to entrance of new solar energy ventures by allowing enterprises with a capital reserve of less than USD 157,480 (RMB 1 million) to qualify for two-year instalments

Low-interest loans and financing channels were provided to enterprises with patented technologies

Integration of solar energy systems into new buildings

The Million Roof Project was launched in 2008 - new residential buildings in Dezhou to be equipped with solar thermal facilities

Also applied to the renovation of existing buildings through RE building integration demonstration project

Urban Planning & Construction Administration to supervise and check-upon-delivery of newly designed or built buildings, to fulfil the requirements of integrating solar thermal or PV energy

Thousand Bathroom Project was launched aiming to provide a solution to the scarcity of hot water in winter for the peasants in Dezhou by building solar public bathrooms in villages. The project costs were shared between the solar water heater manufacturers, the government of Dezhou and local rural residents.

Photovoltaic demonstration project

Installed, or replaced conventional lights with solar lights at 50 traffic junctions, 5 main roads, 5 residential districts, including providing street and landscape lighting in 5 scenic areas

Research and Development

Companies like Himin Solar invest heavily in R&D. The local government has also led and been involved in more than 20 National High-tech R&D Programmes on solar energy

Overcoming the initial challenges

The city had to overcome small size of the local solar energy industry, poorly developed financial mechanisms for growing industrial companies, and the shortage of sector-related skills

Emergence of a large number of workshop-type solar water heater manufacturers

Energy & Green Buildings

2. Total Electrical Energy in the City Derived from Renewable Sources

Results

Between 2005 and 2010, the annual growth rate of the solar energy industry was over 30%

Out of 66,000 new jobs that were created in Dezhou in 2010, 30% were in the solar energy business

120 solar energy enterprises, generating an annual turnover of USD 3.46 billion

Integration of solar energy into new buildings in Dezhou

The energy consumption per unit of GDP was 1.17 tonnes of standard coal per USD 1,574.8

By 2015 the energy consumption per unit of GDP will decrease to 0.875 tonnes of standard coal

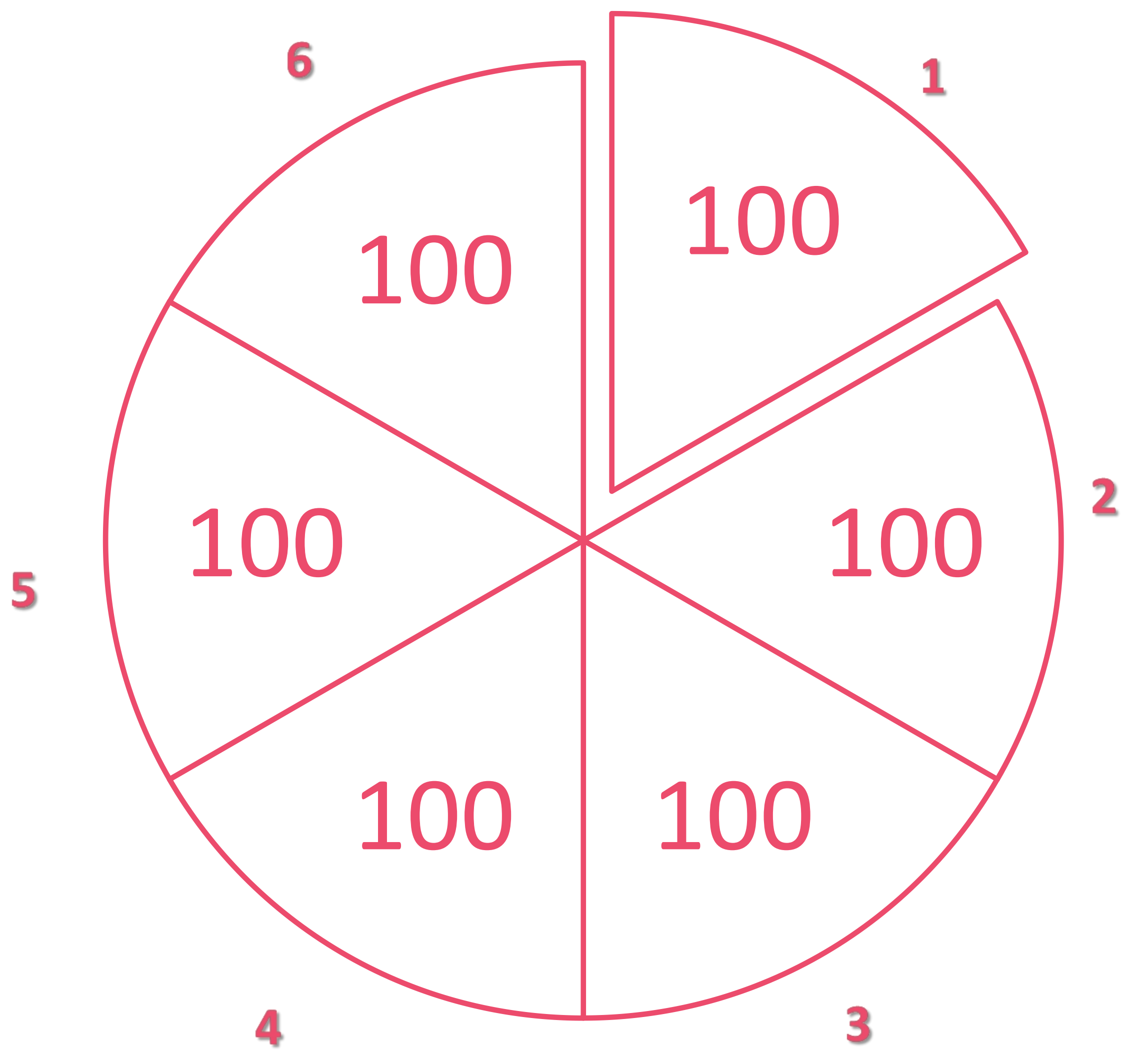
Energy & Green Buildings

2. Total Electrical Energy in the City Derived from Renewable Sources

Costs & Financing
From 1998 to 2008, the local government of Dezhou allocated USD 15.7 million (or RMB 100 million) annually
By 2010, Dezhou stakeholders had invested an accumulated USD 1.23 billion
Renewable energy as a leading sector for urban development
RE has proven to be a leading sector of the urban economy
Energy being centrally positioned within the production process of sustainable goods and services

Mobility and Air Quality
1. Clean Technologies Shared Vehicles
2. Availability of Public Transport
3. Percentage of coverage of NMT network (pedestrian & bicycle) in the city
4. Level of Air Pollution
5. Clean Air Action Plan (Planning and Implementation)

SCORE WEIGHTAGE



M. ARCH. in SUSTAINABLE HABITAT

Mobility and Air Quality

1. Clean Technologies Shared Vehicles

(Unit: %)

Rationale

Conventional fuel burning vehicles release an enormous amount of toxicants to atmosphere, cities must put efforts to introduce a cleaner fuel based shared vehicles.

Description

The indicator assesses the percentage of shared vehicles that operate on clean fuels like CNG, LPG, biofuels or are hybrid or electric vehicles.

Methodology

The city has to calculate the ratio of annual number of clean technologies shared vehicles to total shared vehicles.

$$\text{Formula} = \frac{\text{Total number of shared vehicles on clean technologies}}{\text{Total number of shared vehicles in the city}} \times 100$$

Mobility and Air Quality

1. Clean Technologies Shared Vehicles

Evaluation Score Levels

Level 1

0

No clean technology shared vehicles available

Level 2

25

Clean technology shared vehicles <5%

Level 3

50

Clean technology shared vehicles 5% to <15%

Level 4

75

Clean technology shared vehicles 15% to <25%

Level 5

100

Clean technology shared vehicles >25%

Mobility and Air Quality

1. Clean Technologies Shared Vehicles

Evidence Requirements

Registration data from regional transport office by type of fuel

Data Evidence Available

Type	Value	Unit	Source
E-Buses	36	pc	Imagine Panaji Smart City Ltd
Educational Institution Buses	189	pc	Electricity Dept, Panaji
Passenger 3 wheelers	2,519	pc	**Open Government Data Platform**
Maxi cabs	2,689	pc	**Open Government Data Platform**
Motor cabs	24,795	pc	**Open Government Data Platform**
Motor Cycle for hire	24,055	pc	**Open Government Data Platform**
Passenger buses	5,248	pc	**Open Government Data Platform**
Passenger e-Rickshaw	16	pc	**Open Government Data Platform**
E-Buses	35	pc	KTCL

Mobility and Air Quality

1. Clean Technologies Shared Vehicles

(Unit: %)

Calculation	
100 x (87/59,582) = 0.15 %	
Result	
The percentage of shared vehicles that operate on clean fuels is 0.15 %	
Current Progression Level	
Score	**25**

Clean technology shared vehicles <5%

1	2	3	4	5
		5- 15%	15-25%	> 25%

Mobility and Air Quality

1. Clean Technologies Shared Vehicles

Indicator Analysis

- City has extremely low EV penetration
- State has released a comprehensive EV plan but implementation will take time
- Easier access to conventional fuel stations
- Charging infrastructure is not in place
- Shared vechicles are mostly for intercity travel

Possible Scenarios

- Lack of institutional setup like City EV poilicy
- Lack of infrastructure
- Availability of reliable & sufficient electricity is a challenge
- Higher capital costs of EVs
- Social willingness to accept EVs
- Cities lack comparable environmental action plans suitable for EV
- City governments may collaborate with private players to co-develop models for EV growth

Mobility and Air Quality

1. Clean Technologies Shared Vehicles

Best Practices & Studies

Electrification of City fleet in Cincinatti	
A user study on station-based EV car sharing in Shanghai	

Energy & Green Buildings

5. Promotion of green buildings

Rationale:

Buildings, throughout their life cycles, are one of the prime contributors of GHG emissions in the city. In order to encourage the construction and use of green and energy efficient buildings, national building code 2016 and energy conservation of building codes are developed and notified by the Government. There are number of compliances, implementation procedures and stakeholder co-operation that needs to be in place from the city's side for effective adoption of green buildings. This indicator checks the readiness of the city regarding the compliance procedures, penalty/ reward schemes and stakeholder co-operation for subsequent promotion of new and existing green and energy efficient buildings.

Description:

The indicator will assess the extent to which cities have adopted use of energy efficient and renewable energy operated streetlights. Energy efficient streetlights should have lamps with luminous efficacy of more than 85 lumens per watt (e.g. LED, Sodium vapor lamps etc.)

Energy & Green Buildings

5. Promotion of green buildings

Methodology:

Compliance procedures are only available at state level. Assessment will be on the basis of inclusion of latest provisions of codes, regulations for green buildings at city level, formation of green building cell within city ULBs, availability of promotional/ penalty schemes to spur demand for green buildings, and formation of city level green building committee/equivalent for stakeholder co-operation.

Formula:

Cities will be marked based on the evidence provided for the number of measures implemented. Cities will be marked in 5 levels with scores ranging from 0 to 100.

Data:

Energy Conservation Building Codes (ECBC 2017)

Calculation:

Measure 1 : Energy Conservation Building Codes (ECBC 2017) has been notified and in force in the city.

Energy & Green Buildings

5. Promotion of green buildings

Analysis:

Measure 1 out of 4 Measures described in the framework is notified by the local body.

Progression Level: 2 (Score=25) :

Measure 1 : Energy Conservation Building Codes (ECBC 2017) has been notified and in force in the city.

Energy & Green Buildings

5. Promotion of green buildings

Measure needed for next level:

MEASURE 2: Functioning of green building cell in ULB for the purpose of knowledge dissemination, creating public awareness, empaneling green building vendors, designing green building schemes and their promotions, verification and faster approvals for green buildings in the city.

MEASURE 3: Promotional/ Penalty schemes available for code compliance, pre- certification, certification of green buildings.

MEASURE 4: Functioning of high-level Green Building Committee/ equivalent comprising of ULB's Commissioner and representatives of ULB green building cell, SPV, PMC, UDD, Town Planner, PWD, Green Building Certification agencies, Developers and Building Professional Associations. The committee will provide strategic advice for the promotion and adoption of energy efficient and green buildings in the city.

Mobility and Air Quality

4. Level of Air Pollution

Rationale:

Climate and air pollutants including CO_2 emissions have a common origin- the current energy model. Both are worsened by the burning of fuel and increase the CO_2 emissions. Sound urban planning and clean technologies are now recognized as solutions to air pollution. The smart cities present a unique opportunity to adapt to advanced air quality- monitoring technologies. Cities are encouraged to adopt affordable technologies by introducing low-cost air-quality sensors and linking the latter to the Integrated Command and Control Centres. This approach can complement the Pollution Control Board's existing monitoring system to provide further data on localised areas, hot spots and help generate real-time information for cities to take corrective action as well as gauge improvements. Air pollution data will not only help the government in framing policies and measures but allow citizens to make informed decisions that can improve the quality of their lives.

Mobility and Air Quality

4. Level of Air Pollution

Description:

A city level air-quality monitoring grid is important to generate holistic data, helps to assess the risks, implements control measures and assesses other climate smart strategies adopted by the city. The city is encouraged to assess to what extent it has achieved National Ambient Air Quality Standards (NAAQS),2009. The National Clean Air Programme sets a target of 20 -30 percent reduction of air pollution levels with 2017 as the base year. A city level air-quality monitoring grid is important to generate holistic data, helps to assess the risks, implements control measures and assesses other climate smart strategies adopted by the city.

Mobility and Air Quality

4. Level of Air Pollution

Methodology:

The indicator assesses the existing city level air quality monitoring mechanism, its strengthening requirements and availability of air quality data on public domain. City will be assessed on its additional pollutants monitoring, its reduction strategies, its implementation and compliance to the National Standards.

Formula:

According to National Ambient Air Quality Standard by CPCB

Mobility and Air Quality

4. Level of Air Pollution

Data:

- Basic Daily Monitoring is conducted by GSPCB and published on the website
- Capture levels of PM10, PM2.5,NO x, SO x (as per Central Pollution Control Board Guidelines)
- Additional pollutants monitored (like CO, NH3, Pb and O3 etc. as per NAAQS)
- Daily AQI levels are published and available to public through display boards/SAFAR/ Sameer App/ any other app https://www.aqi.in/dashboard/goa/goa

Calculations:

According to National Ambient Air Quality Standard by CPCB

Mobility and Air Quality
4. Level of Air Pollution

Analysis:

Level2: • Capture levels of PM10 PM2.5, NO x, SO x (as per Central Pollution Control Board Guidelines)

• Additional pollutants monitored (like CO, NH3, Pb and O3 etc. as per NAAQS)

Level3: • Daily AQI levels are published and available to public through display boards/ SAFAR/ Sameer App/ any other app

Progression Level: 3 (Score=50) :

Level4: • Reduction Air Pollution level based on previous year reading if available

• Reduction trend / incremental improvement in compliance to National Clean Air Programme

Level5: • National ambient air quality standard for PM10, PM2.5, NOx and SOx has been met.

Mobility and Air Quality

5. Clean Air Action Plan (Planning and Implementation)

Rationale:

Unsustainable urban planning, lack of proper waste management, poor technology in industries and increased urban transport have all led to rise in air pollution in cities in India. According to the Health Organisation (WHO), seven million people die prematurely from health risks every year owing to air pollution. The Smart city Mission sets out to bring in its fold the urban policy design of public transit oriented urban mobility, smart parking, intelligent traffic management and integrated multi-modal transport, prioritising non-motorised transport, digitalisation of public services, and waste management e.g. reduction of C&D (construction and demolition) waste, all of which are good practices for better air quality. These are also actions that need to be emulated in the entire city.

Mobility and Air Quality

5. Clean Air Action Plan (Planning and Implementation)

Description:

Cities should take onus for providing healthy air quality to the citizens. Clean Air Action Plans mandated by the National Clean Air Programme (2019) of Government of India integrate the cumulative city level actions for better air quality. For a city to be climate smart it should be able to address the issues of reducing air and climate pollutants since both air and climate pollutants arise from similar sources and addressing one has a direct co benefit to the other. Clean Air is integral for achieving climate smartness by a city.

Mobility and Air Quality

5. Clean Air Action Plan (Planning and Implementation)

Methodology:

Indicator assesses to what extent the city has made efforts to improve the air quality, through clean air action planning and proper air quality management strategy in cities. To generate data and identify sources through scientific methods and subsequently to develop and implement sectoral strategies and projects that are components of the clean air action plan. This has to be done in close co-ordination with the State Level monitoring authorities and other stakeholder departments. The clean air action plan needs to be reviewed and monitored to assess improvements in air quality.

Formula:

None

Mobility and Air Quality

5. Clean Air Action Plan (Planning and Implementation)

Data:

- Monitoring Stations for measuring Ambient Air Quality, total 18 stations in Goa, 1 in Panaji at Patto
- Air Quality Monitoring mechanism linked with ICCC/ Sensors based monitoring systems
- Map of monitoring stations available on the website
- Map of air pollution sensors in the city prepared
- Clean Air Action Plan prepared by SPCB based on CPCB guidelines as per National Clean Air Programme, (NCAP) developed

Source: Goa Water Air Rules 2021

- Scientific study based on CPCB /SPCB led Source ApportionmentStudies and Emissions Inventories

Source:GSPCB

Calculations:

None

Mobility and Air Quality
5. Clean Air Action Plan (Planning and Implementation)

Analysis:

The data satisfies the Level 3 of the indicator by implementing Clean Air Action Plan and Pollutants Source Identification

Progression Level: 3 (Score=50) :

Level4: Implementation of at least 2 measures under the domain of the ULB as specified in Clean Air Action Plan

Level5: Impact assessment for implementation of Clean Air Action Plan measures with evidence of improvements in air quality