

WORLD

SUSTAINABLE RESOURCES CITIES INSTITUTE

LOW-CARBON URBAN DEVELOPMENT **SOLUTIONS FOR TRANSFORMATION**

URBAN PATHWAYS CONFERENCE, BERLIN

JAYA DHINDAW DIRECTOR- URBAN DEVELOPMENT, WRI INDIA

WRI ROSS CENTER FOR SUSTAINABLE CITIES • OCT 16, 2017

2015-2030 – UNPRECEDENTED URBAN GROWTH – ESPECIALLY IN S. ASIA & AFRICA



MEDIUM-SIZED CITIES WILL GROW THE MOST



Urban Agglomeration Population

Note: N = 1,692 urban agglomerations (populations \geq 300,000 inhabitants).

Sources: United Nations (2014); World Bank country classification.



MORE OF THE POOR WILL LIVE IN CITIES



Source: Ravallion et al., 2007c: 8. Note: Example trend based on data from India.



Urbanization will not be accompanied by economic growth everywhere IN 2014 Δ GDP per capita **HIGH INCOME** COUNTRIES IN 1960 3 POOR COUNTRIES POOR COUNTRIES IN 2014 IN 1960 2 25 75 0 50 100

Urbanization (%)



THE FASTEST-GROWING CITIES WILL HAVE THE LEAST PUBLIC RESOURCES



Source: Authors' compilation from various sources. Note: Budget data represent years 2010 to 2016.



THE EXTRAORDINARY URBANIZATION CHALLENGE

Globally, 800 million per decade

 India's urban population will double to 800 million by 2050

Source: UN Habitat; UNWorld Urbanization Prospects 2014 Revision; Image: Harvey Barrison

Sources institute

Rapid growth & urban transformation

Urban population expected to almost double from 420 million in 2015 to over 800 million by 2050;

India's population split - 1980, 2015, 2050

Millions



But recent research has shown that official figures underestimate India's "hidden and messy" urbanization SOURCE: World Urbanization Prospects, 2014 Appropriately compact, connected, & coordinated cities can be more productive, socially inclusive, resilient, cleaner, & safer: Driving low carbon urban development is a \$17 trillion global economic opportunity to 2050 based on <u>energy savings alone</u>



Source: Leeds University for New Climate Economy

URBAN INDIA'S FUTURE

620,000 premature deaths p.a. due to poor air quality India's GHG emissions: about ½ originate in urban areas Environmental degradation cuts India's GDP by \$80 billion 75% of India's 2050 infrastructure is yet to be built Delhi has the worst air quality of any major city in the world according to the WHO1

Presenting India's renewed urban focus

Smart Cities Mission | Swacch Bharat Mission | AMRUT Cities | Housing

for All | HRIDAY Cities | Metro Rail Projects



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Image: Flikr/Andreas

GLOBAL CLIMATE CHANGE TARGETS ARE NOT POSSIBLE WITHOUT THE TRANSFORMATION OF CITIES

23% of global GHG emissions are from transport

70% of GHG emissions come from cities

Photo: Flickr/PauloFehlauer; Sources: UN-Habitat, UNFCCC, WHO

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Namma Bengaluru

Among top 100 cities contributing to global economy 75% from service sector; \$500 bn from IT & real estate Globally 9th highest number for foreign investment projects











Bengaluru Update! Disparate Growth of Bengaluru Recently: Most Dynamic City in the world!

An Economic Powerhouse

16th Rank in Overall Economic Strength

- Economist Intelligence Unit (EIU) Hot Spots Beyond great weather!

146th Rank in Quality of life among global cities - Mercer Index 2015

7-10% Growth in vehicular population

- 5004 Road accidents per year (one of the highest)
- **66%** Lakes that are sewage fed

2nd

- **71%** Ground water unfit for consumption
 - Rank in Air pollution



BENGALURU'S WATER STRESS

- Around 2.2million no piped supply (25%)
- Areas outside former BMP area at most stress
- Self provision by buying water or groundwater extraction



URBAN RISKS – LAND SUBSIDANCE

- City is Sinking
- City Subsidance 2.34cm to 3.17cm (average 2.73cm)
- Excessive groundwater pumping
- Reduced recharge potential



URBAN RISKS – VEGETATION CHANGE

- City's Vegetation Changing (2014-17)
- Loss is higher outside BMP
- Loss due to Urbanization
- Gain around lakes due to weeds



URBAN FOOTPRINT

- 466% increase in the built up area of Bangalore from 1973 to 2000
- As per 2014 data over 5,000 acres of Bangalore was under development in the periphery, designed to be car dependent, relying on diesel-fueled power and would survive on purchased

water.





Image Data Source: Global Land Survey and LandSat (USGS), Open Streets Map, NHAI, B

ENERGY CONSUMPTION

- 1406 kwh/person/annum
- Much higher than average in peripheries





Transport sector institutions



Source: Deepak Baindur, IIHS

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CONGESTION



Flyovers



Lack of pedestrian safety + traffic jams



Incomplete Metro



Burdened BMTC -> inefficiency







Growth in peripheries



3400 MW peak demand - dropping hydro reserves

SSSEDI /







MESSY – QoLIFE, GOVERNANCE, DECISIONS MAKING

- Lack of Services [Water, Solid Waste, Transport, Energy]
- Proliferation of private solutions [Water Tankers, Diesel Generators, Motorcycles, Unmanaged Land Fill Sites and now Air Purifiers]
- Highest Growth in Urban Peripheries
- Land values escalating, disincentivises good governance and land value capture becomes private good



WILL REMAIN MESSY FOR 20+ MORE YEARS

- Once in 200 years period of transformation
- Strong mismatch between demographics (30% Urban) and political representation (10% Urban)
- Unprecedented escalation in land values





How do you drive implementation in messy conditions with multiplicity of institutions, no clear decision making and lack of capacity to plan and implement?



TACKLE 3 PROBLEMS TO ACHIEVE LOW-CARBON DEV.CongestionSprawlInefficiency



BUSINESS-AS-USUAL IS UNSUSTAINABLE

Photo credits: (left) WRI Ross Center for Sustainable Cities, (Mexico, center) Pablo Lopez Luz, (Mexico, right) Ruimc77/FlickR



URBAN PLANNING

mminu



HOW WE BUILD CITIES MATTERS

ATLANTA



Population: 2.5 million Urban area: 4,280 km² Transport carbon emissions: 7.5 tonnes CO₂ per person

Source: Bertaud and Richardson, 2004, Kenworthy (2003) citied in Lefevre, B. (2009)



HOW WE BUILD CITIES MATTERS





COMPACT, CONNECTED, AND COORDINATED CITIES SAVE MONEY



mage: Wikimedia Commons/Bob Collowân Source: The New Climate Economy

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INDIA'S SPRAWL IS DIFFERENT

per person in Mumbai

1.00

42.5 m²

per person in Urban China

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Inevitable Urban Expansion in Indian Cities





WRI INDIA

Municipal Boundary Urban Area (2005-06)

Urban Area (2011-12)

- Rapid growth in satellite towns of Delhi (Gurgaon, Noida, Grt Noida, Faridabad etc)
- Mumbai, little movement in peripheries, but witnessing inner city redevelopment
- Pune capitalising on Mumbai's slow down, attracting new economies like IT/ ITES

Source: Generated by WRI India using data from Bhuvan NRSC

Solution 1: Transit Oriented Development (Scales)


TRANSIT-ORIENTED DEVELOPMENT (TOD)

- Walkable: Proper integration of non-motorized modes of transit
- **Mixed-use:** Planned mix of commercial and residential buildings
- **Mixed-income:** Inclusive TOD through affordable housing
- High-density: More housing units near transit stations to increase transit ridership
- Access to Mass Transit: Residents must have access to reliable transit
- Access to Opportunities: Jobs, services, housing, recreation, public space



EMBARQ Brasil. DOTS Cidades - Manual de Desenvolvimento Urbano Orientado ao Transporte Sustentável. November 2014. Accessed August 23, 2016. http://wricidades.org/research/publication/dots-cidadesmanual-de-desenvolvimento-urbano-orientado-ao-transporte.



BANGALORE- STATION AREA DCR



SAFE ACCESS APPROACH

In the safe access approach the needs of "PEOPLE" lie at the centre of the strategies developed for station accessibility plans and station area improvements.





NAYA RAIPUR- SECTOR DESIGN

- > Project type: Green field
- > Demonstration Site : Sector 31 Residential Site admeasuring 60.3 hectare.
- > 16,000 population as per proposed Master Plan.
- > Project worth is INR 300 Crore.



Need for the project:

- > To integrate TOD principles in Designing the city.
- > To preserve natural terrain and water networks.





Layered approach to Sector Design





HUBLI DHARWAD- CORRIDOR LEVEL DESIGN



Objective – Demonstrate TOD around BRT station in Navanagar area and scale it to the rest of the stations along the entire corridor of BRT in Hubli-Dharwad.



NAVANAGAR TOD: HUBLI-DHARWAD



- Partnered with DULT to develop Navanagar node of proposed BRT & safe access to BRT from significant public space
- Moving towards implementation (final GFC complete, tender out)
- Team on committee for advising Hubli-Dharwad Plan



MANEK CHOWK – AHMEDABAD: PUBLIC SPACE DESIGN

- Project to improve a public space in a historic neighborhood Chowk
- Final report submitted to municipal corporation
- Project included in municipal budget



Solution 2: Landuse and Transport Integration



METRO LINES AND STATIONS IN BENGALURU

- Length of Metro lines in Ph.I (active): 31.52 Kms
- Length of Metro lines in Ph.I: 42.3 Kms
- Number of Stations in Ph.I (active): 30
- Number of Stations in Ph.I: 41
- From Mysore Road Terminal to Baiyappanahalli and Sampige Road to Nagasandra the Metro lines are active
- The Southern arm of Phase I is to be opened soon



LOCATIONS OF JOBS IN BENGALURU

- Details of various companies (primarily white collared) were obtained from fundoodata.com
- Out of the list of 6000 odd companies, 4132 were spatialized using the address
- The number of jobs in each company was estimated based on the data
- Total number of Jobs (Median est) in Bengaluru : 10,06,600



REGIONAL ACCESSIBILITY (60 MINS)

JOBS	POPULATION
0 – 20 %	2,44,661
20 – 40 %	4,68,235
40 – 60 %	9,63,473
60 – 80 %	22,57,396
80 – 97 %	45,09,957

 Majority of the public are having good access to jobs within 60 minutes in normal case scenario



ACCESS FROM / TO CHINASWAMY STADIUM

- The access from M Chinnaswamy stadium was calculated as a single point analysis (Isochrones)
- The departure time is placed between 9 PM and 11 PM
- Such a departure time was chosen to create a scenario of people coming out of the stadium after a cricket match
- Analysis shows that many areas are not accessible at the given time



Analyst C 🟠 🔒 https://analyst.conveyal.com/#f4426e9eaae8a85d7f8f0cd3be5d1585/77.794189453125/13.046703337153815/11/analysis-single/ Transport Analyst Data 🕶 Analysis • Project Settings Bangalore -Jinke Devanahalli Channarayapatna Kodigehalli Ambalagere Bachahalli Kumbiganahalli Accessibility to pixpop Southe

Varadenahalli Tyamagondlu Channahalli Haniyuru Ramagovindapura Madure BLR Sulibele 1.214 Jakkanahalli Doddajala Belamaranahall 1M Karappanahalli Honnenahalli Ganganahalli Araledibba Hesaraghatta Narasi Gangapura 4004 Basavanahalli Bittasandra Nelamangala Kannuru Kumbalahall -40 60 MINUTES Gundur Chikka Jakkur Hegdenagara Banavara Hoskote Byappanahalli Mahadevapura - Scenario 1 - Scenario 2 Shivarapatt

Gowdanahalli

Kothanur Bilishivale Anchepalya Travel Time Range: 0-120 minutes Hirandahalli Hedaginabele Honnasandra NH75 Doddagattinagabbe

Harohalli

Sarjapura

Kalkunte

Agrahara

Lakkuru

Sampangere

Chikkatirupati

Kittanahalli Maluru Mallasandra Koralur Bengaluru Channasandra Whitefield Dommaluru

Ganapathihalli Kurubarapalya Patanagere Bettana Savandurga Palya S Golahalli Gerupalya Thalaghattapura + Manchanabele

Udayapura

Bannerghatta

Hagalahalli



Doddakannelli



Hebbagodi

Konappana Agrahara

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0 mins Show Isochrones

Scenario 2 No Change Scenario 2 New Coverage

Scenario 2 Faster Not in range

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Show Transit



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Solution 3: Strategic Spatial Planning





DAVANAGERE POPULATION: 4,35,128; AREA: 77.12 sq.km

POPULATION: 3,22,428; AREA: 70.01 sq.km

SHIVAMOGGA

KALABURAGI (GULBARGA) POPULATION: 5,32,031; AREA: 64 sq.km

TUMAKURU POPULATION: 3,05,821; AREA: 48.6 sq.km

the 11 corporations

Move from traditional land-use approach for planning and development towards a strategic spatial planning approach

	KTCP Act , 1961	Actual Situation
Karnataka State		State Five Year Plans Urban Vision 2020
District/ Region	Outline Development Plan/ CDPs for LPAs within Region	Annual Plans South Karnataka Region Plan; BMR Revised Structure Plan 2031; Interim Master Plans for local planning areas within Region
Bangalore Municipal Area	Outline Development Plan/Master Plan	Revised Master Plan for BMA JNNURM CDP; JNNURM DPR; Development projects for zones
Ward Boundary	Town Planning Scheme	



Duplication and Non-conformity with other department's databases







Solution 4: Managing Urban Expansion



Population Growth 1901-2011



Source: Census 2011

Population Growth 2031



20.3 million (projected as per RMP-2031, BDA)

9 million (as per 2011 census in BDA)

Source: Census 2011

Primacy of Bangalore



Zipf's Law: Bangalore, a clear case of primacy. Hubli-Dharwad and Mysore, the second and third largest cities in the State are only 1/10th the size of Bangalore.

Develop peripheral and satellite ring roads as area-based development projects rather than mere road projects by integrating land-use and transport







Expansion of Bengaluru beyond its Metropolitan Region: Case Chikkaballapura

Approaches to plan Chikkaballapura as a satellite for Bengaluru

- Clear city structure, connectivity network to support organised ٠ expansion
- Support walking and cycling & accessibility to public transport ٠
- Conserve the natural water systems to sustain life forms ٠
- Plan equitable access to public facilities, utilities and transport • services
- Plan open spaces and green areas as relief for better micro climate. •

Land surface temperature in Chikkaballapur to inform location of gardens and open spaces

Legend

— Highways LPA Boundary

Settlement Boundary

Temperature

High : 36.21 C

Low : 24.38 C

Map generated by WRI India, 2016



Kms

2

Town Planning Scheme for Planned and Serviced Land



Fig. 4: Vinzol II TP scheme, showing the process of plot reconstitution

Integration of gated communities in the peripheries



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Solution 5: Participatory Community Planning



NIPC - City wide challenge

scale: City level (BBMP)

primary stakeholders: Community associations, BBMP, organising and funding partners

Community engagement type: Community led formulation and implementation

Funding mechanisms:

CSR funded

MEET THE CHALLENGE, TRANSFORM YOUR NEIGHBORHOOD





Adopt local area planning that allows for improved infrastructure and services for new and existing wards

This is where we began!



* Survey from registered applicants to NIP Competition

Proposals by Communities





Solution 6: India's 100 Smart Cities



Sustainable Development - Smart Cities

Objective

Economic Viability Creating jobs

Boosting key industries Attracting new business

Leadership & Good Governance Empowered & proactive leadership

Environmental Sustainability

Preserve natural resources Minimize impact

Social Vibrancy Quality of life Social inclusion

Social Infrastructure	• Smart Healthcare • Smart Education	 Telemedicine Applications Electronic Records Management Hospital and Clinic Asset Management Remote monitoring for disabled E and Integrated Learning Knowledge Sharing Network Virtual Infrastructure/Campuses
Smart Utilities	• Smart Water • Smart Waste • Smart GRID	 Smart Metering, Monitoring and network management Waste Management, Automatic notification, collaboration of authorities for waste collection & treatment Smart transmission & distribution network & Smart meters (It uses information and communications technology to predict and adjust to network changes autonomously to improve reliability and connect to new sources of generation).
Intelligent Transport and Connectivity	 Physical Infrastructure Digital Infrastructure 	 Multimodal transport network, BRTS, Metro Rail, Tram, Inland Waterway Intelligent Transport System, Congestion Management,
Smart Buildings	 Optimize building operation and management 	• Energy efficient building, Automation driven etc
Public Safety	 Optimize response time in case of emergency 	 Surveillance of public systems, secure public transactions and administration
Governance	• Encourage and capture feedback from citizens	 Use of multiple channels, including the phone, websites, mobile applications, and even social media tool for monitoring and program management





Smart Cities



*

MOBILITY

Photo by: Ashwat Mahendran/Flickr



ALMOST ALL CITIES FAIL AIR QUALITY STANDARDS

PARTICULATE MATTER PER M3 FOR TOP 50 CITIES – HIGHER PARTICULATE MATTER MEANS WORSE AIR QUALITY





URBANIZATION CHALLENGE IN INDIAN CITIES

Traffic Fatalities (2013)

Traffic Fatalities

Chart 1.1: Compound Annual Growth Rate 1994-2003 and 2004-2013



Image source: WRI India

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WRI INDIA

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Workers lose 8 days per year sitting in traffic

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HIGH QUALITY PUBLIC TRANSPORT AFFECTS CITY PRODUCTIVITY

MASS TRANSIT PLAYS A MAJOR ROLE IN REDUCING URBAN EMISSIONS, AND LEADS TO BETTER GROWTH



Note: * Determined by composite rankings against a range of indicators. Based on ranking of 24 international cities with #24 being the top rank. For more information on these see PwC Cities of Opportunity available at http://www.pwc.com/us/en/cities-of-opportunity/



HIGH QUALITY PUBLIC TRANSPORT AFFECTS QUALITY OF LIFE

MASS TRANSIT PLAYS A MAJOR ROLE IN REDUCING URBAN EMISSIONS, AND LEADS TO BETTER GROWTH



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MOVING PEOPLE: AVOID-SHIFT-IMPROVE (ASI) APPROACH



Solution 1: Complete Streets



RECLAIMING INDIA'S STREETS-- RAAHGIRI DAY

Photo: Flickr/EMBARQ Sustainable Urban Mobility

FIG

Redesign roads to make them safer for all users esp. pedestrians and cyclists













Solution 2: Buses and BRT



SEARCH FOR LOW COST HIGH QUALITY PUBLIC TRANSPORT



* Busway / BRT year commencement Source: BRTData.org, March 2016

25

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BIG Bus Network

- Route Network Optimization & Redesign (circular & trunk)
- 2. Gearing up towards 3,500+ buses and 2.5 million riders daily
- 3. Feeder network, transfer facilities, user information systems
- 4. Financial Modelling, Subsidies, Fare & Fare Integration



BRT IN MEGACITIES



Istanbul



Sao Paulo



México City

Rio de Janeiro

Bogotá

BRT IN MEGACITIES



AHMEDABAD, INDORE, SURAT, RAJKOT, INDORE BRT





Solution 3: Multi-modal Integration



Integrate various modes of public transport and intermediate public transport through schedule, fare, and physical integration



Key Building Blocks of Multimodal Integration



Source: WRI - EMBARQ India in association with Directorate of Urban Land & Transport, Karnataka

Solution 4: New Sustainable Mobility



Progressive regulations for emerging shared mobility options like ridesharing, carpooling, shared bicycles, and taxi aggregators

WHAT ARE THE TRENDS IN NEW MOBILITY VENTURES IN INDIA?



Ride Sharing is evolving but continues to have low ridership. Global companies BlaBlaCar and Tripda have entered India. The global B2C space is growing with entry by Hertz, Enterprise Rent-A-Car, Avis, Daimler, BMW and U-Haul. This market is still nascent in India. However, the self drive car rental place is an upcoming one. Park Sharing is in early stages in India. While there are some B2C models aggregating parking spaces and offering on demand valet, there are currently no P2P models.





SHARED, ELECTRIC AND AUTONOMOUS WILL HAVE FAR REACHING IMPLICATIONS





Solution 5: User Pays Principle



PROGRESSIVE TRANSPORT POLICIES







(Congestion Charge London)

Ensure car-users pay the full cost of driving, including the costs of parking and congestion





Solution 6: Public Bikeshare System



SHARING ECONOMY TAKES OFF

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PBS SYSTEMS IN INDIAN CITIES







ENERGY



INDIA'S CLEAN ENERGY AMBITIONS

From J gigawatts to

Ministry of Nev and ne of a gigawatts

solar power by 2022

Narendra Modi, Flickr

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INDIA'S TARGETS TO REACH 100GW SOLAR BY 2022



Notes: FY = All years in chart are fiscal years from April 1 to March 31; GW = 1,000 MW. Sources: Bloomberg New Energy Finance (BNEF); The Economic Times.



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Solution 1: Energy Efficiency



Energy efficiency for cities

- LED implementation
- Demonstrating new business models—pooling roof-space for larger procurement size to vendors
- Aggregating demand for energy efficiency & RE among companies—industrial parks, (Mahindra World City, Chennai)
- Residential rooftop solar adoption to meet targets under solar policies



- Identify and overcome information, technical, and financial barriers to installation of rooftop solar PV
- Focus on energy-efficiency and demand-side management via by promoting the use of energy efficient appliances and user education





Solution 2: Renewable Energy



Renewable Energy for cities

- Global coordinator the UN SE4All Global Building Efficiency Accelerator (BEA)
- Supporting Rajkot city in designing a building efficiency policy, and implementing demonstration projects
- Working in Kochi smart city to align solar cities and smart cities clean energy objectives and projects
- Developed guidebook for accelerating building efficiency for policy makers



- Facilitate the procurement of renewables by large electricity consumers to reduce their dependence on diesel and other pollutants
- Promote increased public participation in BESCOM's decision-making



184 MW Installation – Coco
cola, Infosys
100 MW – Mahindra World
City
400 MW – Policy
Intervention
500 MW – Rooftop



Solution 3: Circular Economy



India: Municipal wastewater

70% of wastewater (sewage) is released untreated into water bodies





Source: Central Pollution Control Board. Inventorization of Sewage Treatment Plants. March 2015
Wastewater – treatment, use and reuse





Pictures sourced from http://www.millenniumwaterstory.org/Wastewater%20Reuse%20-%20Some%20Reflections.html



Circular systems - Energy recovery and other co-benefits





Solution 4: Waste to Energy



India: Municipal Solid waste

- 377 million urban dwellers in 7,935 towns and cities
- 62 million tonnes of municipal solid waste per annum
- 43 million tonnes (MT) of the waste is collected, 11.9 MT is treated and 31 MT is dumped in landfill sites.



Solutions around solid waste management





WHAT CAN WE LEARN FROM CITIES THAT HAVE TRANSFORMED?

Medellin, Colombia

Surat, India

Photo Credits: Deutsche Welle/Patrick Benning/Flickr; GFDL (http://www.gnu.org/copyleft/fdl.html)], via Wikimedia Commons

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The opportunity Game-changing solutions are out there

Managing Urban Expansion

Transit-oriented development

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Improve Energy Efficiency Smart, efficient buildings

Addressing congestion

Mass Transit, Bike sharing systems and other low impact modes



- But solutions need *improving*, *scaling* and *adapting* for maximum impact:
 - Extending the coverage of mobility, energy, and other services to underserved areas
 - **Diversifying** options for greater choice and accountability, and adapting to local context.

Source: UTTIPEC, DDA, WRI India)

Photo credit: Anne Maassen

- •From moving vehicles to moving people
- •From *urbanization* to *managing urban expansion in a sustainable manner*
- •From traditional energy supply to implementing practices providing clean, reliable energy





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THANK YOU!

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