

LCS-Rnet 3rd Annual Meeting
Transition Towards Low-Carbon Societies in a Changing World

Transforming Urban Infrastructure for Low-Carbon Cities
— Issues, Options and Emerging Lessons in Developing Countries

Feng Liu

Energy Sector Management Assistance Program (ESMAP)

The World Bank

ESMAP and Its Energy-Efficient Cities Initiative

ESMAP

- ❑ Established in 1983, a **global program** supported by a multi-donor trust fund.
- ❑ With a mission to assist low- and middle-income countries to increase know-how and institutional capacity to achieve sustainable energy solutions for poverty reduction and economic growth
- ❑ Thematic focus on global energy challenges: **energy security, energy access, and climate change**
- ❑ Three core functions: **think tank, knowledge clearinghouse, and operational leveraging**

EECI

- ❑ Launched in 2008, with an objective to mainstream and scale-up EE measures in cities
- ❑ Main activities:
 - *Analyze urban EE issues and identify solutions*
 - *Share global good practices and lessons learned*
 - *Mobilize partners and financing*
- ❑ Key characteristics:
 - *Clients are mayors and municipal bodies*
 - *Program is demand-driven*
 - *Promotes innovations and results*

Why Focus on Cities?

Concentration of wealth

- ❑ In **2010** cities account for
 - 50% of global population
 - 80% of global GDP
 - 66% of global energy consumption
- ❑ 600 urban centers hold 20% of global population and 60 % of global GDP

(MGI, Mapping the Economic Power of Cities, 2011)

Shifting landscape and drivers

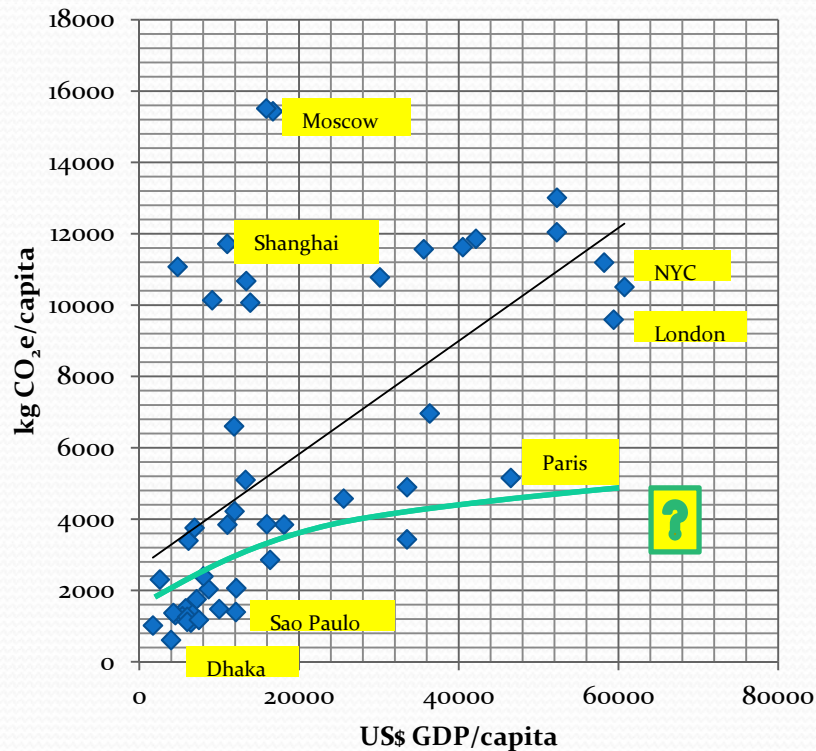
- ❑ By **2030** cities will account for
 - 60% of global population
 - 73% of global energy consumption
- ❑ **Developing countries** will account for
 - 94% of urban population growth
 - 81% of the urban energy growth

(IEA, World Energy Outlook 2008)

Low-Carbon Cities and Development

Measuring a city's carbon footprint

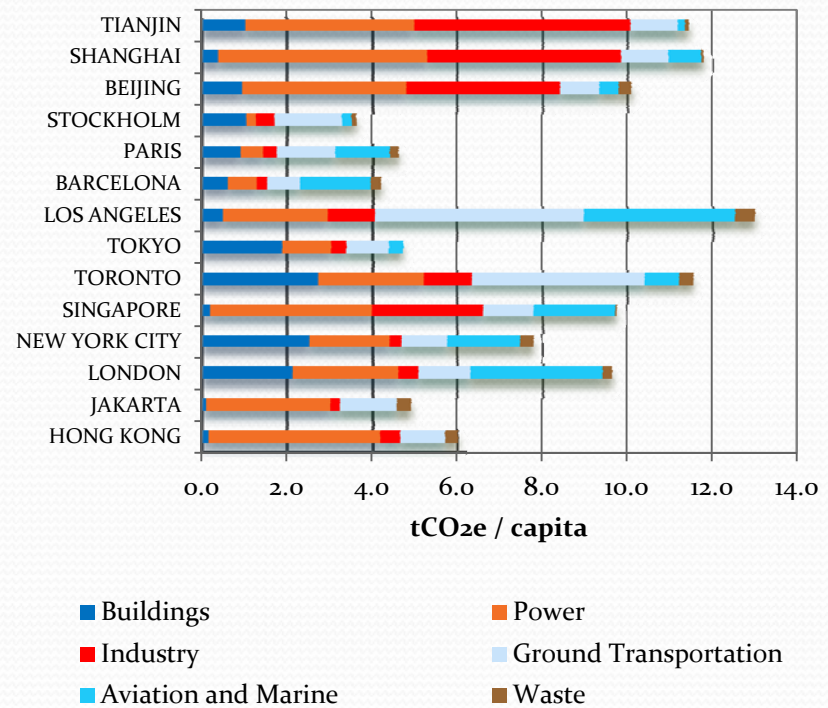
World's top 50 cities by population, 2005



(WB, 2010, Cities and Climate Change: An Urgent Agenda)

Considering underlying factors and development needs

Industry and power dominate CO₂ emission in Chinese cities



(WB, 2011, Sustainable Low-Carbon City Development in China, forthcoming)



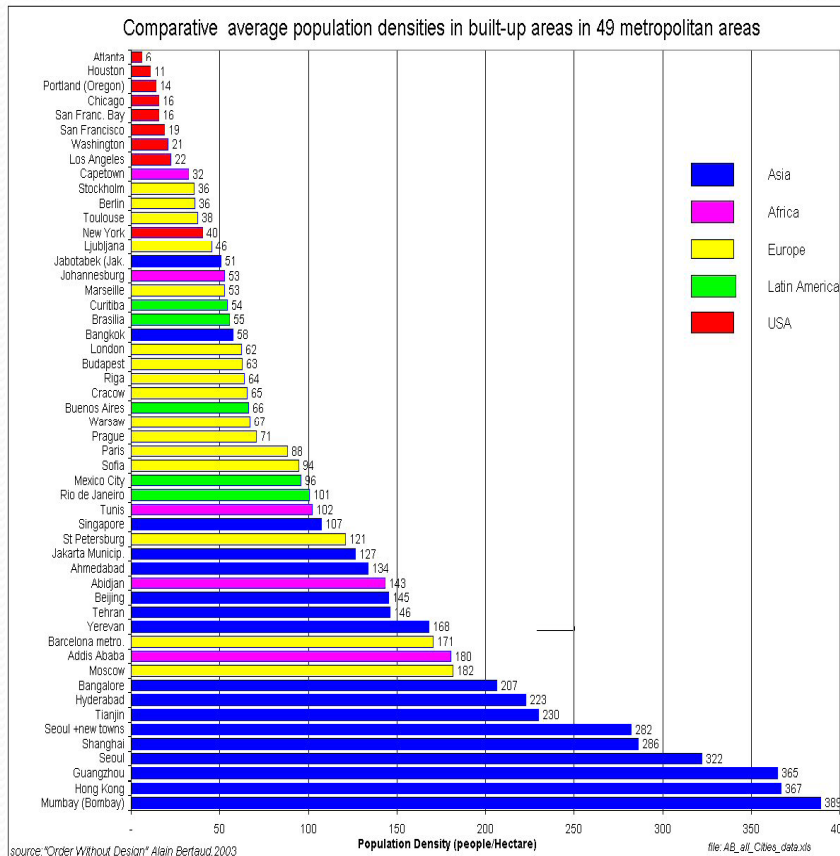
Low-Carbon Growth Innovations from Developing-Country Cities

- ❑ Bus rapid transit (BRT) implemented in Curitiba, Brazil
- ❑ City-scale domestic hot water supply using solar thermal technologies, Rizhao, China
- ❑ Large-scale bundling of municipal energy efficiency projects, State of Gujarat, India
- ❑ Integrated waste-management in Mexico City, Mexico
- ❑ Affordable, financially sustainable, and efficient water supply in Phnom Penh, Cambodia
- ❑ Many more are needed!

Urban Infrastructure Lessons

Developing-country cities are already very dense

Development and redevelopment need to harness the density bonus

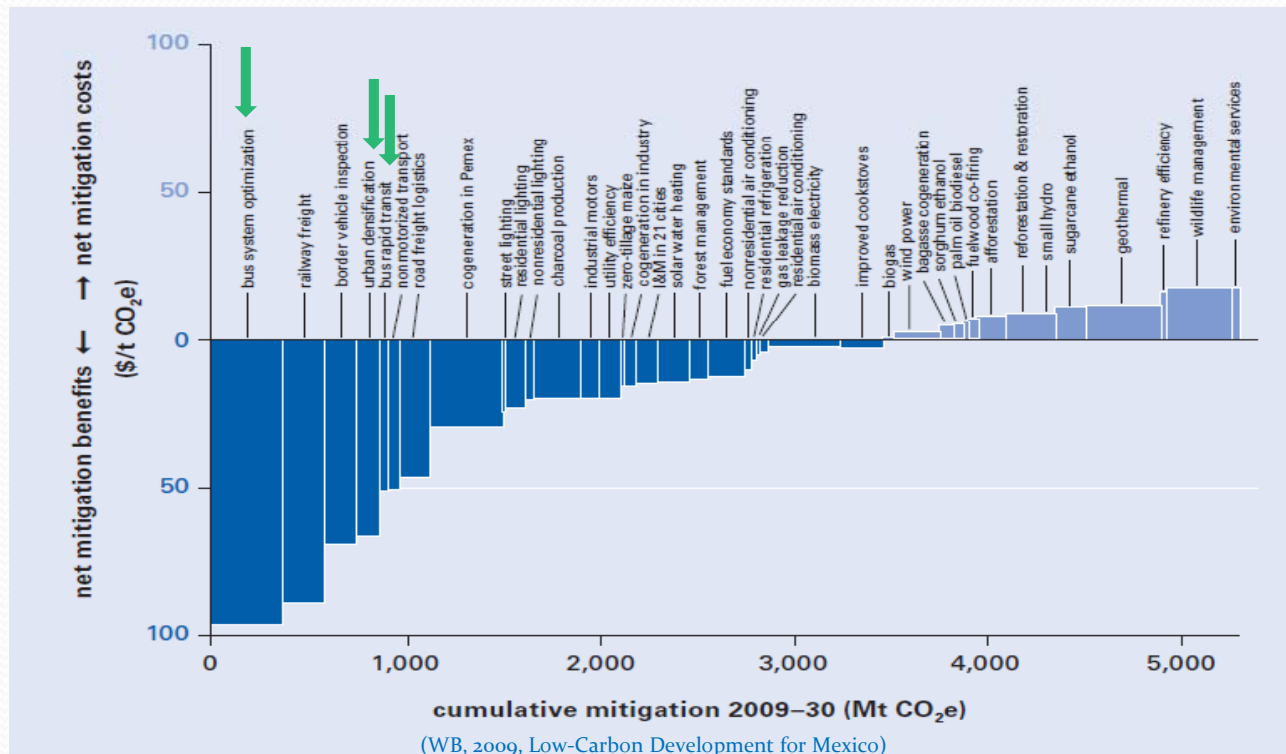


(WEC, 2010, Energy and Urban Innovation)

- ❑ Urban planning that promotes communities and mixed use
- ❑ Mobility solutions that improve the effectiveness and efficiency of public transit systems
- ❑ Building technologies that maximize efficiency of energy and water use
- ❑ Municipal utility services (energy, water, wastewater, solid waste) that are affordable and financially sustainable

Optimizing Urban (Intra-City) Transport

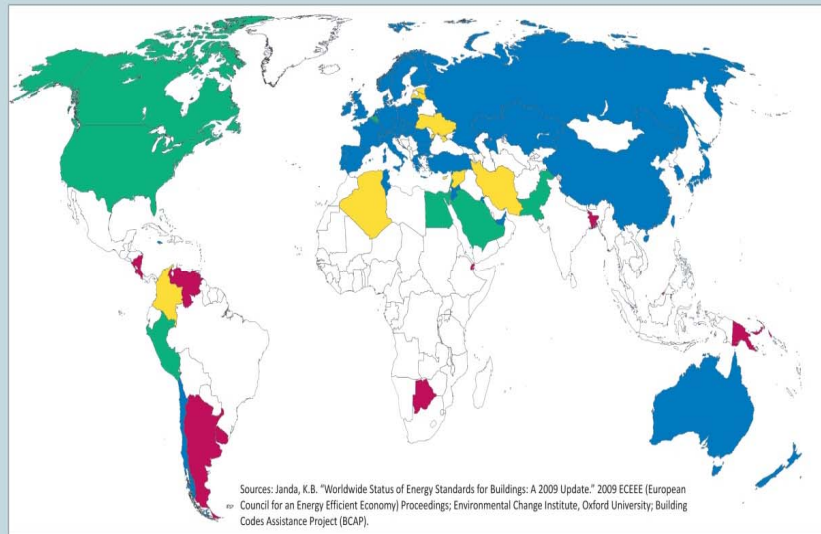
- Implications of Mexico low-carbon development MAC curve



- Increasing the operational efficiency of intra-city goods distribution can reduce fuel consumption of trucks by up to 30% at low cost (MGI, Building globally competitive cities: the key to Latin American growth, 2011)

Implementing Mandatory Building Energy Codes

Worldwide Status of Building Energy Codes/Standards – Residential



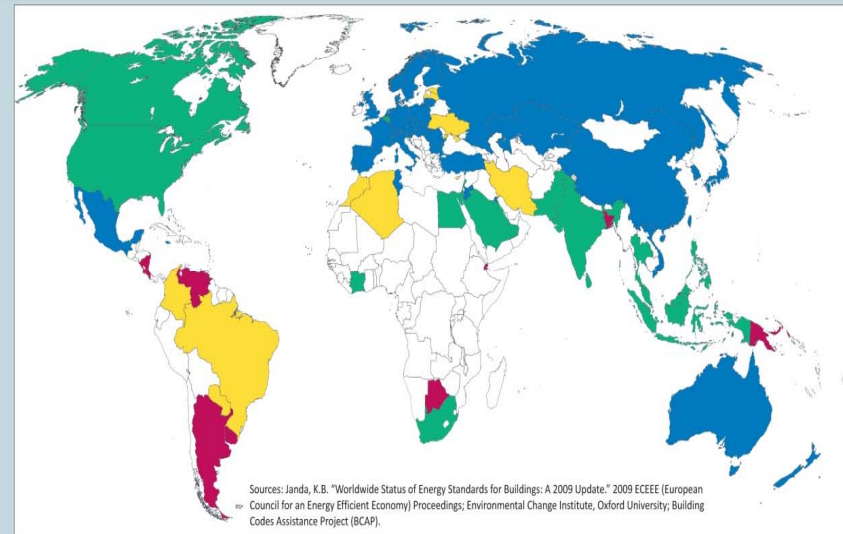
Sources: Janda, K.B. "Worldwide Status of Energy Standards for Buildings: A 2009 Update." 2009 ECEEE (European Council for an Energy Efficient Economy) Proceedings; Environmental Change Institute, Oxford University; Building Codes Assistance Project (BCAP).



ENVIRONMENTAL
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Worldwide Status of Building Energy Codes/Standards – Non-Residential



Sources: Janda, K.B. "Worldwide Status of Energy Standards for Buildings: A 2009 Update." 2009 ECEEE (European Council for an Energy Efficient Economy) Proceedings; Environmental Change Institute, Oxford University; Building Codes Assistance Project (BCAP).



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- ❑ Warm climate countries lag significantly in development and implementation of building energy codes.
- ❑ A critical aspect which is not indicated by the maps is ENFORCEMENT, which has been a significant issue for developed economies and a serious issue for developing countries.

Improving Municipal Utility Services

- ❑ In many developing-country cities about 30% of water produced is leaked during distribution, compared to 10% or lower of international best practices
- ❑ Up to 25% of energy use in existing water and wastewater utilities can be saved with attractive financial returns
- ❑ Smart meters are highly effective in cutting electricity theft and making consumers more cost-sensitive
- ❑ Integrated waste management by reducing waste generation and reusing, recycling, and recovering materials of economic value
- ❑ Implications for new municipal utility infrastructure



Incentivizing Cities and Citizens

Cities can lead but need support from national and regional governments

- ❑ Developing performance indicators and linking fiscal transfer and green financing to results
- ❑ Facilitating peer-to-peer learning and sharing of good practices (e.g., C40)

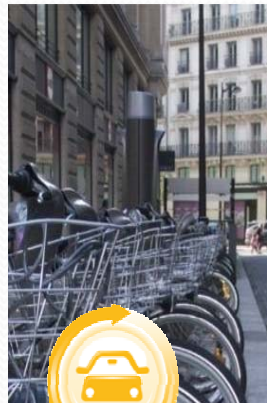
Most of the financing for low-carbon growth will come from the private sector, show people what they want

- ❑ Using market-based instruments
- ❑ Harnessing the power of information and social media

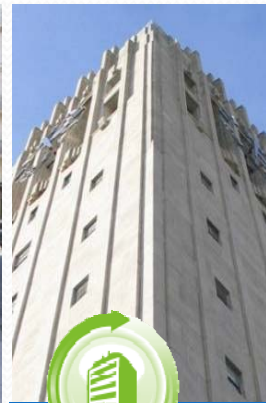
Engaging Cities on Low-Carbon Growth

Tool for Rapid Assessment of City Energy (TRACE)

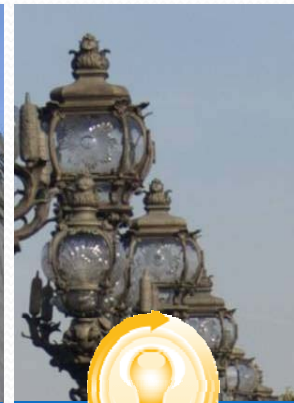
An Innovative Decision Support Tool for Evaluating Energy Efficiency Opportunities in Cities



TRANSPORT



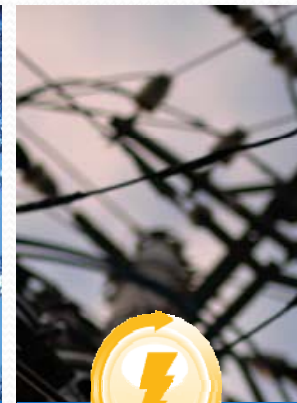
BUILDINGS



**PUBLIC
LIGHTING**



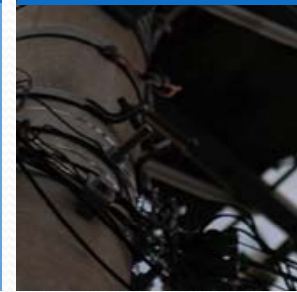
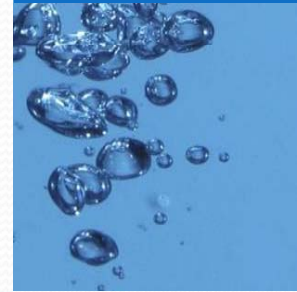
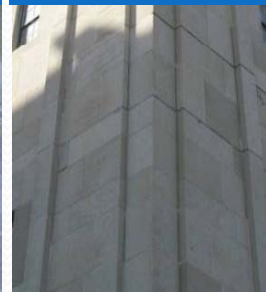
**WATER &
WASTEWATER**



**POWER &
HEATING**



**SOLID
WASTE**



TRACE Architecture

Energy Efficient Cities Initiative
Tool for Rapid Assessment of City Energy Save

Energy Benchmarking

Compare the performance of your city to others

- Benchmark Data
- Benchmark Results

Sector Prioritization

Identify the sectors with highest priority

- Relative Energy Intensity
- Sector Energy Spending
- City Authority Control
- Sector Priority Results

Energy Efficiency Recommendations

Find ways to improve your city's energy efficiency

- Recommendations
- Initial Appraisal
- Energy Savings Assessment
- Review

 **EECI**
Energy Efficiency Management Assessment Program

 happoldconsulting

 **TRACE**

 User Guide & Documents

TRACE Recommendation Matrix

Home Recommendations Matrix Export Save

The matrix below sorts recommendations by 3 attributes: First Cost, Energy Efficiency and Speed of Implementation. Back To Review Final List

Filter by speed of implementation < 1 year 1-2 years > 2 years

First Cost

	> \$1,000,000	\$100,000 - \$1,000,000	< \$100,000
Energy Savings Potential >200,000 kWh/annum	Municipal Residential (Public Housing) ...	Public Spaces Lighting Audit and Retrofit Solar Hot Water Program Improve Efficiency of Pumps and Motors Improve Performance of System Network Transformer Upgrade Program	Procurement Guide for New Street Light ... EE Municipal Vehicle Fleets Fuel-Efficient Waste Vehicle Operations
100,000 - 200,000 kWh/annum		Active Leak Detection and Pressure Man... EE Sorting and Transfer Facilities Non-Technical Loss Reduction Program Active Leak Detection and Pressure Man...	City-Wide Integrated Public Lighting Ass... Municipal Buildings Energy Efficiency Ta... Buildings Benchmarking Program Water Efficient Fixtures and Fittings Waste Composting Programme
<100,000 kWh/annum		Traffic Signals Audit and Retrofit Program Water Meter Programme	Computer PowerSave Project Educational Measures Waste Vehicle Fleet Maintenance Audit a...

<http://www.esmap.org/esmap/EECI>