

Cities and Energy:

An overview + introduction to energy policymaking in New York City

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Massachusetts
Institute of
Technology

Agenda

Response to yesterday's speakers?
A brief reflection

Energy Systems and Planning: An
Urban Perspective

Overview of cities and energy

Introduction to Energy Policymaking in NYC

Reflecting

on

What did you hear yesterday that is:

- personally or professionally important?
- of particular relevance to EDF?

..

Do these changes create vulnerabilities or opportunities for you or EDF?

Over what time scales?

Is there something that would help you better understand these issues or address these challenges?

- US and the global economy
- The presidential election
- US-China relations
- Issues in energy and environmental law
- Smart cities

**The bottom line:
“Energy Smart” cities
are imperative**

**Many innovative efforts
are underway**

...but it won't be easy



Source: IEA 2008

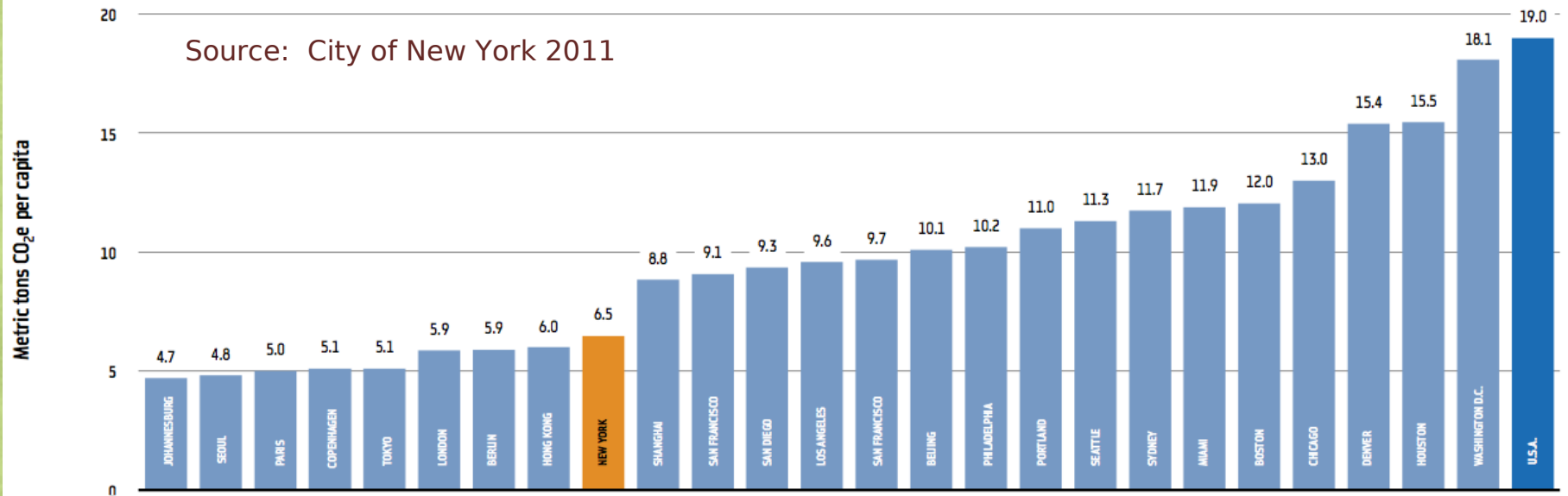
% of total primary energy demand in region attributable to cities/urban areas

Region

US	80%
European Union	69%
Australia & New Zealand	78%
China	75%

Cities drive global energy demand but may also be part of the solution

Per Capita Greenhouse Gas Emissions for U.S. and International Cities (excluding Agriculture and Non-Local Processes*)



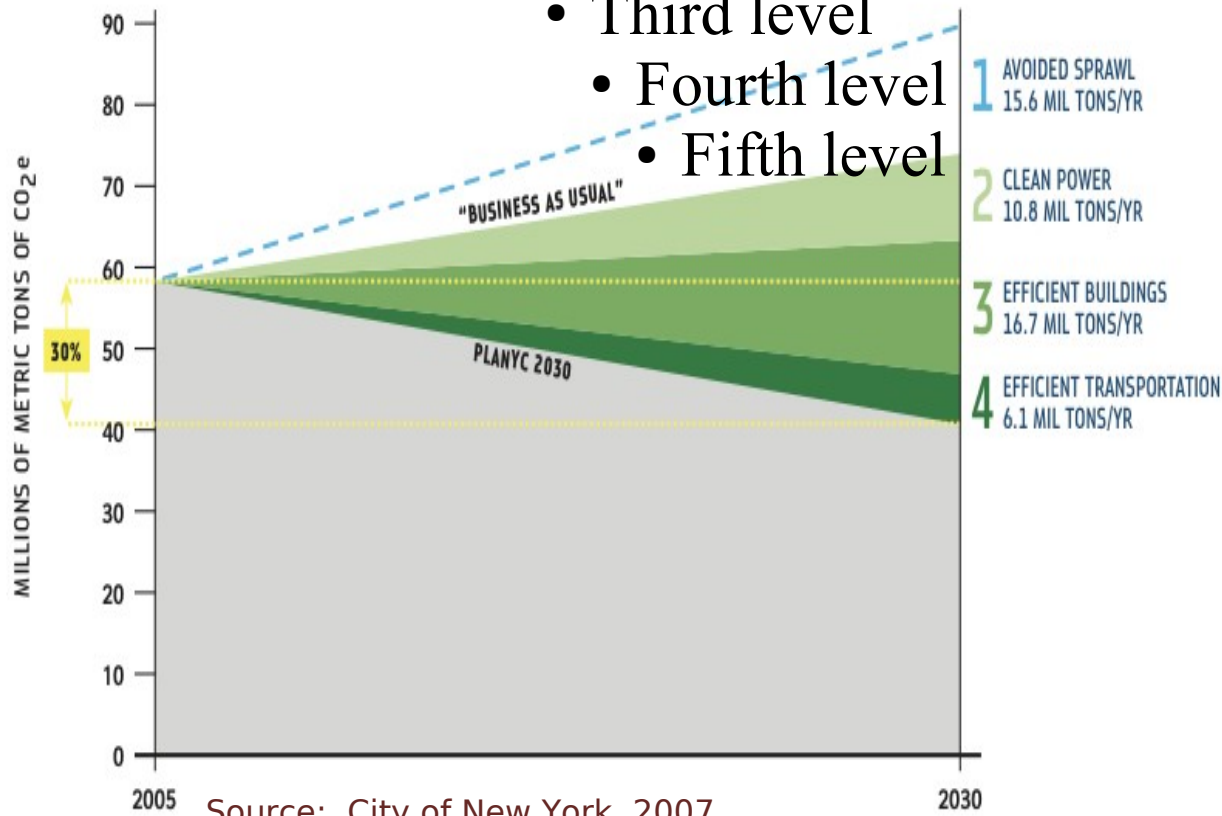
Example: City of New York claims a growing NYC has global carbon benefits

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Projected Impacts of Our Greenhouse Gas Reduction Strategies



Source: City of New York, 2007

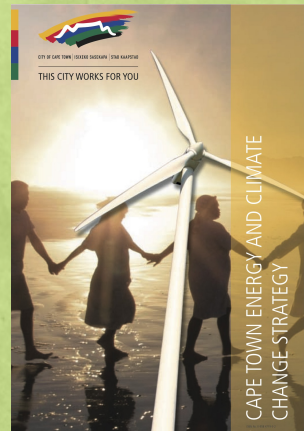
Source: NYC Mayor's Office of Long-Term Planning and Sustainability

The result will be an annual reduction of 33.6 MIL tons—and an additional 15.6 MIL tons avoided by accommodating 900,000 people in New York City

Cities are taking action

The policy drivers vary:

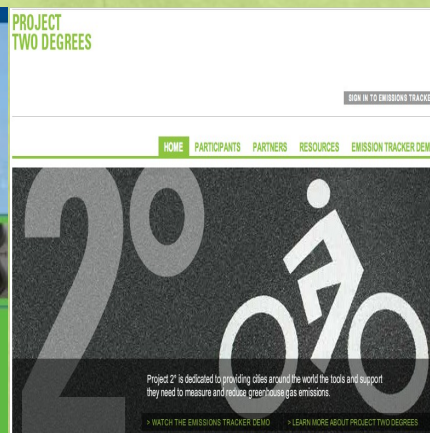
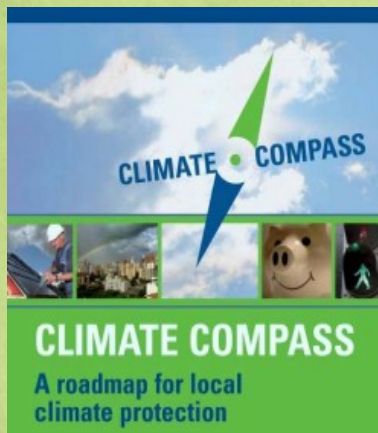
- Security of supply
- Local environmental quality
- Fuel poverty
- Economic competitiveness
- Global sustainability/Climate change



Low Carbon Development Roadmap for Jilin City

Chatham House, Chinese Academy of Social Sciences,
Energy Research Institute, Jilin University, E3G

March 2010



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

ESMAP Energy Sector Management Assistance Program
 happoldconsulting

TRACE User Guide & Documents

Technical assistance and diagnostic

These plans and technical assistance initiatives make clear the opportunities for clean energy and energy efficiency are immense, but must necessarily vary by city

New vehicle technologies and support infrastructure



Traffic-fighting programs



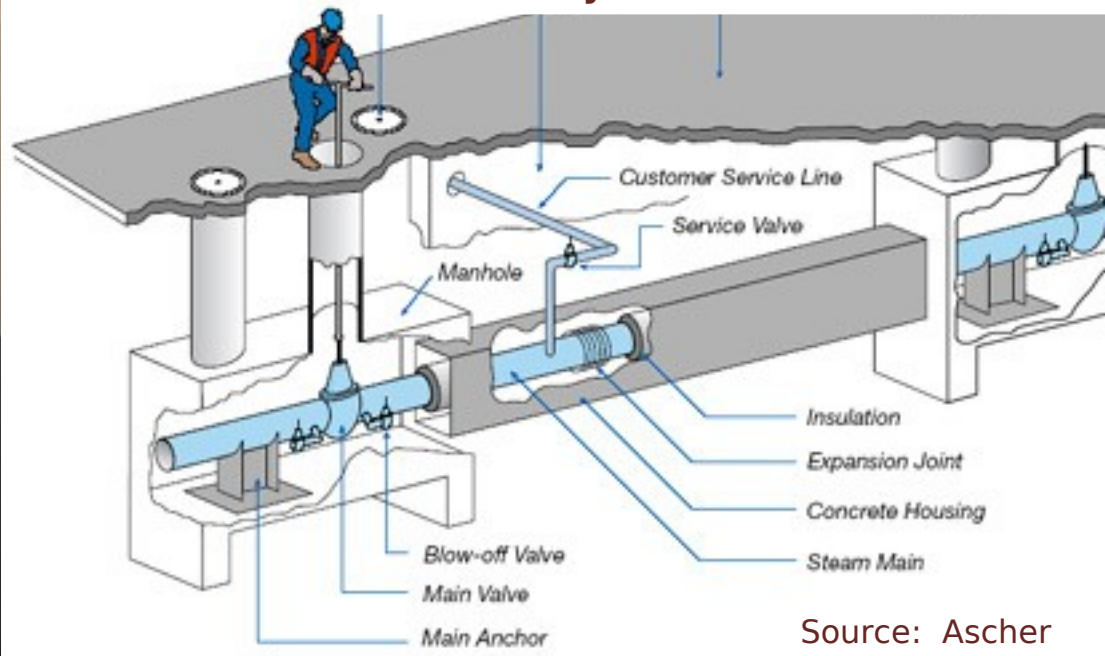
BRT? Or a superbus?



Empire State Building retrofit:
-- replace all 6500 windows
-- install building automation
-- goal = cut energy use by 38%
-- payback period < 3 years

Columbia University:
expanded use of
cogeneration technology
could reduce CO2 emissions
in NYC by 49%

of buildings over eight (8)
stories in Shanghai:
1980: 113
2008: 13,100



In other words, the potential
for building retrofit projects
is massive

Source: Ascher

4 overarching factors affecting local energy planning efforts:

- Local resource/infrastructure conditions
- Local policy and planning environment
- Macro-market and regulatory pressures
- Financing



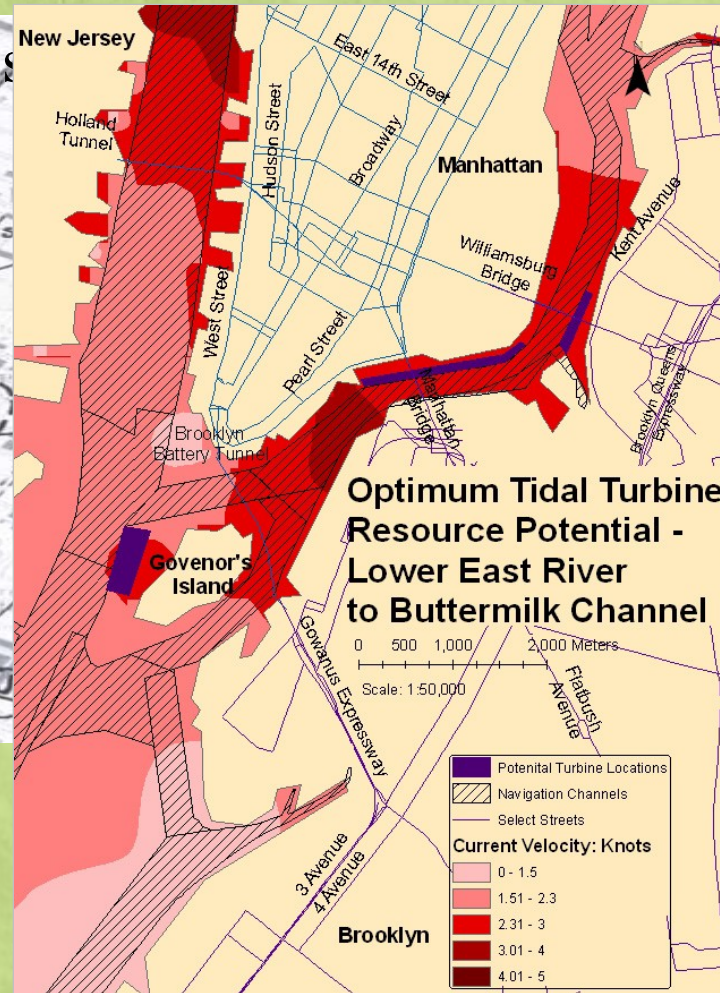
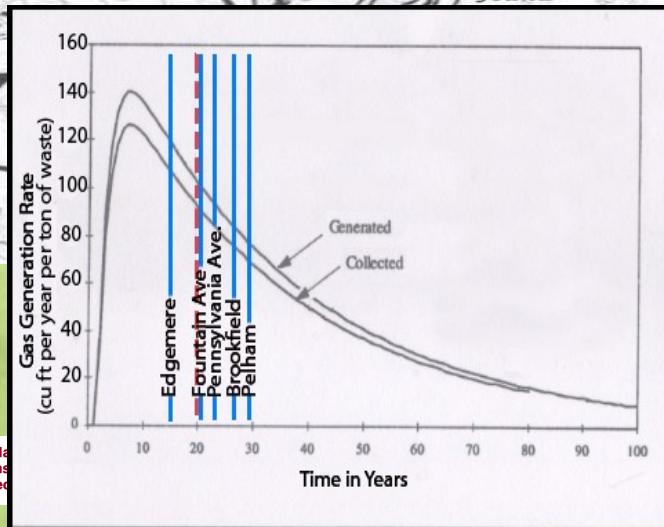
Factor #1: Local circumstances help or hinder deployment

Resource potential varies

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Other important local factors affecting local energy planning efforts

- Age and size of building stock
- Historic infrastructure investment
 - District energy
 - In-city power generation vs. transmission capacity
- Average household income and local economic base



“Lock in” caused by historic investment and system design decisions

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(a) Isolated roughness flow

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• Fifth level

(b) Wake interference flow

(c) Skimming flow

Factor #2: Policy and planning potential linked to capacity to act

Cities are “creatures of the state”, meaning they often cannot act alone

Congestion pricing: NYC vs. London

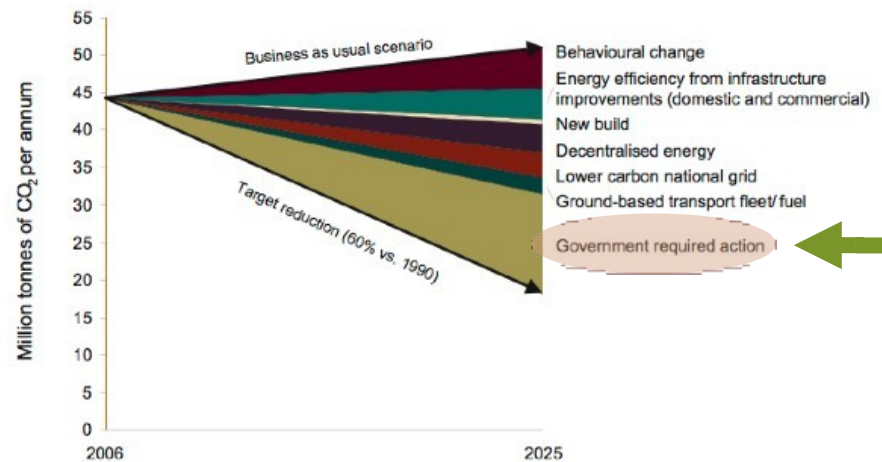
Municipal vs. investor-owned utility

Who can deliver the reductions

Under all scenarios considered in this action plan, the Mayor and the GLA alone cannot deliver more than 15 per cent of the necessary reductions. Responsibility for tackling climate change must be shared between the Mayor, the London boroughs (5-10 per cent of requirement), London's companies and public sector organisations (35-40 per cent), Londoners (5-10 per cent) and national government (30 per cent).

London Climate Change Action Plan, 2007

Figure xiii 2025 scenario without required government action



Source London Energy and CO₂ Emissions Inventory; GLA

Example: PlaNYC policy instrument choice heavily skewed

Data availability drives policy choice and technology investment decisions

Data points to different needs & opportunities, which will vary by building type and size

Energy Usage by Building Type in New York City
Percent of total energy in British Thermal Units (BTU)

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WHAT WE USE FOR ENERGY FOR

BUILDING TYPE	HEAT	HOT WATER	LIGHTING	APPLIANCES	COOLING	OTHER	TOTAL
1-4 family residential	7.6%	2.8%	1.7%	2.2%	0.6%	0.0%	14.7%
Multi-family residential	7.4%	7.4%	3.0%	3.9%	1.2%	0.0%	22.0%
Commercial	8.5%	2.8%	10.2%	4.5%	4.5%	0.9%	31.4%
Industrial	2.6%	2.1%	4.0%	3.3%	1.1%	0.2%	13.0%
Institutional/government	6.3%	4.0%	3.6%	1.7%	1.4%	0.9%	17.9%
ALL TYPES	32.4%	18.9%	22.5%	15.6%	8.8%	2.0%	100%

*Appliances including electronics and refrigerators as well as other appliances
**Cooling includes ventilation as well as air conditioning

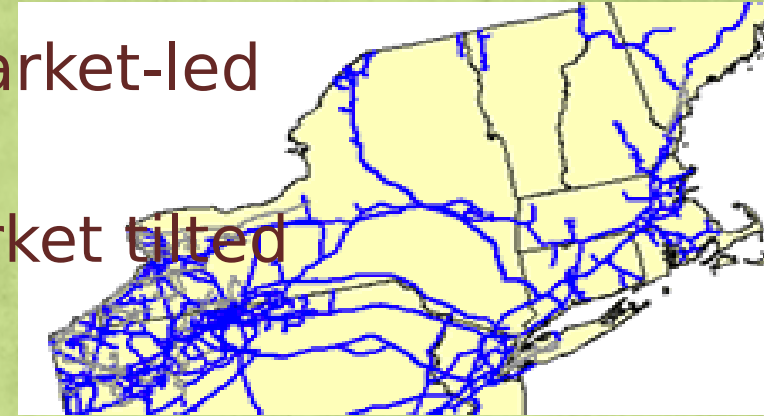
Source: Con Edison; KeySpan; U.S. Department of Energy; New York State Energy Research and Development Authority

Factor #3: Local market and regulatory environment: disconnected from local wants or needs?

Technology inapplicable due to market-led feedstock constraints

In-city vs. out-of-city supply -- market tilted towards BAU large supply sources

- Permitting easier outside of cities
- Wholesale markets emphasize price
- Central government \$\$ policies



Gaps in natural gas deployment limits technology choice

Entrepreneurs/investors looking for the “next Google” can } *But are these efforts compatible with local goals?*
Example: electric cars vs. congestion reduction

Biofuels

Electric vehicles

Fuel cells

Factor #4: The challenge of project financing – the same old story

Global/local recession creates hesitancy to invest

Price distortions

Externalities not woven into market prices

Artificially depressed energy prices

Choice of discount rate contentious

ESCOs not uniformly available in all cities/countries

Buildings particularly problematic

Tenant vs. landlord – who pays, who benefits?

Energy Policymaking in NYC



NYC Energy system overview

Restructured market since 1997

Competitive supply, regulated distribution

1 electricity distribution firm (Con Edison)

2 gas distribution firms (Con Edison and National Grid)

ESCOs

- 74 residential ESCOs (24% of customers have switched = 25% of residential load)
- 97 commercial ESCOs (86% of large customers have switched = 90% of large customer load)

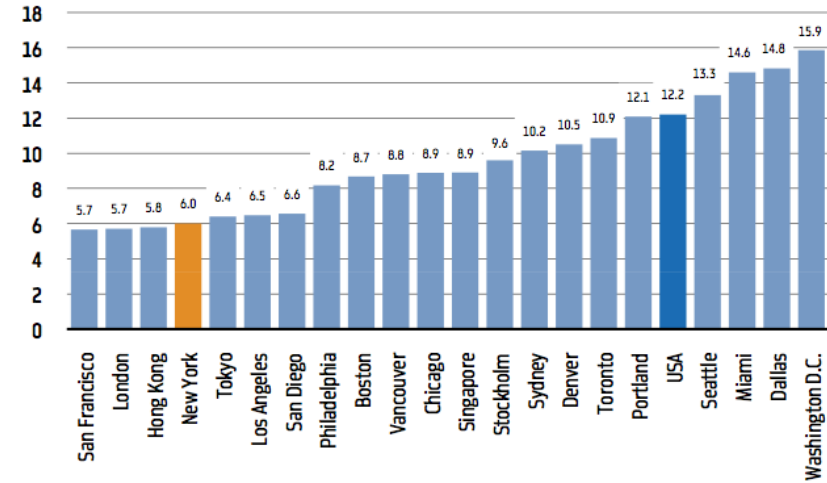
NYISO manages wholesale market

NY only, adjacent to PJM (New Jersey) and NE-ISO (Connecticut)

Market environment

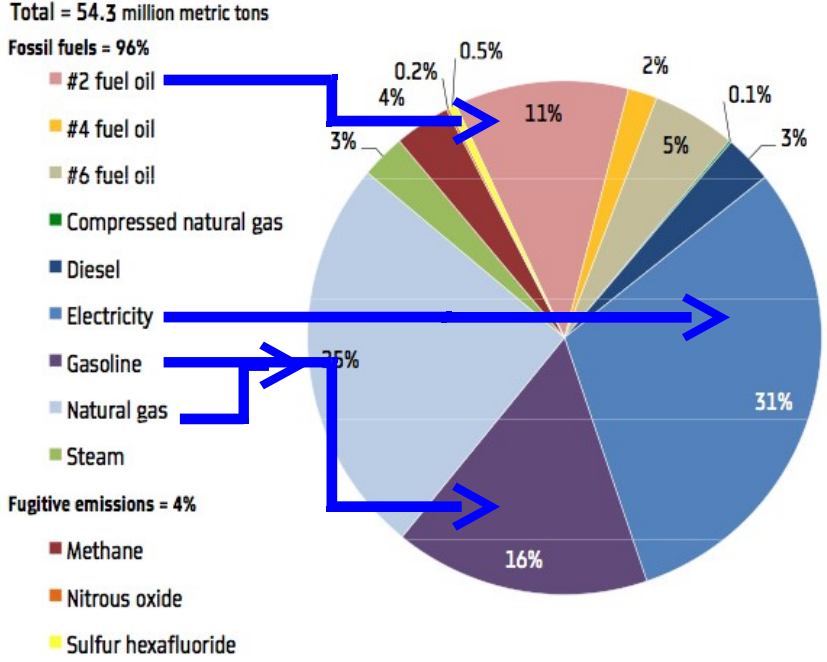
- NYC customers use less energy than most, but in aggregate, use lots of power
 - Peak summer demand = ~11,500 MW
- NYC is a load pocket
 - In-city generation capacity = 9,590 MW operational, 595 MW mothballed
 - Transmission capacity into city = 7,060
- High retail prices (highest in the US?)

Annual Electricity Consumed Per Capita, MWh



Source: See Appendix for sources of city and U.S. electricity consumption

2010 Citywide CO₂e Emissions by Source



Emissions from fugitive HFCs are less than 0.1% of total.

Policy Environment

Governor establishes NYS energy plan

Public Service Commission = regulator

NYSERDA = R&D funding

Regional Greenhouse Gas Initiative (RGGI)

Mayor = limited power

Energy Policy Task Force

Sustainability Advisory Task Force

In-house Energy Conservation Steering Committee

Recent policy efforts

2004 Energy Policy Task Force

Largely Con Ed/real es industry led

Key finding: Poten shortfall puts local economy at risk

Solutions:

Build new central stati supply capacity

Reauthorize state pow plant siting law

The New York City Energy Policy Task Force

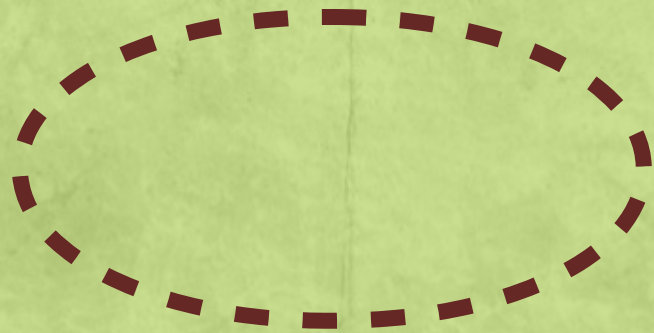
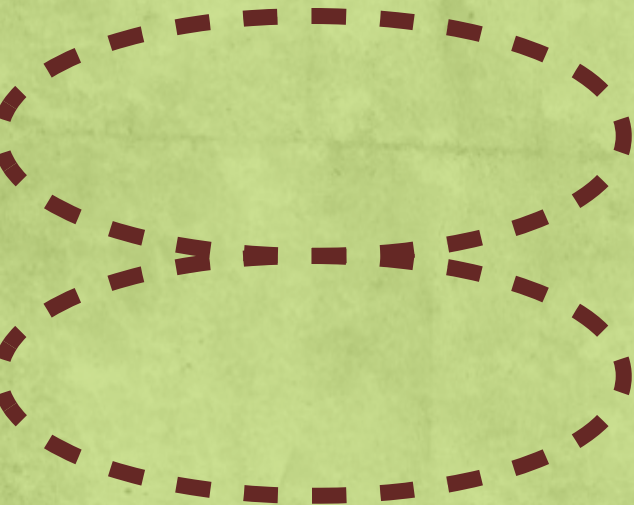


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planNYC

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PlaNYC 2.0 (2011) energy goals

Our plan for energy:

Improve energy planning

- 1 Increase planning and coordination to promote clean, reliable, and affordable energy

Increase our energy efficiency

- 2 Implement the Greener, Greater Buildings Plan
- 3 Improve our codes and regulations to increase the sustainability of our buildings
- 4 Improve compliance with the energy code and track green building improvements citywide
- 5 Improve energy efficiency in smaller buildings
- 6 Improve energy efficiency in historic buildings
- 7 Provide energy efficiency financing and information
- 8 Create a 21st century energy efficiency workforce
- 9 Make New York City a knowledge center for energy efficiency and emerging energy strategies
- 10 Provide energy efficiency leadership in City government buildings and operations
- 11 Expand the Mayor's Carbon Challenge to new sectors

Provide cleaner, more reliable and affordable energy

- 12 Reduce greenhouse gas emissions from power plants and costly in-city power plants
- 13 Encourage the development of clean distributed generation
- 14 Foster the market for renewable energy in New York City

Modernize our transmission and distribution system

- 15 Improve the reliability and encourage conversion from highly polluting fuels
- 16 Ensure the reliability of New York City power delivery
- 17 Develop a smarter and cleaner electric utility grid for New York City

Prioritizing buildings

1 million buildings citywide

Responsible for 75% of citywide emissions

85% of building stock in 2030 already exists

<2% of buildings consume 45% of energy used in all buildings

2010 Citywide CO₂e Emissions by Sector

Total = 54.3 million metric tons

Buildings = 75%

Residential

Commercial

Industrial

Institutional

Transportation = 21%

On-road transportation

Transit

Wastewater, fugitive = 2%

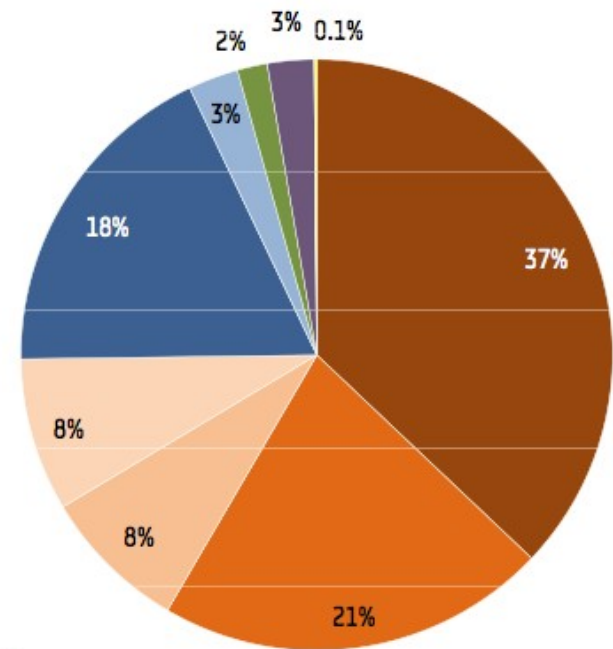
Wastewater, fugitive

Solid waste = 3%

Solid waste

Streetlights and traffic signals = 0.1%

Streetlights and traffic signals



Much of NYC square footage is housed in very few large buildings

Total Building Area by Building (Lot) Size

Type	All Buildings		Buildings \geq 25,000 sf (2,325 sq. mtrs)		Buildings \geq 50,000 sf (4,650 sq. mtrs)	
	Lots	Bldg Area	Lots	Bldg Area	Lots	Bldg Area
Total	804,914	5,257,515,722	25,765	3,050,203,603	14,914	2,662,440,781

Percent of Total Building Area by Building Size

Type	All Buildings		Buildings \geq 25,000 sf (2,325 sq. mtrs)		Buildings \geq 50,000 sf (4,650 sq. mtrs)	
	Lots	Bldg Area	Lots	Bldg Area	Lots	Bldg Area
Total	100.00%	100.0%	3.20%	58.0%	1.85%	50.6%

NYC has over 800,000 building lots containing almost a million

buildings

...but over half of that area is housed in less than 2% of the lots

Greener Greater Buildings Program

NYC Energy Conservation Code for new buildings

Mandatory energy and water benchmarking for buildings >50,000 s.f. (4650 m²) starting in 2011

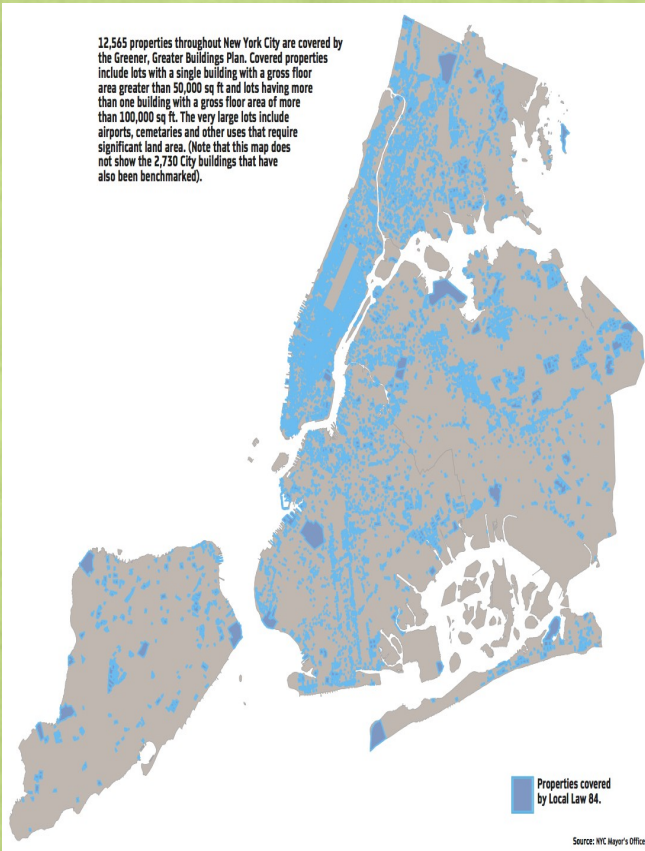
Mandatory energy audits and retrocommissioning (every 10 years)

Lighting upgrades and sub-metering (by 2025)

Green workforce development training

Green building finance

12,565 properties throughout New York City are covered by the Greener, Greater Buildings Plan. Covered properties include lots with a single building with a gross floor area greater than 50,000 sq ft and lots having more than one building with a gross floor area of more than 100,000 sq ft. The very large lots include airports, cemeteries and other uses that require significant land area. (Note that this map does not show the 2,750 City buildings that have also been benchmarked).

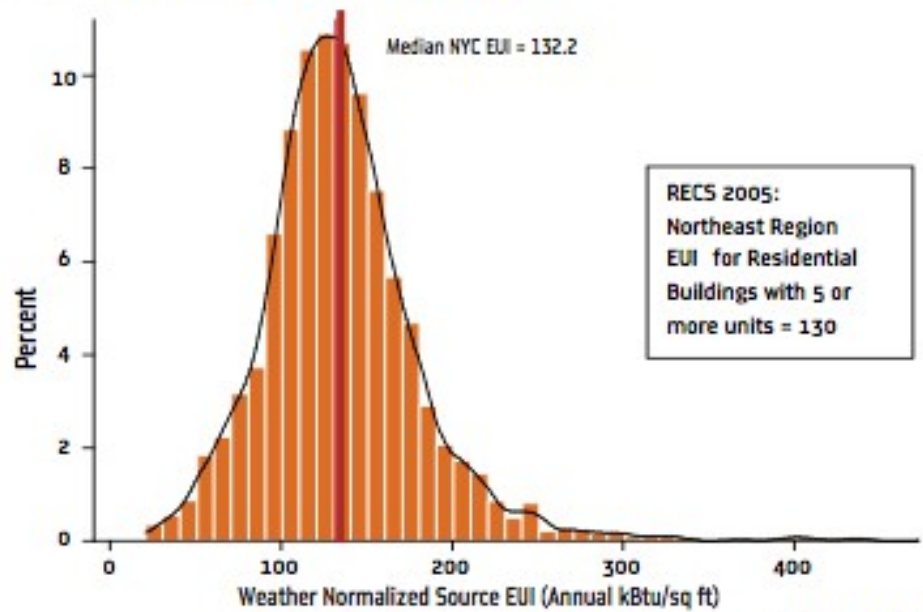


Source: NYC Mayor's Office

Source: City of New York
2012

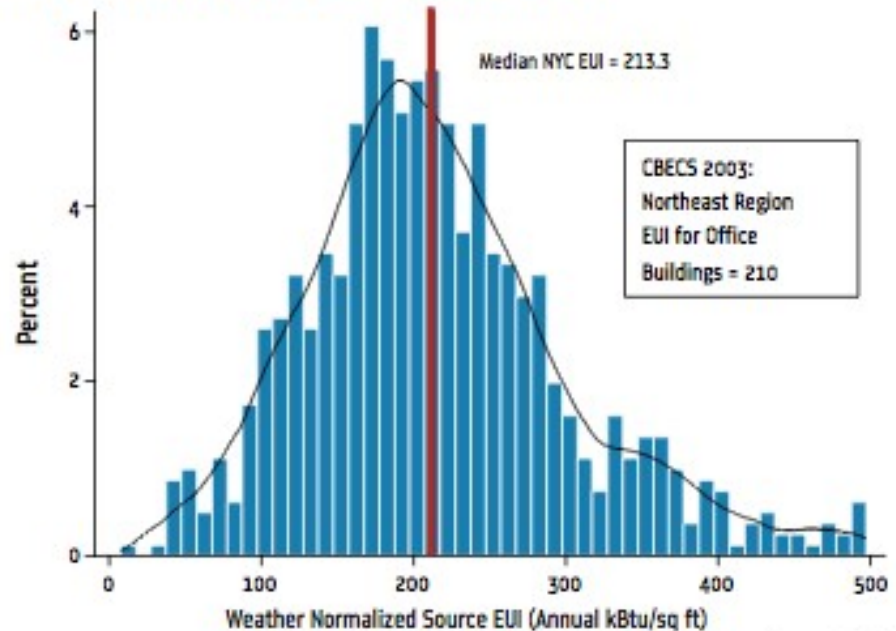
GB Benchmarking results 2011

Figure 17: Histogram of Multifamily EUIs



Source: New York University

Figure 18: Histogram of Office Building EUIs



Source: New York University

Implications for today's other sessions?

Roles and responsibilities

City leadership?

Architects & engineers – leading the way or following customer demands?

What role for the utility?

- New opportunities (electric vehicles)
- Business risks (EE policies targeting high percentage of building energy use)

Policy priorities – new or existing buildings?

Market push vs. city interests/needs

Electric vehicles?