



Greening Mass Transit & Metro Regions:

The Final Report
of the Blue Ribbon Commission
on Sustainability and the MTA



Elliot G. Sander
Executive Director & CEO
Metropolitan Transportation Authority, NYS
347 Madison Avenue, Seventh Floor
New York, N.Y. 10017-3739

Dear Lee,

The Blue Ribbon Commission on Sustainability and the MTA is pleased to transmit to you its final report, *Greening Mass Transit & Metro Regions*. Your decision to empanel this commission, which you convened in the fall of 2007 long before the impact of the global recession was known, turned out to be prescient.

As my fellow commissioner Robert Yaro noted, this report calls for a green transformation and expansion of the MTA network, which serves New York City, the Hudson Valley, Long Island and southern Connecticut. Our final report makes scores of recommendations in a number of key areas of sustainability planning. Implementing these recommendations will result in the comprehensive greening of our region's transit system. We made every effort to ensure that our recommendations for greening the MTA also dealt with the economic realities described in the Ravitch Commission Report. As Commissioners, we believe that the recovery of the American economy and future well-being of the metropolitan region will hinge in part on new industries and new jobs created by greening the way we live and the way we work.

Our recommendations will not only give the MTA agencies tools for reducing and managing the MTA's ecological footprint, but also policies and strategies designed to accelerate the rate at which the MTA and the MTA region can reduce dependence on fossil fuels. While it has long and intuitively been understood that mass transit networks like the MTA play a pivotal role in reducing a region's carbon footprint, the Commissioners would like to see a future where this intuition can be quantified, verified and eventually monetized – thereby helping improve and expand mass transit in a carbon-constrained world. Anyone committed to enhancing regional mobility, spurring productivity, and promoting greener living environments will find this report to be a useful guide for reengineering the public and private sectors. The adoption of the Commission's recommendations will help the region and the MTA weather the recession and will position the MTA and the region to thrive in the decades ahead. As our report makes clear, the transition to a lower-carbon economy and the development of green industries and green jobs will not succeed if the nation overlooks the greening power of rapid transit – as well as the greening power of integrating the expansion of rapid transit with green residential development and green commercial development.

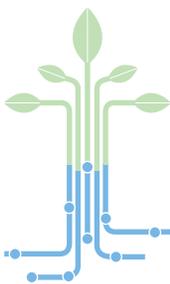
All of us who have served on the Commission are especially proud of the MTA employees from New York City Transit, the Long Island Rail Road, Metro-North Railroad, MTA Bridges & Tunnels, MTA Capital Construction and MTA Consolidated Bus Operations who submitted their own ideas for greening the MTA to the Commission. It is gratifying to know that there are many folks among the MTA's 70,000 employees who are committed to making sustainability part of the MTA's DNA.

While our work on this report is done, we stand ready to work with you – and to reconvene informally – to offer advice and to assess the MTA's progress in greening the agencies and greening the MTA's 5,000-square-mile service territory.

Sincerely,



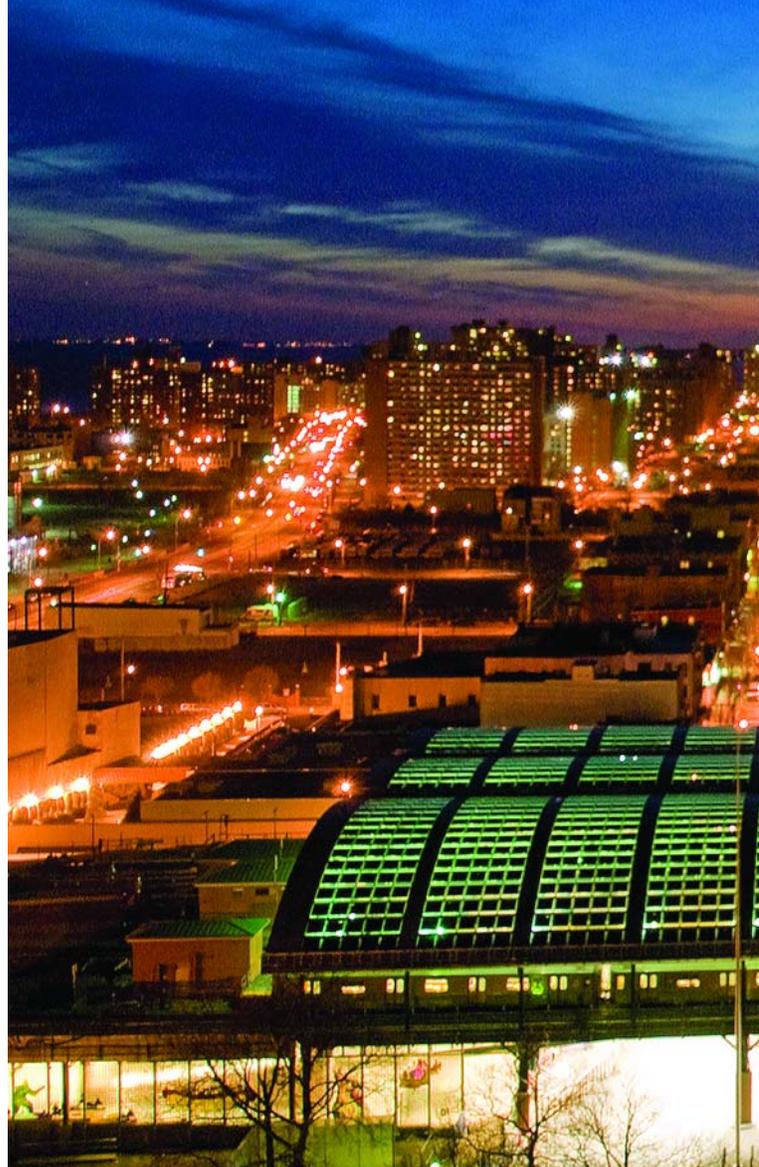
Jonathan F. P. Rose
Commission Chair
Blue Ribbon Commission on Sustainability and the MTA



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Stillwell Avenue-Coney Island, Brooklyn is the first subway station to use solar energy.

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The Blue Ribbon Commission on Sustainability and the MTA

Appointed in September 2007 by MTA Executive Director and CEO Elliot G. Sander, the Commission was charged with developing sustainability-related recommendations for the MTA and its operating agencies. The recommendations aim to expand the greening power of transit to more riders and communities, while managing and reducing the MTA's per-rider energy consumption and environmental footprint. To develop the plan, the 22 commissioners divided into Working Groups covering key areas of sustainability planning: Energy/Carbon, Facilities, Smart Growth/Transit-Oriented Development (TOD), Materials Flow, Water Management and Climate Adaptation. Each group worked with designated MTA staff, research consultants, and pro bono experts. The report also examines cost-savings through green initiatives, adaptation strategies for climate change, and legislative priorities. The report contains nearly 100 recommendations in all, with about 20 that are transformational, 40 near-term, and about 30 that require legislative and/or policy action by decision-makers at the federal, state, and local levels.

Commission Chair

Jonathan F.P. Rose, president, Jonathan Rose Companies. Jonathan F.P. Rose's business, not-for-profit, and public policy work focuses on integrating transportation, housing, environmental, and open space policies to create healthy, equitable metropolitan regions. Mr. Rose's firm currently manages over \$1.5 billion of projects creating models of green urban solutions. Mr. Rose serves on a number of boards, including the Enterprise Foundation, the Urban Land Institute, and the Natural Resources Defense Council.

Commissioners

Rohit T. Aggarwala, director, New York City Office of Long-Term Planning and Sustainability

Julie Belaga, co-chair, Connecticut League of Conservation Voters

Marcia Bystryn, president, New York League of Conservation Voters

Peter A. Cannito, former president, MTA Metro-North Railroad

Cecil Corbin-Mark, director of programs, WE ACT for Environmental Justice

Robert F. Fox Jr., partner, Cook+Fox Architects

Anna-Marie Francello, executive director and CPA, UBS

Emil H. Frankel, director of transportation policy, Bipartisan Policy Center

Ashok Gupta, air and energy program director, Natural Resources Defense Council

Sarah Lansdale, executive director, Sustainable Long Island

Kevin Law, chairman, Long Island Power Authority

Emily Lloyd, former commissioner, New York City Department of Environmental Protection

Thomas Maher, director of environmental coordination, Nassau County

Alex Matthiessen, Hudson Riverkeeper and president, Riverkeeper

Susan Metzger, board member, Metropolitan Transportation Authority

Janette Sadik-Khan, commissioner, New York City Department of Transportation

Nancy Shevell, board member, Metropolitan Transportation Authority

Joseph J. Smith, senior vice president, MTA New York City Transit Department of Buses and president, MTA Bus Company and MTA Long Island Bus

Ned Sullivan, president, Scenic Hudson

Michael E. White, executive director, Long Island Regional Planning Board

Robert D. Yaro, president, Regional Plan Association

The MTA staff assigned to support the Commission included: Ernest Tollerson, director, Policy and Media Relations; Projjal Dutta, director, Sustainability Initiatives; Peter Bass, director, Agency Wide Environmental and Energy Policy; and other members of the Policy Group. A complete list of the MTA headquarters, and agency staff, pro bono experts, and consultants can be found on the acknowledgments page at the end of this report.

Why We Must Accelerate the Greening of the MTA

Robert D. Yaro, President, The Regional Plan Association

This report calls for a green transformation and expansion of the MTA system, North America's largest mass transit network. The recommendations in this report represent the most ambitious greening of a regional transit system ever undertaken and the most significant enhancement of the MTA system in half a century. Among its many transformational initiatives, the report calls for the MTA to draw 80 percent of its total operating energy from clean, renewable energy sources by 2050. At the same time, it urges a significant expansion of regional transit access. It argues, in no uncertain terms, that the MTA transit system must reach and absorb two-thirds of the New York metropolitan area's projected growth of 4 million people between now and 2030 if we are to achieve sustainability, create more livable communities, and maintain our global economic dominance.¹

The report contains scores of recommendations in a number of key areas of sustainability planning. In preparing these initiatives, every effort was made to address the economic realities described in the Ravitch Commission Report² and to demonstrate how greening the MTA system can generate long-term savings and spur economic growth. The Blue Ribbon Commission strongly believes that these initiatives will be necessary to carry our unique, highly productive metropolitan area into the next half century. The proposed policies and strategies will enhance regional mobility, spur productivity, and promote greener, more attractive living environments. They will reduce oil dependency, cut family fuel bills, and limit the CO₂ emissions that contribute to global warming. These recommendations, if adopted, will prepare the MTA and its service area to thrive in the 21st century while dealing with the challenges posed by intense economic competition, severe climate change, and worldwide demand for sustainable energy.

This green transformation heralds the third major era of public transportation's development in the MTA service area. The first era, from 1904 to 1940, saw the initial construction of the urban transportation systems that enabled the New York region to triple its population from 6 million to 18 million residents and to rise to the pinnacle of world economic power. It is well to recall that much of this vital investment followed the Panic of 1907 and continued during the Great Depression of the 1930s, as New Yorkers sustained their confidence in the region's future.

In the second era, from 1980 to the present day, another generation of New Yorkers invested \$76 billion to bring the MTA system back to a state of good repair after a generation of disinvestment and decay dating back to the 1950s. This renewal and modernization of the MTA system enabled the region's remarkable return from the fiscal crisis of the 1970s to a second period of global preeminence. Once again, this public investment in a world-class transit system was sustained despite recessions in the early 1980s and 1990s and the downturn following the terrorist attacks of 2001.

Assuming this report's proposals are carried out, the third era of development in the MTA region will equip the system for a low-carbon future while expanding capacity to meet the region's growth and mobility needs through 2030. According to current projections, that growth will include some 4 million additional residents, 3 million new jobs, 1.3 million more daily trips, and a 30 percent increase in the regional economy. By ensuring that an increased share of this growth develops as transit-oriented clusters rather than sprawl, the MTA's expansion will have a significant impact not only on regional productivity, but on our national energy and climate-stabilization goals.

This is an important point. As the Commission has emphasized throughout, the role of a transit system like the MTA in reducing greenhouse gases is not always fully appreciated. This role takes three forms. First, the mode shift from automobiles to transit ridership dramatically lowers CO₂ emissions on a per-passenger-mile basis. Second, the resulting reduction in road congestion means that the remaining vehicle traffic runs more efficiently, further lowering emissions. Third and most significantly, by enabling clustered development, a transit network shrinks the average mileage between destinations. This reduces vehicle miles traveled overall while encouraging biking, walking, and greener lifestyles.

The recommended system enhancements will reduce regional CO₂ emissions throughout the metropolitan region, while expanding the mobility we need to maintain our global leadership in commerce, finance, culture, media, and higher education. The green transformations will mean a major step toward the urgent energy and sustainability priorities recently identified by New York State, New York City, Long

¹MTA projects a growth of 4 million people in its service area by 2030. The Commission recommends that the MTA system capture two-thirds of all new vehicle miles travelled (VMT) added in its service area and that two-thirds of all new development be clustered within a quarter-mile to a half-mile of MTA transit access.

²New York State Governor David A. Paterson appointed the Metropolitan Transportation Authority Financing Commission in June 2008. Its Final Report was released on December 4, 2008.

Island, the Hudson Valley, and Connecticut, as well as the administration of President Barack Obama. Achieving these transformations will also produce a valuable blueprint for greening transit agencies and other major public entities nationwide. But we must be absolutely clear about the stakes. If the recommendations are not implemented, the MTA system will not have the capacity to sustain the region's projected economic and population growth.

Should we fail to act now, there is little doubt that much of the projected economic growth will be diverted to those global cities capable of sustaining it, placing New York's leadership at serious risk and undermining the economic potential for future generations. As we issue this report, London, Tokyo, Shanghai, Hong Kong, and other global competitors are launching similar efforts to expand and green their transit systems, in part as a conscious effort to help stimulate economic activity and capital investment during the global recession. The Commission's recommendations are crucial steps toward slowing the potentially dire impacts of climate change. They are also the investments New Yorkers must make now, following the can-do ethic of the city's previous generations, to safeguard and expand an irreplaceable component of our economy and infrastructure during a period of financial adversity.

Carbon Avoidance as a 21st Century Revenue Source

By removing some 3 million drivers from the roads each day, the MTA avoids more carbon emissions from the atmosphere than 648,000 acres of forest can absorb. This "carbon avoidance" benefit of MTA operations is increasingly viewed as a measurable commodity with societal benefits and a market value. In effect, the MTA provides unreimbursed carbon reduction services for which many industries now claim financial and funding credits.



Clean Air Hybrid Electric Bus, MTA New York City Transit

GHG Emissions of Transportation Options



Sightline Institute (<http://www.sightline.org/maps/charts/climate - CO2byMode>)

Why Greening the MTA Makes Economic Sense

David Lewis, Senior VP, National Director, Economics and Financial Services, HDR Inc.

The policies and strategies proposed in this report will do more than achieve transit and climate-stabilization targets. They will also have far-reaching implications for the New York metropolitan region's short-term and long-term economic performance. Whether implemented singly or collectively, these recommendations have the potential to generate significant returns on investment, with benefits far outweighing costs.

Equally important, these initiatives augur a new investment and operating philosophy for the MTA, one that will serve as a forward-looking model for other organizations. The reality is that all enterprises today, public and private alike, must begin to account for the real costs of carbon-based technologies and the resulting CO₂ emissions. This is no longer a matter of choice. Governments around the world are ramping up carbon taxes, cap-and-trade systems, and other policies designed to generate market signals that compel enterprises to account for climate and pollution costs as they would for any other investment and operating decision. The initiatives in this report will align the MTA's decision-making and business practices with this rapidly emerging market reality.

The current financial crisis gives these recommendations an even more immediate economic relevance. The crisis is widely viewed as a unique opportunity to frame stimulus actions in a way that will redirect public investment over the long term. Such redirection focuses on three long-standing concerns: climate change; energy security; and infrastructure renewal and expansion. All three of these priorities argue for expanded investment in transit. In other words, a transit system such as the MTA stands dead center at the stimulus sweet spot.³

Moreover, the MTA system stands as a model for other metropolitan regions as they adapt to a changing economy – an economy that will pay higher dividends for energy efficiency and dense concentrations of intellectual capital. With a third of all U.S. transit ridership, the MTA region is by far the most transit-oriented area in the country and – not coincidentally – one of the most energy-efficient and economically productive. Of the nation's 100 largest metro regions, it has the lowest transportation carbon emissions per capita. Compared to the average American, residents of the MTA region produce 43 percent less CO₂ emissions and, thanks to the density of high-value services, enjoy a per capita GDP that is 30 percent higher than the average for U.S. metro areas. Similarly, in other U.S. cities, high

levels of productivity tend to correlate with high levels of transit service.⁴

Rising energy costs and the pricing of CO₂ emissions will only elevate the value of the MTA transit network as a model for other metropolitan areas. To sustain this value and the New York area's leadership role, the MTA must keep pace with the other major global transit systems that are now rapidly modernizing and expanding for economic advantage. The importance of making this investment sooner rather than later should be a common concern of all commuters, businesses, citizens, and local governments that rely on MTA services and shape the context in which the MTA system operates.

Transit's Four Green Economic Impacts

According to the recently published Stern Review,⁵ failure to enact deep reductions in greenhouse gasses (GHGs) will result in overall costs from climate change equal to the loss of between 5 percent and 20 percent of global GDP, now and forever. This provides a dramatic example of the deeper connection between environmental sustainability and economic viability. As this Commission's report makes clear, transit helps gains in productivity and sustainability to rise in tandem. An expanding transit system not only lowers carbon emissions, it raises property values. It not only reduces oil consumption, it concentrates high-value services and so forth. Here are four key factors through which transit leverages environmental and economic gains:

1. Avoiding Carbon Emissions: A regional mode shift from automobiles to transit yields economic and environmental benefits at many levels. For example, the CO₂ emissions from transit ridership are about one-fifth of those produced by single occupancy automobiles, as measured on a per-passenger-mile basis. Thus, in addition to overall fuel efficiency, the shift from automobiles to transit means an 80 percent rate of carbon avoidance. Since transportation accounts for nearly 40 percent of GHG emissions in the U.S., the greening of the nation's largest transit system has significant value, both directly and as an infrastructure model for other urban areas. As it continues to quantify its carbon avoidance rates, the MTA will also be well positioned for emerging carbon trade markets and carbon-based funding criteria.

2. Managing Regional Congestion: Transit reduces traffic congestion, which cost the regional economy some \$13 billion in 2007 alone, according to the Partnership for

³See, Deutsche Bank Group, Economic Stimulus: The Case for "Green" Infrastructure, Energy Security and "Green" Jobs, November 2008.

⁴(As cited in), David Lewis and Fred Lawrence Williams, Policy and Planning as Public Choice: Mass Transit in the United States, Ashgate, 1999.

⁵Nicholas Stern, The Economics of Climate Change: The Stern Review, Cambridge University Press, 2006.

⁶Partnership for New York City, Growth or Gridlock, 2006 (HDR|Decision Economics).

New York City.⁶ By improving traffic flow, transit optimizes regional mobility for both passenger and freight sectors. This in turn reduces fuel costs, vehicle operating costs, and the costs associated with traffic accidents. By easing congestion, transit also reduces CO₂ emissions from the remaining auto traffic, resulting in yet another level of carbon avoidance. Moreover, studies show that in periods of rapid land development and population growth, transit rail systems in highway corridors will absorb and stabilize any related rise in traffic congestion.

3. Optimizing Land Use: Transit enables more clustered residential and commercial development, which brings dramatic economic and sustainability gains. According to a study by the National Research Council, more compact settlement patterns could save the nation \$540 billion in building and infrastructure costs.⁷ Moreover, compact transit-based development not only reduces automobile travel, it reduces the average miles between destinations for all modes of travel, including automobiles. Thus, the land-use patterns generated by transit produce a “virtuous spiral” with an ongoing decline in energy consumption and corresponding rise in carbon avoidance. This is clearly evident in high-density, transit-rich New York City, where per capita energy consumption is now about one quarter the national average.

4. Generating Higher Values: The value of transit to regional economies will be felt through higher worker mobility, lower energy costs, reduced pressure on public services, and other effects. Significantly, those benefits will also extend beyond direct transit system users to the economy at large. One example is the impact on property values, as demonstrated in numerous studies. A study for the Federal Transit Administration, for example, indicates an increase in residential equity value of about \$160 for every 100 additional feet of transit station proximity.⁸ Another study in Washington, D.C. shows that for each 1,000 foot decrease in the distance to a transit rail station, commercial property values increased by \$2.30 per square foot, while the total value for properties averaging 30,500 square feet rose by over \$70,000.

These examples indicate some of the ways in which the Blue Ribbon Commission’s recommended enhancements of the MTA system will achieve not only critical environmental goals but economic gains that will help to offset

A Transit-Based Economy Produces More with Less Energy

The MTA sells some 8.5 million passenger trips daily at twice the energy efficiency of the most advanced hybrid cars. Thanks largely to the MTA’s efficiency, New Yorkers are among the world’s most productive workers and thriftiest energy users – with a per capita BTU consumption of one quarter of the national average.

recessionary effects across the region. The report will also begin the important process of quantifying carbon avoidance, implementing lifecycle accounting and other internal steps to prepare the MTA for an emerging low-carbon economy. These include a Sustainability Return On Investment (SROI) model outlined within the chapter on the Transit’s Triple Bottom Line; see page 71. Such models are already in use at some major organizations and will further prepare the MTA for markets in carbon trading and carbon-based program funding.

From an economist’s perspective, the Commission’s recommendations could not be more timely. State governments, federal legislators, and the Obama Administration all agree that faced with a daunting global recession, a large economic stimulus must be directed toward infrastructure projects with demonstrable economic returns. In addition to the benefits described above, economic data from the MTA’s previous capital programs provide a clear record of the stimulatory effects on regional employment and industrial contracts. Initial assessment of the current recommendations indicates a possible yield of 105,500 net new jobs per year, employment income of \$5.1 billion a year, and regional economic output of fully \$17 billion per year for the period from 2010 to 2019.⁹

This urgent stimulus priority at the federal level intersects with the equally urgent international commitment to contain global warming, reduce GHGs, and reach a goal of 80 percent renewable energy by 2050. As the Commission’s work has made amply clear, the MTA system is one of the few public assets in the United States capable of generating significant, measurable returns on investment in all of these crucial areas.

Green Ideas from MTA Employees



From the Shop Floor and Frontlines of MTA Agencies

One initiative launched by the Commission was a Green Ideas survey sent to the MTA’s 70,000 employees. A number of these green ideas from employees are highlighted in special boxes within this report.

⁶Burchell, Robert, with George Lowenstein, William Dolphin, Catherine Galley, Anthony Down, Samuel Seskin, Katherine Gray Still and Terry Moore, *Costs of Sprawl-2000*, Transportation Cooperative Research Program, TCRP Report 74, National Academy Press, 2002.

⁷US Department of Transportation, Federal Transit Administration. *The Value of Mobility Improvements in Fixed Guideway Transit*, May, 2002.

⁹HDR Inc., economist David Lewis’ firm, adopted aggregated implied multipliers from a recently completed project that analyzed transit investment of a comparable magnitude and complexity in another jurisdiction. Specifically, the multipliers adopted are from the cost benefit and economic impact assessment of the Regional Transportation Plan for the Greater Toronto and Hamilton Area.

Top Recommendations for Greening the MTA and the MTA Region

The 22 commissioners divided into Working Groups focusing on key areas of sustainability. Each group consulted MTA staff and pro bono experts, commissioned research studies, and produced long-term transformational recommendations and near-term recommendations. The complete set of recommendations are found in each chapter.



Energy/Carbon Working Group

- The MTA should draw 80 percent of its energy from renewable sources by 2050. To help achieve this, the MTA should join a consortium of public entities to pursue offshore wind farms capable of generating up to 1,500 megawatts of clean energy.
- The MTA should identify carbon avoidance as a revenue source to underscore the MTA's role as a provider of climate stabilization services in its region and to establish the value of MTA services under any decarbonization policy (carbon tax, cap-and-trade, post-Kyoto /Copenhagen rules, etc.).
- The MTA should reduce operational energy use and GHG emissions on a per-passenger mile basis by 25 percent by 2019 through energy retrofits, smart fleet technologies, and more.
- The MTA should establish a "green" MetroCard contribution program, through which customers could make voluntary, tax-deductible donations to fund green aspects of sustainable capital and operating projects at the MTA.
- The MTA should field test and implement weight reduction and regenerative braking technologies, as recommended by the Commission's Smart Fleets Task Force.



Facilities Working Group

- The MTA should adopt Leadership in Energy and Environment Design (LEED™) Silver as its standard for all building projects, new construction, and major renovations wherever applicable, and either recommission existing buildings or pursue LEED Existing Buildings: Operations and Maintenance (LEED-EB) where possible.
- For all other transit facilities not covered by LEED Silver standards, the MTA should develop MTA Green Design Guidelines based on the LEED system.
- The MTA should develop a green Lifecycle Analysis (LCA) system for facilities to track the upfront costs and long-term savings from high-performance and regenerative design features.
- The MTA should increase the number of LEED-accredited employees and require 90 percent of new hires for facilities design positions to be LEED-Accredited Professionals (AP).
- The MTA should seek a LEED-EB rating for Grand Central Terminal.



Smart Growth/TOD Working Group

- The MTA should capture two-thirds of all new vehicle miles traveled (VMT) generated within its region through 2030. To achieve this, the MTA should advise communities and collaborate with them on how to create and expand feeder and distributor lines and eliminate gaps in the regional transit network.
- The MTA should promote clustered development throughout its region, seeking to draw two-thirds of all new development to within a quarter-mile to a half-mile of transit access within the MTA network.
- The MTA should take the lead in closing the "last mile" transportation gap by improving access to transit through robust, flexible feeder and distributor services, as well as pedestrian and bike improvements.
- The MTA should develop a system-wide TOD program that articulates principles and guidelines for TOD project development and should assist communities, developers, and stakeholders throughout the region in planning these community-based initiatives.

The Need for Sustainable Capital Spending at the MTA

On December 4, 2008, the Commission on Metropolitan Transportation Authority Financing, appointed by Governor David Paterson and chaired by Richard Ravitch, concluded that the MTA's 2010-2014 capital program would require around \$30 billion. That Ravitch Commission finding was consistent with the MTA's own forecasts of its capital needs for the 2010-2014 program, which will enable the MTA to keep its core infrastruc-

ture in a state of good repair, continue work on its mega-projects and adjust the capital program to take account of inflation. The Blue Ribbon Commission on Sustainability and the MTA believes that the vitality of the region and its economy cannot be maintained without a robust, resilient MTA infrastructure. The Sustainability Commission has considered the impact of critical sustainability



Materials Flow Working Group

- The MTA should institute a green Lifecycle Analysis (LCA) system to manage materials from procurements through disposal.
- The MTA should introduce source-separation of waste in NYCT subway stations.
- The MTA should enhance its efforts to reuse and expand markets for its waste.
- The MTA should flex its market power to promote green goods.
- The MTA should seek more revenue and energy potential from MTA waste.
- The MTA should encourage the use of low-carbon local materials by all MTA agencies and vendors.
- The MTA should expand the procurement of sustainable railroad ties at all rail agencies.



Water Management Working Group

- The MTA should identify beneficial uses for the millions of gallons of groundwater pumped out of subway system tunnels.
- The MTA should reduce its use of potable water by up to 75 percent or more by 2020 by substituting rainwater, recycling greywater, and/or other conservation practices.
- The MTA should implement systemwide metering and submetering to reduce its water consumption.
- The MTA should improve water fixtures and conservation at MTA facilities through water efficient designs, water-saving fixtures, and employee programs. As the Commission stated in the interim report, the MTA should encourage the use of local drinking water by its 70,000 employees to minimize bottled-water consumption.
- The MTA should improve the efficiency of its vehicle washes systemwide.



Climate Adaptation Working Group

- The MTA should develop a climate-adaptation decision matrix to identify options for protecting transit infrastructure from storm surge, extreme heat, and other manifestations of climate change.
- The MTA should implement a Climate Adaptation Resiliency Evaluation procedure (CARE), which would be activated when any new projects or major alterations are undertaken where critical structural components are located in present or potential coastal surge flood zones.

issues on MTA capital planning. The Commission believes that the MTA should have \$75 billion to \$100 billion over the course of the next two MTA capital plans (2010-2014 and 2015-2019) to prepare the MTA and its service region for a sustainable future. Investments at these higher levels will help the MTA region and the nation weather the current recession as well as accelerate the region's transition from fossil-fuel dependency

to a low-carbon economy. The Commission recommends that all of these capital expenditures be designed to meet the green standards described in this report. For projects already designed, any design review or subsequent design iteration should be carried out in keeping with the recommendations contained in this report.

Strategy for the 21st Century: Legislative and Policy Recommendations at a Glance

The Commission believes that a number of legislative and policy actions for federal, state, regional, and local decision-makers will be necessary to assure the sustainability and future well-being of the MTA network and the New York region. A complete set of legislative and policy recommendations are found in the full 21st Century chapter on page 63.

FEDERAL

Pass a \$1 Trillion Green Stimulus Bill

- Focusing on 21st century transit and renewable energy

Authorize and Reform 2010-15 Transportation Bill at \$1 Trillion

- Emphasize state of good repair
- Reform funds distribution process and prioritize funding for metropolitan areas
- Develop performance measures that recognize existing densities/transit use
- Incentivize regional, intermodal, and pricing projects
- Streamline federal processes/procedures
- Require minimum green construction and operating standards for receipt of federal funds

Require Greenhouse Gas (GHG) Reductions

- Link land use and infrastructure investment to reduce GHG emissions by adapting California's SB 375 to work on a national scale through regional reduction targets and plans

Provide Leadership/Funding for Climate Adaptation

- Establish a lead federal agency to coordinate federal, state, and local efforts and funding for climate-adaptation plans, programs, and strategies

Raise Federal Gas Tax 40 Cents Over 5 Years, Index It to Inflation, and Fund a Shift to Mileage-Based User Fees

Establish Carbon Emissions Avoidance Market and Dedicate 25 Percent of Revenues to Transit

Increase Monthly Commuter Tax Benefit to \$230/Month for Transit Commuters

Provide Incentives to Lenders That Offer Location Efficient Mortgages (LEMs)

Provide Incentives to Developers Who Design and Construct to LEED-ND Standards and Achieve Gold Rating

NEW YORK STATE

Provide New Funding for the MTA

- Enact a Regional Mobility Tax of 1/3 of 1 percent of wages as recommended by the Ravitch Commission
- Authorize tolling and variable pricing strategies as recommended by the Ravitch Commission, in order to pay for transit operations and expansion
- Allocate revenue from Regional Greenhouse Gas Initiative (RGGI) auctions to VMT reduction strategies, including transit
- Create clean-air surcharge for vehicles

Encourage Use of Pension Funds and Endowments for Investments in Transit Projects

Require Greenhouse Gas (GHG) Reductions

- Set an enforceable statewide limit on GHG emissions with measures to reduce 80 percent by 2050
- Link land use and infrastructure investment to reduce GHG emissions by adapting California's SB 375 to NY State through regional reduction targets and plans

Create MTA Regional Bus Authority (RBA)

- Integrate and expand bus service and accelerate the development of Bus Rapid Transit (BRT) routes throughout the region via RBA, as envisioned by the Ravitch Commission

Expand Last-Mile Services

- Improve access to transit through robust and flexible feeder and distributor services and pedestrian and bike improvements

Reform Tax Increment Financing (TIF)

Establish Transit-Oriented Development Districts

- Smart Growth Cabinet and the MTA should establish Transit Development Districts to prioritize and coordinate funding
- Provide assistance to local communities

Authorize Automated Cameras for Bus Lane Enforcement

NEW YORK CITY

Create an All-Agencies TOD Task Force to Work with the MTA to Accelerate In-City TOD

Implement On-Street Parking-Pricing Strategies to Manage Parking Demand and Keep Lanes Clear for Buses

- Charge higher rates at peak hours for city parking spaces to increase turnover and reduce the blocking of lanes by decreasing the amount of time motorists spend “cruising” for parking

Scale-Up Street Management Programs

- Expand street-management programs city-wide to reduce congestion, improve safety, and allow buses to travel faster and more reliably

SUBURBAN COUNTIES AND CITIES

Promote Transit-Oriented Development (TOD)

- Institute zoning ordinances and TOD-friendly parking policies to encourage development at transit-supportive densities
- Develop station-area plans to prepare TOD sites and ensure adequate station access

Implement Bus Rapid Transit (BRT)/ Light Rail Transit (LRT) Routes

- Dedicate right-of-way or existing lanes to BRT
- Provide signal prioritization and physical street improvements

Expand Last-Mile Services

- Improve access to transit through robust and flexible feeder and distributor services and pedestrian and bike improvements

Implement Parking-Pricing Strategies to Manage Parking Demand on Streets and at Stations

Implement Street-Management Programs to Keep Lanes Clear for Buses

REGIONAL

Establish a Regional Gas Tax with the 10 Regional Greenhouse Gas Initiative (RGGI) States and Dedicate Revenues to VMT Reduction Strategies, Including Transit

CONNECTICUT

Enhance Commuter Rail Parking

- Increase parking capacity at commuter rail stations by establishing ConnDOT enforceable goals for towns
- Implement all forms of parking and station access strategies including pricing, satellite parking, ped/bike improvements, bike parking, car-share/carpooling, and feeder services

Promote Transit-Oriented Development (TOD)

- Use principles developed by the Responsible Growth Task Force to guide decision-making around land use and transportation
- Provide funding and assistance to local communities to encourage TOD

Encourage Housing near Transit

- Prioritize allocation of housing tax credits, tax exempt bonds, Department of Economic & Community Development funds, HOMEConnecticut, and other funds to support multifamily and mixed-income housing development near transit
- Promote and monitor the progress of the HOMEConnecticut program, which provides incentives to municipalities for higher density housing near transit

Implement Bus Rapid Transit (BRT) Routes

Expand Last-Mile Services

- Improve access to transit through robust and flexible feeder and distributor services and pedestrian and bike improvements
- Develop programs and strategies to encourage commuters to use buses (i.e., electronic displays reporting real-time customer information)

“Over the next 40 years, the U.S. is projected to grow by 90 million people and the New York metropolitan area by 4 million. We simply cannot afford the economic, social, and environmental impacts of sprawl. The solution is to develop our metropolitan areas around transit, and the MTA is a model of such regional transit service. In addition to accommodating future growth, we must also mitigate and adapt to the impacts of climate change and biodiversity loss. To do all this, the MTA system must both grow and, at the same time, reduce its own environmental footprint. The result will be a more robust and resilient region. The work of this Commission, along with the contributions of hundreds of MTA employees, sets us on the right path to advance this essential work.”

Jonathan F.P. Rose

Chair, Blue Ribbon Commission
on Sustainability and the MTA

Reports And Recommendations

From The Blue Ribbon Commission's Sustainability Working Groups



Energy/Carbon Working Group

Energy use, fuel consumption, emissions, and CO2 avoidance

Chair: Ashok Gupta, air and energy program director, Natural Resources Defense Council



Facilities Working Group

Building and facility design, construction, operations, and maintenance

Chair: Robert F. Fox Jr., Cook+Fox Architects



Smart Growth/Transit-Oriented Development (TOD) Working Group

Land-use planning, transit access, and transit-oriented development

Chair: Ned Sullivan, president, Scenic Hudson



Materials Flow Working Group

Greening procurement, minimizing waste, and maximizing savings

Co-chair: Marcia Bystryn, president, New York League of Conservation Voters

Co-chair: Michael E. White, executive director, Long Island Regional Planning Board



Water Management Working Group

Water resources, management, conservation, and protection

Chair: Alex Matthiessen, Hudson Riverkeeper and president, Riverkeeper



Climate Adaptation Working Group

Preparation for rising sea levels, storms, and other climate changes

Chair: Klaus Jacob, Lamont-Doherty Earth Observatory, Columbia University

Given the interdependence of sustainability policies, a number of these topics are covered in more than one working group section.

“The climate crisis calls for bold and urgent action that promotes investments in transit, renewables, energy efficient buildings and transit-oriented development. The result will be a much healthier metropolitan region, both economically and environmentally.”

- Ashok Gupta, air and energy program director,
Natural Resources Defense Council
Chair, Energy/Carbon Working Group





Energy/Carbon

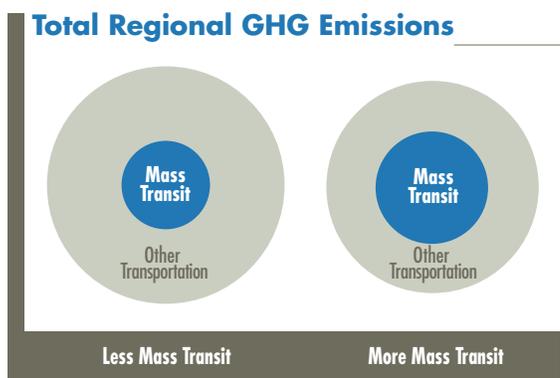
Energy use, fuel consumption, emissions and CO2 avoidance

For policymakers worldwide, climate change is now an established fact demanding concerted action. Already, data indicate a closing window of opportunity if we are to forestall the worst environmental and economic effects of global warming. Against this backdrop, the MTA offers a working model of high-value infrastructure for a low-carbon economy. The MTA system provides the rapid mobility essential to a prosperous economy while reducing fossil fuel consumption. As a result, the MTA region enjoys one of the highest rates of economic productivity and lowest rates of energy consumption in the world. The MTA system demonstrates how investment can mitigate global warming while sustaining economic growth.

The Commission looked at innovative ways to further improve the MTA system's carbon efficiency. The resulting recommendations fall into two categories. The first is integral to the MTA's mission as the nation's largest public transit system. With every extension of its transit operations, the MTA system takes tens of thousands of additional drivers off the roads (typically on a permanent commuting basis), transporting them instead on fuel-efficient subways, trains, and clean-technology buses – thus reducing oil consumption and CO2 output. A slight increase in transit carbon output typically signals an exponentially higher increase in carbon avoidance. In other words, growing the MTA's carbon footprint actually shrinks the region's net carbon footprint. Having assumed an even greater global urgency, this traditional mission will continue to be the MTA's foremost contribution to sustainability. Quantifying this regional benefit should provide new ways to identify and evaluate funds or resources for the MTA. The Commission's recommendations for expanding MTA transit access region-wide are addressed primarily in the Smart-Growth/TOD and Strategy for the 21st Century: Legislative and Policy Recommendations chapters of this report.

The second category, the main focus of this chapter, concerns energy and carbon reductions within the MTA system itself. The MTA has a history of pioneering cleaner, more efficient energy consumption at every level of operations, from the nation's largest all-CNG bus fleet at Long Island Bus to innovations in track design and green architecture. The sustainability gains show up in a number of statistics. For example, the MTA accounts for 65 percent of all New York City commutes while using just 5 percent of New York City's total energy consumption. Likewise, the fact that New Yorkers consume one quarter as much energy per capita as the average American is largely attributable to the MTA system. In other words, if the entire nation matched the energy/carbon profile of the MTA's transit radius, we would cut foreign oil dependency dramatically and achieve the Kyoto Protocol carbon emission targets decades ahead of schedule.

The Commission looked at energy/carbon solutions in all areas of operations, as outlined below. Since no single initiative can radically alter the MTA's current energy consumption, the recommendations focus on a combination of traditional efficiency programs and strategic investments in new energy technologies. Several programs deserve special mention. The first involves energy retrofits of MTA facilities in conjunction with the New York Power Authority (NYPA), an ongoing program that is projected to save greater than 78,000 megawatt hours of electricity and 123,000 gallons of diesel fuel per year by 2010. Related upgrades to energy-efficient lighting throughout the system include compact fluorescent light bulbs (CFL) in subway tunnels and light-emitting diode (LED) lighting for the Verrazano Narrows Bridge, one of the first LED lighting systems installed on any major U.S. span. The second program of particular note involves the development and piloting of green technology initiatives, including the use of energy generated by solar panels and tidal turbines, as well as testing of energy storage technologies and researching wind energy potential on MTA facilities and corridors. Finally, to help obtain 80 percent of the MTA electrical power from green sources by 2050, the MTA should join forces with NYPA and others to develop the vast potential of offshore wind power. If carried out as recommended, this transformational clean-energy initiative would completely alter the energy/carbon profile of the MTA and its service area. Since energy/carbon reductions are a primary goal of all sustainability programs, additional initiatives can be found under the Facilities chapter and the other sections of this report.



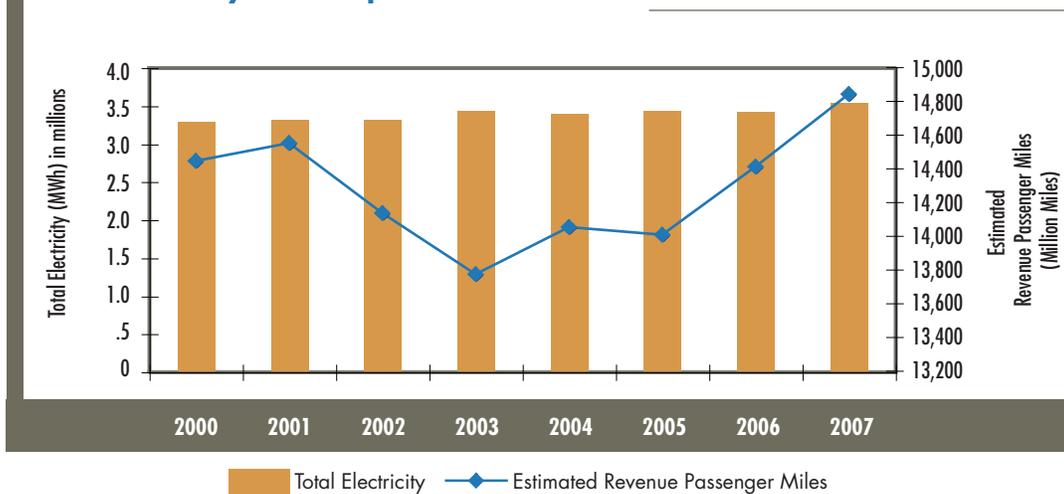
A small increase in transit's carbon footprint typically delivers an exponentially greater decrease in the region's carbon footprint, resulting in substantial net carbon avoidance.

BASELINE

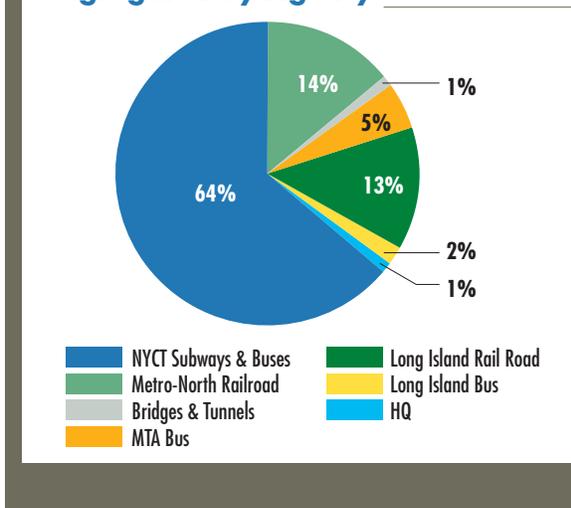
A model for low-carbon, high-value productivity, the MTA system provides 65 percent of all New York City commutes, while using just 5 percent of the city's total energy consumption.

Like all transit systems, the MTA is an energy-intensive operation. The system's current electrical consumption is approximately 3.5 million megawatt hours (2007). Approximately 80 percent of this total goes for vehicle traction. The MTA is exploring advances in rail technology and optimal reductions in traction power, while also investing in alternative energy sources and continuing to squeeze energy efficiencies from facilities, lighting, and other non-traction energy uses.

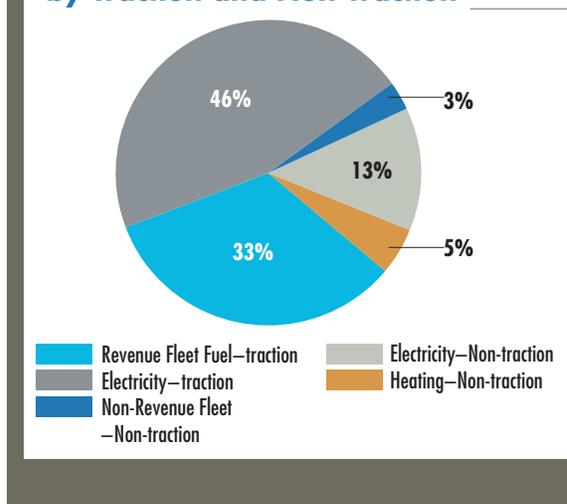
MTA Electricity Consumption Data 2000-07



MTA GHG Emissions Segregated by Agency



MTA GHG Emissions, Segregated by Traction and Non-Traction



Note: Previously, carbon emission calculations for electricity, originally presented in The Interim Report of the Blue Ribbon Commission on Sustainability and the MTA, were based upon emissions data for NYC and did not take into account the lower emission factors associated with electricity generation in MTA service areas outside of the city. Consequently, total MTA carbon emissions associated with electricity were overstated (2.8 million metric tons). Current carbon emission data has been refined to account for all MTA sources of electricity with updated emission factors (based on The Climate Registry's General Reporting Protocol).

TRANSFORMATIONAL RECOMMENDATIONS

Recommendation 1. Move Aggressively Towards Renewable Energy Generation

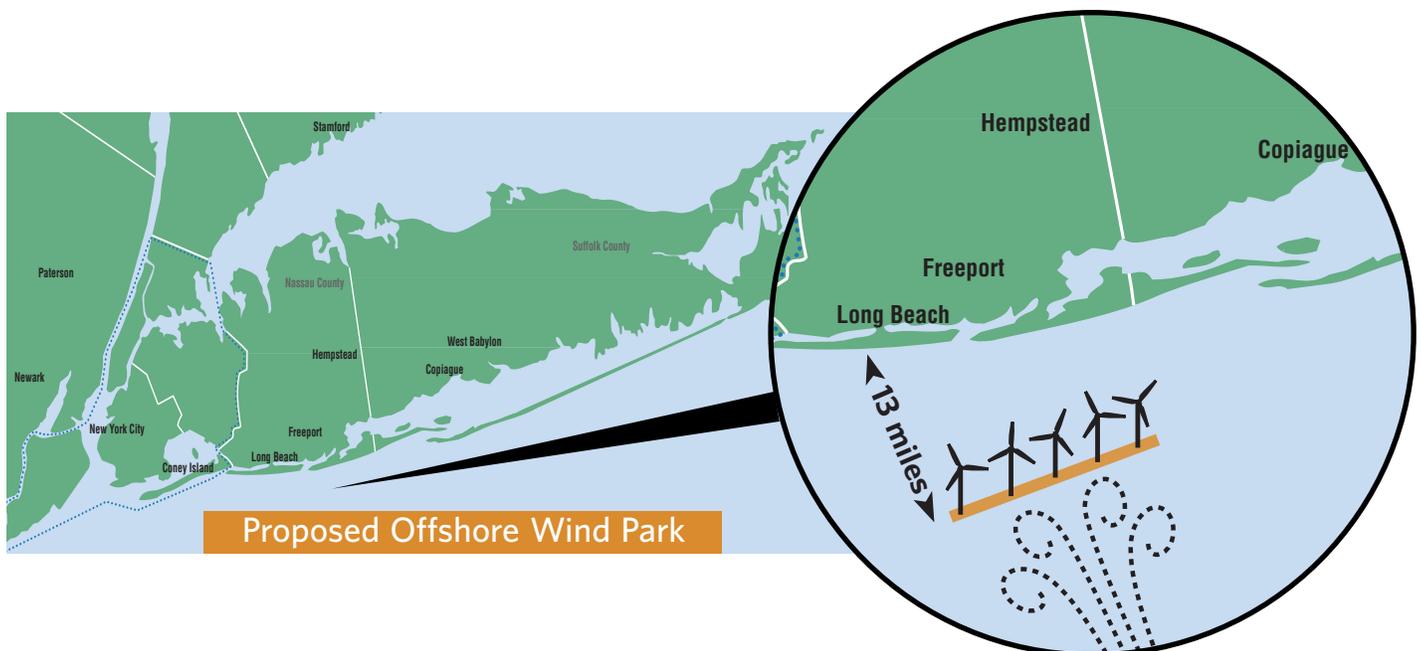
The MTA should move forward with an aggressive schedule of renewable energy use, development, and generation, with an initial phase of 7 percent renewable energy by 2015 and a long-term goal of generating 80 percent of the MTA's total electrical energy needs from clean, renewable energy by 2050. The MTA consumed approximately 3.5 million megawatt-hours of electricity in 2007, costing approximately \$367 million.

Combined with the MTA's current contributions to carbon avoidance, this green transformation of the MTA's electricity supply will represent a major step toward true regional sustainability and a permanent source of low-carbon economic productivity for the entire metropolitan area. To meet this goal, the MTA should take action now on the offshore wind farm initiative described in Project 1 below. In addition to generating clean energy, this transformational initiative will:

- Help meet the growing demand for additional power sources in the densely populated New York metropolitan area.
- Develop a renewable energy source that will function as a hedge against future "oil shocks" and rising fossil-fuel prices.

For the initial phase, the MTA should use a mix of onsite distributed generation and Renewable Energy Credits (RECs) to achieve the 7 percent renewable energy goal by 2015, thus supporting the goals of the New York State Renewable Portfolio Standard. By seeking the long-term goal of 80 percent by 2050, the MTA will vigorously support the emerging consensus among scientists, policymakers, and environmental leaders worldwide regarding carbon reductions and climate stabilization. The Commission also recommends that the MTA target both percentages on the basis of its total energy consumption while continuing to increase ridership. Following are five Energy Projects for attaining this transformational recommendation.

• **Energy Project 1. Join Offshore Wind Consortium.** To accelerate the MTA's conversion to renewable energy, the MTA should enter into a consortium with New York Power Authority (NYPA), Long Island Power Authority (LIPA), New York City, the suburban counties, and other parties to develop offshore wind sources along the coastlines of Kings, Queens, Nassau, and Suffolk counties capable of generating up to 1,500 megawatts (MW) of clean energy. Governor Paterson has already convened a working group with Con Edison and LIPA to assess the feasibility of wind turbines off Rockaway Point. NYPA has expressed a strong interest in joining forces with the MTA. The MTA should be a major player in the consortium. With its large, steady power requirements, the MTA is an ideal user of wind power. In addition, onsite renewable generation and consumption have the added advantage of avoiding congested transmission lines, which have often hindered the proliferation of renewable power in New York State. The scale, clean energy potential and high efficiency of offshore wind farming, along with the funding value of RECs, makes this a potentially transformational project for the MTA.



Modeling Carbon Avoidance

Many businesses and public entities now use models that quantify reductions in carbon emissions and assign such reductions a market value. Similarly, the MTA has begun to quantify the “carbon avoidance” realized by any regional shift from automobiles to transit. Since carbon avoidance is one of the most cost-effective ways to reduce emissions, the MTA will seek to measure it in a way that can be applied in cap-and-trade markets or other funding systems. As documented in studies by the American Public Transportation Association (APTA), transit services produce three levels of carbon avoidance:

- A direct reduction of carbon emissions on a per-passenger-mile basis through the mode shift from automobiles to transit ridership.
- A reduction in emissions from the reduced traffic congestion, allowing more efficient automobile traffic flow with less idling and stop-start driving.
- The reduction in emissions through more clustered land-use patterns that permanently reduce the mileage between destinations for all types of transportation, including automobiles.

These three tiers of carbon avoidance mean that expanding the MTA is among the most effective ways to permanently reduce regional carbon levels on a large scale. Apart from future revenue opportunities, the carbon-avoidance value of MTA transit is arguably the only way that New York City, Nassau County, and other government entities will be able to grow economically while achieving their stated or legally mandated carbon reduction goals. The same applies to states in the MTA service area and to the country as a whole.

• **Energy Project 2. Initiate Renewable Energy Schedule with RECs.** The MTA should step up its commitment to renewable energy through the immediate purchase of more Renewable Energy Credits (RECs). The accelerating conversion to renewable energy will then advance in two phases. Phase One (2009-2014): RECs purchased through a NYPA-issued mini-RFP based upon market availability. Phase Two (2015 and forward): MTA participates in offshore wind energy generation in collaboration with NYPA, LIPA, Con Edison, and others. In the event offshore wind proves to be infeasible or substantially delayed, the MTA should develop plans to participate in a NYPA-facilitated RFP for other new in-state renewable energy generation, including new land-based wind.

• **Energy Project 3. Purchase 6 Megawatts of On-Site Solar Power.** The MTA should participate in a NYPA-issued RFP for the purchase of up to 6 megawatts of power generated by solar panels installed on MTA roofs and property with the aim of acquiring solar power at a competitive, fixed price with a positive return on investment over the life of the project. The installations will be financed, owned, and operated by the solar power provider and the MTA should buy this solar power from NYPA. The MTA and NYPA have issued a RFI (Request For Information) to solicit information on costs, services, and other factors from the widest range of potential providers. The RFI was issued on November 18, 2008 (<http://www.nypa.gov/doingbusiness/powerpurchase/powerpurchase.htm>).

• **Energy Project 4. Build Integrated Wind/Solar Energy Sources.** The MTA should assess the feasibility and costs of integrating wind turbines, solar panels, or a mix of the two, into new roof installations. For example, at the Far Rockaway Bus Depot, this technology could supply approximately 30 percent of the depot’s 300 kilowatt (KW) load. At present, a feasibility study has been conducted and potential funding sources are being identified.

• **Energy Project 5. Tidal Power at Roosevelt Island Station.** The MTA should pursue an agreement with a vendor to provide approximately 50 percent of the power for NYCT’s Roosevelt Island station using tide-powered turbines. At present, the supplier has reinstalled two tidal turbines and applied for a 1 megawatt commercial power license, with license approvals and installation of additional turbines slated for late 2010.

Recommendation 2. Quantify Carbon Avoidance to Demonstrate Transit’s Climate-Stabilization Role and to Score Transit’s Share of Decarbonization Revenue

The MTA should institute accounting procedures to quantify the carbon emissions avoided by its transit services. In addition to the mobility value provided by MTA transit, the system’s carbon avoidance is now a measurable, unreimbursed commodity with an emerging market value. The MTA must begin to position itself not only as a transportation network, but as the provider of the same climate-stabilization benefits for which many industries now claim financial and funding credits. The MTA should continue its efforts with the American Public Transportation Association (APTA) to measure and log its carbon footprint with The Climate Registry (TCR). The MTA’s footprint should record not only carbon emissions produced by MTA operations, but carbon emissions avoided as well.

Recommendation 3. Target Specific Energy and Carbon Reductions

As a general guideline, the Commission recommends that the MTA publish long-term target dates and specific interim dates for its energy and carbon savings, much as it does for financial and ridership projections. The target of an 80 percent reduction in total GHGs by 2050 will set the framework and bring the MTA’s programs into line with internationally recognized sustainability goals. As a near-term example, the MTA should establish the goal of a 25 percent reduction in energy consumption and CO₂ emissions on a per-passenger-mile basis within ten years (by 2019).

Recommendation 4. Leverage the MTA's Market Power to Spur Renewable and Innovative Energy Industries and Partnerships

As the MTA seeks to lower its carbon emissions and transition its operations into clean, renewable energy, it has an opportunity to incubate and support renewable and cutting-edge energy entrepreneurs, industries, and suppliers throughout the mid-Atlantic region. As a large energy consumer with highly consistent yet dispersed energy needs, the MTA is an ideal customer for many renewable energy technologies. And as a public benefit corporation, the MTA can pilot new energy-efficiency technologies that may have a longer-term return on initial investments, whether on its own or in partnership with other major public entities. The MTA's role in pushing the development and marketing of the diesel hybrid-electric bus is an example of this potential made real. Currently, the MTA is partnering with the New York State Energy Research and Development Authority (NYSERDA), which has dedicated \$2.5 million in funding, in the form of a Program Opportunity Notice or PON (PON 1217) for pilot projects or research in transportation-related energy-efficient technology. Three projects have been selected, totaling approximately \$1.25 million of \$2.5 million available, with the second round of proposals to be evaluated in the first quarter of 2009. The selected project proposals, which involve cutting-edge energy technologies, are: (1) field test a giga-cell battery for wayside energy storage; (2) model onboard ultra-capacitor energy storage potential; and (3) perform Phase 2 of a regenerative-braking potential study. The Commission believes the MTA should continue to use this market power where possible to help build renewable energy industries throughout the mid-Atlantic region.

On-Site Wind Power in the MTA System

In addition to its long-term goal of offshore wind power, the MTA is investigating opportunities to develop wind power directly on some of its properties or right-of-ways. Due to acreage requirements and community constraints, the opportunities are limited to small-scale projects. Small wind turbines range from 20kW to 100kW. They have very low maintenance requirements and a typical life of 20-plus years.



The estimated total for cost-effective wind power on MTA properties is between 246 and 356 megawatt hours per year. Although that total is low as a percentage of the MTA's renewable energy goals, the MTA does have an opportunity to be a market leader as the first U.S. transit authority to integrate wind energy with transit operations. The MTA's project consultants identified six sites with potential for small-scale wind development. One of these potential sites was the Montauk Station on Long Island, shown above. The full Renewable Energy Report is available at www.mta.info/environment.

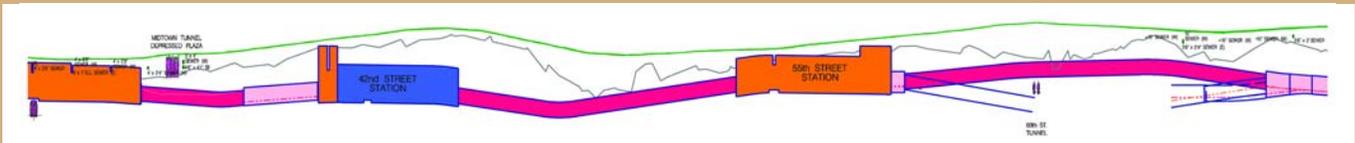
NEAR-TERM RECOMMENDATIONS

Recommendation 1. Accelerate NYPA Energy Retrofits and Energy-Efficiency Projects

The MTA should expand its energy retrofits in collaboration with NYPA, which now have a proven record of significant and compounding energy savings. At present, the MTA plans to nearly double its program of energy retrofits and energy-efficiency projects with NYPA. To set a clear framework for this important source of energy savings, the Commission recommends that the MTA set a goal of re-evaluating the energy efficiency potential in 100 percent of major MTA facilities every 10 years.

A Greener Subway Track

Some energy savers, like Compact Fluorescent Lightbulbs (CFLs) in subway tunnels, are no-brainers. Others are not so obvious, such as the engineering of “humped tracks” on the Second Avenue Subway project. By adjusting track inclines at stations, designers use gravity to reduce the energy trains expend in braking and acceleration, shaving extra kilowatts off each train arrival. Similarly, minute calibrations of the turn radius in tracks can minimize energy loss in braking. MTA’s R160 subway cars, equipped with regenerative braking, have the potential to capture the braking energy as trains enter a station and transfer it to trains departing on the adjacent tracks. With the conversion to an all AC fleet, the MTA would have the opportunity to use the full potential of regenerative braking and capture significant energy savings.



2nd Ave Subway Cross Section – Humped Tracks

Recommendation 2. Field Test and Implement Weight Reduction and Regenerative-Braking Technologies, as Recommended by the Commission’s Smart Fleets Task Force

The MTA should reduce its demand for propulsion power and fuel by moving aggressively to identify and implement the most energy-efficient innovations being tested in its Smart Fleets program. Both regenerative-braking systems and design innovations that lighten the weight of rolling stock while maintaining safety are the most promising advances in the current Smart Fleet programs. The MTA must continue to expedite testing of new technologies that shave the energy expended for traction power, by far the MTA’s largest energy demand.

Recommendation 3. Expand the Use of LED Lighting

The MTA should expand its use of LED lighting within the MTA system by taking advantage of opportunities for LED fixtures in signals, emergency cut-off lights, tunnel lighting, and other applications. The MTA should also expedite its replacement of bridge necklace lighting with new LED fixtures, which testing indicates cut energy consumption by approximately 73 percent and reduce crew maintenance costs. For the pilot project at the Verrazano-Narrows Bridge, LED necklace lights were delivered in November 2008 and installation will be completed by June 2009. The MTA should undertake LED installations at the three major remaining MTA bridges (Bronx-Whitestone, Robert F. Kennedy, and Throgs Neck).



LED Bridge Lighting

The MTA has begun replacing the existing necklace lighting on the Verrazano-Narrows Bridge with LED lighting, significantly reducing energy consumption, maintenance costs, and waste.

Potential Traction Power Reductions

The MTA's traction power alone requires some 2.8 billion kWh a year. NYCT consumes about 80 percent (2.3 billion kWh) of the total. The Commission examined technologies and techniques with the potential to reduce MTA traction power. These take two forms: (1) Regenerative energy management techniques; and (2) Mass reduction of train-car components. The lighter the train cars, the less energy the MTA needs to move them.

Regenerative techniques include on-board and trackside energy storage, operational enhancements such as start/stop synchronization, and software modifications allowing train cars to better use regenerated energy. Mass reduction techniques include elimination of redundant components, substituting lighter materials such as aluminum for steel, and design optimization to enable identical structural performance with reduced weight.

Energy Saving Scenarios – 10%, 15%, 25%: Existing Fleet and New Car Procurement (R160 OP2 + R179, R188)

Energy Reduction Goal	Technology Required	Issues/Special Requirements	Total Cost (Differential Cost)
10% (Low Case)	<ul style="list-style-type: none"> All Reasonable Lightweighting Technology (2.5% reduction) Moderate Regeneration Performance (7.5% reduction) by on-board energy storage 	<ul style="list-style-type: none"> ~ 2,000 lbs per car average weight reduction must be applied to 4,800 car overhaul-eligible fleet and all 1,500 new-build cars Average regeneration of 3.75 kWh per stop, per 10 car train required for the 4182 regen capable fleet* Implies that 31% of the regen capable fleet must have full 12 kWh on-board energy storage (1,300 cars) Optimal regeneration requires special train braking performance (moderate stop) 	<ul style="list-style-type: none"> \$35 M Lightweighting \$268.5 M Regeneration 40 yr lifecycle cost (2-year battery replacement interval)
15% (Medium Case)	<ul style="list-style-type: none"> All Reasonable Lightweighting Technology (2.5% reduction) High Regeneration Performance by on-board energy storage (12.5% reduction) 	<ul style="list-style-type: none"> ~ 2,000 lbs per car average weight reduction must be applied to 4,800 car overhaul-eligible fleet and all 1,500 new-build cars (full fleet) Average regeneration of 6.25 kWh per stop, per 10 car train required for the 4,182 regen capable fleet* Implies that 52% of the regen capable fleet must have full 12 kWh on-board energy storage (~2,200 cars) Optimal regeneration requires special train braking performance (moderate stop) 	<ul style="list-style-type: none"> \$35 M Lightweighting \$447.5 M Regeneration 40-yr lifecycle cost (2-year battery replacement interval)
25% (High Case)	<ul style="list-style-type: none"> All Reasonable Lightweighting Technology (2.5% reduction) Very High Regeneration Performance by on-board energy storage (22.5% reduction) 	<ul style="list-style-type: none"> ~ 2,000 lbs per car average weight reduction applied to 4,800 car overhaul-eligible fleet and all 1,500 new-build cars (full fleet) Average regeneration of 11.25 kWh per stop, per 10 car train required for the 4,182 regen capable fleet* Implies that 94% of the regen capable fleet must have full 12 kWh on-board energy storage (~3,900 cars) Optimal regeneration requires special train braking performance (moderate stop) 	<ul style="list-style-type: none"> \$35 M Lightweighting \$805 M Regeneration 40-yr lifecycle cost (2-year battery replacement interval)

All three scenarios above are realistically achievable using technology that has a reasonable near-term availability. Achieving all three scenarios, however, is highly dependent on maximizing regenerative energy performance using regulated train braking and on-board energy storage using best-in-class lithium battery technology. Note: Cost estimates are associated with application on all applicable NYCT subway fleets. Further details are available online at www.mta.info/environment.

Note: *Regenerative capable fleet is 4,182 cars = 2,270 existing fleet + 382 R160 Op2 + 1,530 R179, R188.

Maximum Achievable Energy Savings by Fleet Groups

	Regeneration <small>(Assumes perfect regeneration using a full 12kWh on-board)</small>	Lightweighting
Existing Fleet – Retrofit (overhaul eligible) 4,886 cars	Energy Savings: 384,084,000 kwh CO ₂ Avoided: 165,156,120 kg Cost:* \$23.3 M Note:* only 2,270 cars regen capable	Energy Savings: 24,092,235 kwh CO ₂ Avoided: 10,359,661 kg Cost:* \$20.9 M Note: Avg 1,440 lb per car savings
New Cars – designed but not yet built (R160 Opt 2) 382 cars	Energy Savings: 64,634,400 kwh CO ₂ Avoided: 27,792,792 kg Cost:* \$3.9 M	Energy Savings: 2,709,009 kwh CO ₂ Avoided: 1,164,874 kg Cost:* \$2.8 M Note: Avg 2,144 lb per car savings
New Cars – not yet designed (R179, R188) 1,530 cars**	Energy Savings: 258,876,000 kwh CO ₂ Avoided: 111,316,680 kg Cost:* \$15.7 M	Energy Savings: 16,092,136 kwh CO ₂ Avoided: 6,919,619 kg Cost:* \$11.9 M Note: Avg 3,203 lb per car savings

Costs are expressed as differential cost, defined as the increased cost necessary to achieve the desired savings beyond costs that would be incurred regardless. For regeneration, differential cost is equal to procurement cost since it is a new system addition to the fleet.

*Regeneration Cost represents the recurring cost to replace the rechargeable batteries every 2 years due to extremely high cycling that occurs in an urban transit system. Lightweighting cost represents the differential cost and does not have an associated recurring cost metrics such as cost, CO₂, or energy savings.

**Note: R188 class “new cars” are actually composed of 386 new chassis, and 120 R142a up-converted chassis; however this does not materially impact key performance.

Potential Annual Energy Impact by Lightweighting Innovations—Assume All Overhaul-Eligible and New Cars (R160 Op, R179, R188)



Key Takeaway

The greatest annual energy savings is not necessarily the most cost efficient

Key Takeaway

Other benefits, such as operational and safety improvements, can occur with these modifications in addition to weight savings

- Composite instead of plymetal panel flooring
- Giga cell battery with alternative battery box
- Utilize Oilless Compressor concepts
- Corrugated wheels / Lightweight wheels
- Utilize single draft gear (tube style) link bar
- One free axle on 1 non-motorized truck replacing OSMES
- Gear unit with lowest weight
- Lightweight floor pans
- Eliminate OSMES, brackets and equipment
- Eliminate flip up seats
- Eliminate secondary center collision posts
- Trip cock linkage weight reduction
- Eliminate 1 of 2 coupler adapters on NMTs units
- Reduce weight of coupler guides on type 1 truck
- Reduce heater grill weight
- Reduce advertisement card clips weight

ACHIEVEMENTS TO DATE

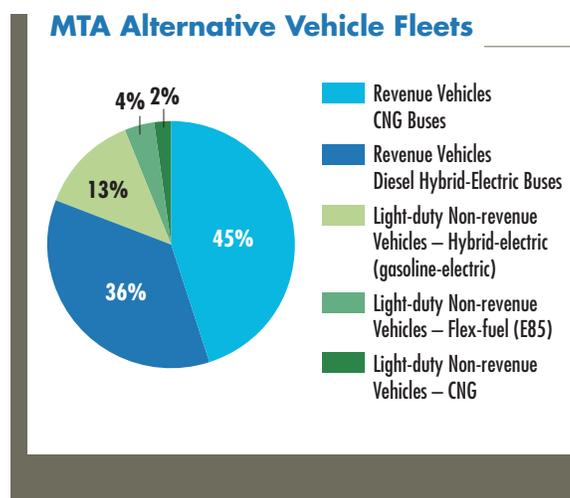
The MTA's energy retrofits with NYPA continue to squeeze significant amounts of energy out of MTA facilities, lighting systems, and other non-traction operations. While green technology grabs headlines, sustainability can also advance through innovations with less pizzazz. That's the case with one of MTA's most effective energy-saving programs. MTA works closely with NYPA on a bond-funded program of energy retrofits at MTA facilities. Where potential energy savings are found, NYPA draws on their bond capital to pay for new, energy-cutting upgrades. NYPA recoups its investment over a period of years through the resulting energy savings. MTA pays the same electricity bills during the payback period, but lowers its actual energy consumption. MTA gains major facility improvements without a dime of capital investment. The energy savings then revert to MTA after the payback period. Collectively, these ongoing projects will result in MTA energy savings of 78,000 megawatt hours (MWh) per year by 2010 (saving approximately \$9.4 million per year) and will eliminate some 32,600 metric tons of CO₂ emissions annually.

The MTA agencies have also made initial reductions in energy consumption and the MTA carbon footprint by transitioning to various types of compressed natural gas (CNG) and hybrid vehicles; by integrating photovoltaic (PV) panels and fuel cells into new facilities; and through the purchase of renewable energy credits (RECs).

Current totals are as follows:

- **Alternative-Fuel Vehicles:** In its revenue bus fleets, the MTA now runs 1,107 CNG buses and 875 diesel-hybrid-electric buses. In its non-revenue light-duty service fleets (maintenance vehicles, dispatch vehicles, etc.), the MTA has a total of 484 alternative-fuel vehicles, mostly hybrid gas-electric. Some 91 percent of all new light-duty service vehicles purchased over the last year are alternative-fuel vehicles.

- **Renewable Energy Sources:** The MTA facilities currently generate approximately 1,400 MWhs of energy from on-site PV panels and a hydrogen fuel cell. The MTA also supports the generation of renewable energy through its purchase of renewable energy credits (RECs). In 2007, the MTA purchased 7,500 MWhs of RECs, of which 3,000 were from wind and 4,500 from sustainably managed biomass.



Energy-Efficiency Achievements:

- **LED Train Signals:** New York City Transit has replaced nearly 100 percent of its incandescent train signals with high-efficiency LED signals, resulting in energy savings of approximately 6,000 megawatt hours of electricity per year, in addition to the substantial maintenance savings associated with less frequent signal light replacement.

- **Battery Energy Storage:** Long Island Bus has completed the installation of a high-efficiency sodium sulfur battery energy storage system at their Mitchell Field facility. The battery system, which can store and discharge up to 1 megawatt of electricity, is charged at night when electricity demand and utility rates are low and then used during the day to power compressors for fueling the Long Island Bus fleet of compressed natural gas buses.

Green Ideas from MTA Employees



Install Remote Meter Reading Devices for each type of utility meter (water, gas, and electric) so that all utility meters can be read on a consistent cycle (i.e., every 30 days, or 60 days etc.) This would also make it easy to read utility meters that are in hard to reach places.

— Minna Hamilton, MTA Bus

- **Rapid Roll-Up Doors:** MTA Bus Company has added high-speed rapid roll-up doors. The high-speed roll-up doors are well insulated and open and close up to three times faster than conventional steel roll-up doors, minimizing the air exchange between the depot and the outside environment and resulting in decreased heating and cooling demand throughout the year.



Facilities

Building and facility design, construction, operations, and maintenance

Along with major fixed structures such as bridges, rail lines, and tunnels, the MTA maintains a highly diverse building portfolio of hundreds of facilities, including rail stations, subway stations, maintenance barns, office buildings, and such landmark properties as Grand Central Terminal. The buildings represent a wide range of functions and styles. Many are open-air structures; some border wetlands, rivers, or parks; most date from the early 20th century; a number feature state-of-the-art designs; several occupy some of the most valuable real estate in the world. The MTA acts as both a builder and operator of its facilities. Both roles involve extensive management of energy systems, materials, and other aspects of sustainability. Because these holdings are so extensive, the MTA can make a significant contribution to regional sustainability through green building design and management.

MTA's Corona Maintenance Facility was North America's and the MTA's first LEED™ (Leadership in Energy and Environmental Design) certified transit facility. Based on this pioneering effort, the Commission has determined that LEED standards can apply to some transit facilities, and the Commission has recommended that in the future all applicable MTA projects seek a LEED Silver certification.

However, the current LEED standards do not substantially apply to many typical transit facilities, such as power substations and most rail stations. With guidance from the Commission, the MTA is drafting the green building guidelines that will specify how these facility types can be designed in a sustainable way (see table later in this chapter).

The *MTA Green Building Guidelines* will incorporate LEED criteria, as well as MTA-specific environmental criteria relating to noise and vibration, security, maintenance of transit operations, visual impact, and other transit-specific qualities. Once developed, these guidelines can serve as an industry model for green transit facilities and should be submitted to the U.S. Green Building Congress (USGBC) for potential adoption as a *LEED for Transit* standard.

The other area where LEED standards may not apply to MTA facilities is in older structures. The MTA portfolio includes a large number of legacy structures from the early 20th century or before. While there are LEED standards for existing buildings (LEED-EB), only a minority of MTA structures can be readily adapted to meet them due to their specified functions. The MTA should seek LEED-EB certification for Grand Central Terminal, which would make it a national showcase for greening landmark buildings.

For greening most of the MTA's facilities, two ready options exist. Many of the more recent buildings should be recommissioned to optimize all energy systems. The MTA is identifying and assessing such structures. The remaining facilities should undergo rigorous energy auditing, as described in the Energy/Carbon chapter of this report.

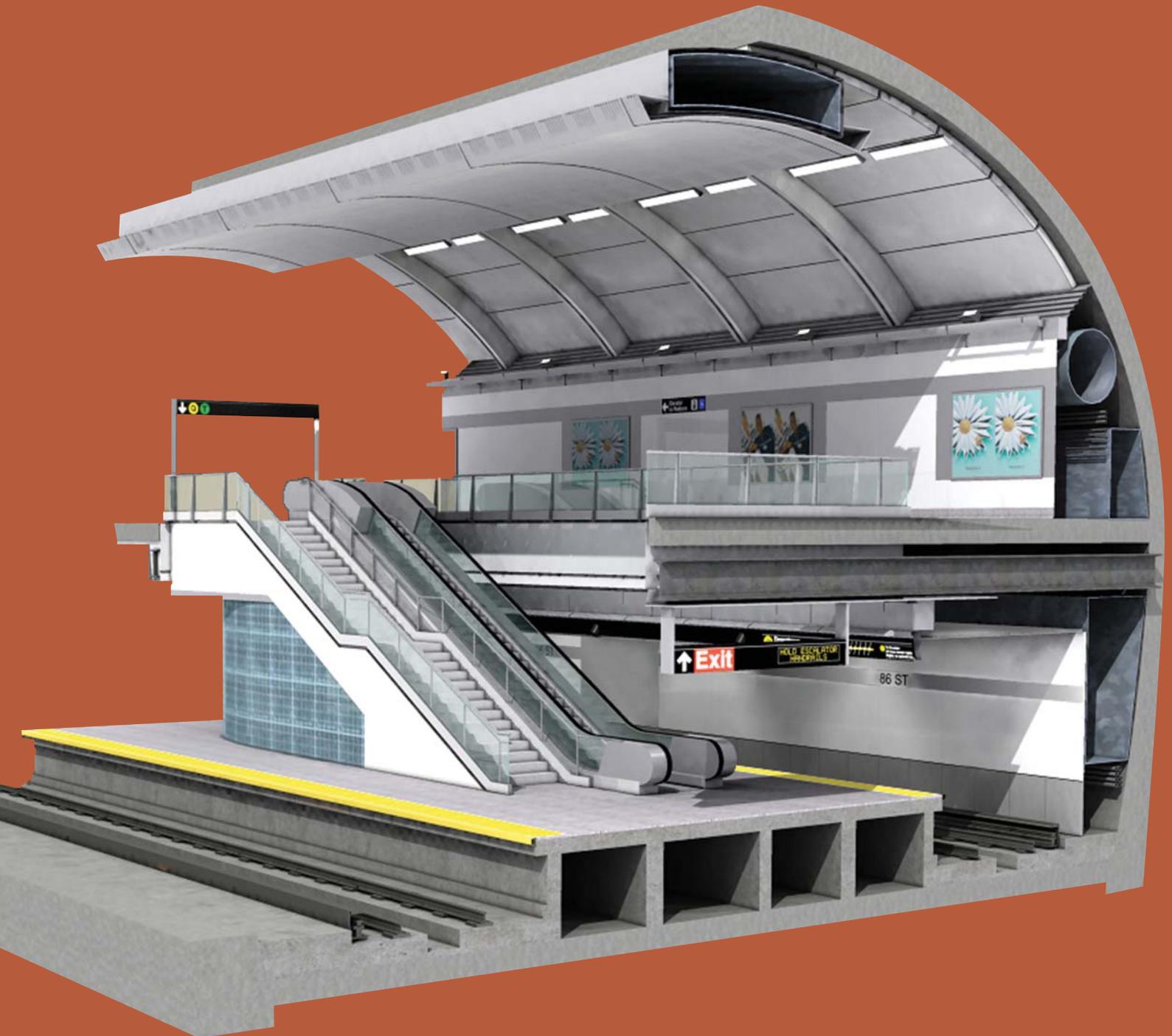
The Commission has urged the MTA to accelerate its building energy retrofits in conjunction with the NYPA, recommending that MTA set a goal of reevaluating the energy-efficiency potential of 100 percent of major MTA facilities every 10 years. The retrofits entail ongoing green enhancements, such as high-efficiency lighting systems, boilers, and HVAC systems. In addition, the MTA has a number of green innovations for its existing facilities in various stages of planning, including high-performance roofs (vegetated "green" roofs, white roofs, and rainwater-retentive "blue" roofs) and other rainwater capture systems, solar panels, motion-activated escalators, groundwater thermal exchange systems, and more. Greener building maintenance should become standard operating procedure and would complement the initiatives described in the Energy/Carbon, Materials Flow, and Water Management chapters of this report.

In light of the current financial climate, the Commission looked carefully at costs and potential savings in green building design. Its survey showed that LEED buildings can achieve operating cost savings as great as 9 percent annually, often enough to absorb their somewhat higher project contracting costs within a reasonable payback period. Upfront capital costs for LEED buildings can vary widely, depending on the project and the level of LEED attainment sought, according to King County Metro Transit in Washington State and Los Angeles County MTA, two transit agencies with experience building LEED facilities. They estimate that it can cost little or nothing extra for projects to attain LEED certification and as much as 25 percent extra to attain LEED Platinum. Los Angeles MTA also found that some building projects could move up from LEED certified to a higher LEED rating at little or no added cost.

To realize the full value of green design, the Commission has also recommended that the MTA adopt a Lifecycle Analysis (LCA) system for buildings, like the one described in the Materials Flow chapter of this report. Building design and maintenance can also benefit from the Sustainable Return on Investment (SROI) model presented in the Transit's Triple Bottom Line chapter.

“People often ask me ‘What makes a building green?’
And I always answer, It’s not one big thing, it’s hundreds of little things.’ ”

- Robert F. Fox Jr., AIA, LEED AP, Partner Cook+Fox Architects
Chair, Facilities Group



Cavern Stations, which are mined within bedrock, represent a number of opportunities for sustainable design on the new Second Avenue Subway.

LEED™ Certification

The green building movement has generated a revolution in new criteria for measuring energy consumption, emissions, and other sustainability factors. The prime mover in this revolution is the 10,000-member U.S. Green Building Council (USGBC), a nonprofit organization of architects, builders, and organizations, including the MTA. The USGBC's Leadership in Energy and Environmental Design (LEED™) certification is "a national rating system for developing high-performance, sustainable buildings." The council currently promulgates eight LEED rating systems for different types of construction, including standards for upgrading existing buildings. More on LEED standards can be found at www.usgbc.org.

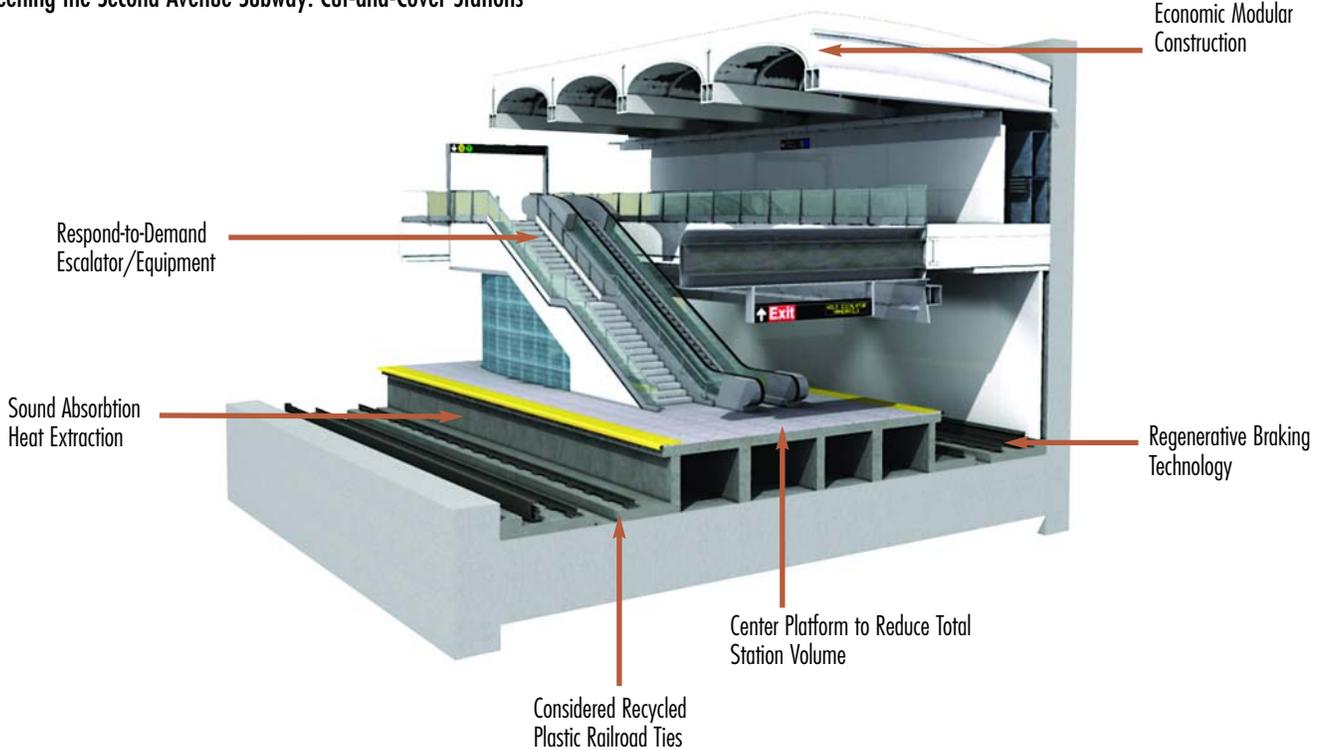


The Corona Yard Maintenance Facility, which opened in 2007, earned the MTA's first full LEED certification from the U.S. Green Building Council.

Green Design and ROI

Both government and private sector analysis indicate significant energy and operating savings from green buildings, often enough to cover any extra costs. LEED buildings tend to have 8 percent to 9 percent lower operating costs. The New Building Institute in a March 2008 study showed that the median Energy Usage Intensity (EUI) for 121 LEED-EB certified buildings was 69 kBtu/sq ft, 24 percent lower than the national average for commercial buildings, according to the Commercial Buildings Energy Consumption Survey (CBECS). The same study showed EUI for Gold and Platinum certified buildings was 50 percent lower EUI than the national average. In a study of 12 green buildings, the General Services Administration found that the buildings used 26 percent less energy than average, had 13 percent lower operating costs, emitted 33 percent less CO₂, and had 27 percent higher customer satisfaction.

Greening the Second Avenue Subway: Cut-and-Cover Stations

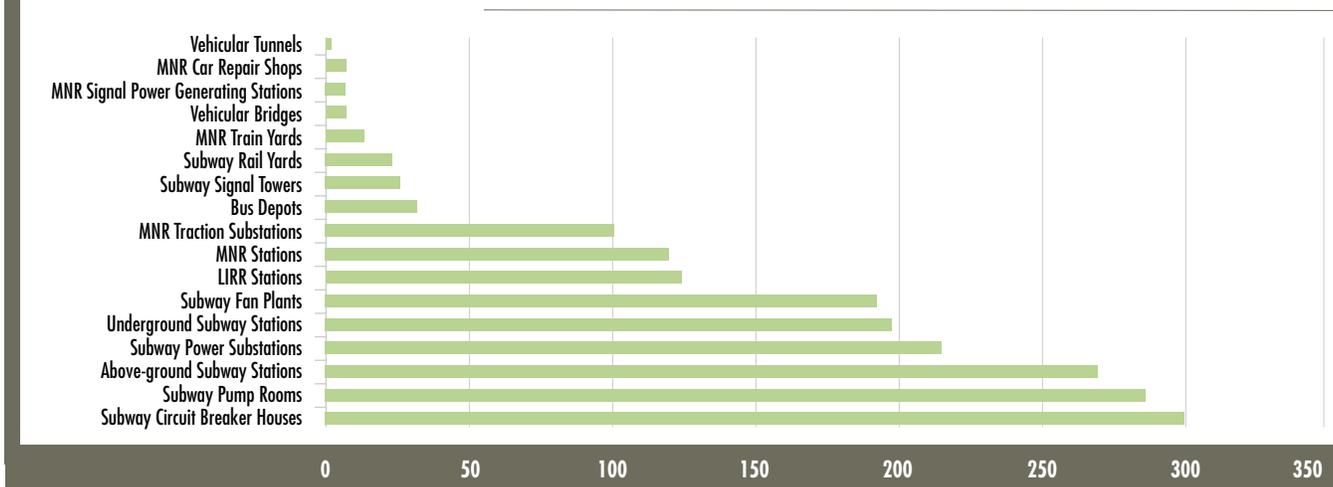


Cut-and-cover stations on the new Second Avenue Subway – trenched out from grade – incorporate a number of sustainable design elements.

BASELINE

The MTA facility portfolio encompasses thousands of structures, from fan plants to office towers. This chart illustrates the diversity and quantity of just a few building types.

MTA Facilities: A Small Sample



Greener and Grander

The MTA's Grand Central Terminal is one of the world's most magnificent train stations, glittering with hundreds of the city's earliest electrical chandeliers. To help sustain this landmark in a low-carbon economy, the MTA has replaced over 1,700 light bulbs in interiors and tunnels with compact fluorescent bulbs (CFLs). The CFLs save more than 100,000 kilowatt hours and over \$100,000 annually. Because CFLs last approximately 7,500 to 10,000 hours, up to ten times longer than incandescent bulbs, they also save the MTA thousands of dollars in replacement and labor costs.



TRANSFORMATIONAL RECOMMENDATIONS

Recommendation 1. Adopt LEED Silver Standards for All Applicable MTA Buildings

Expanding on the green innovations of its LEED-certified Corona Maintenance Shop and other recent projects, the MTA should pioneer high-performance designs for all of its system facilities. To this end, the Commission urges that the MTA adopt LEED Silver standards or higher for all new building projects, new construction, and major renovations wherever applicable. And the MTA should either recommission existing buildings or pursue certifications as LEED Existing Buildings: Operations and Maintenance (LEED-EB) where possible. For existing facilities, the MTA should determine which buildings can be adapted to the LEED-EB criteria and then pursue recommissioning according to a prioritized schedule.

Recommendation 2. Develop New Green Design Standards for Transit Facilities

Since the current LEED categories do not cover transit-specific infrastructure, such as stations, electrical substations, and pump rooms, the MTA should develop its own green building guidelines for facility design and renovation. The *MTA Green Building Guidelines* should be drafted in consultation with the USGBC and offered as a model for transit agencies nationwide. The MTA should then propose that the guidelines form the basis of a new *LEED for Transit* standard for transit facilities not covered by existing LEED programs, thus disseminating the standards through an independent auditing organization. An outline of the MTA Green Building Guidelines is shown later in this chapter with a full version to be available afterward on the MTA website at www.mta.info/environment.

Recommendation 3. Intensify Green Renovations and Renewable Energy Sources at Existing MTA Facilities

Where existing facilities cannot be readily brought into LEED-EB compliance, the MTA should expand its program of energy retrofits and building recommissionings. For energy audits, the MTA should set a goal of completing NYPA retrofits to reevaluate 100 percent of major MTA facilities every 10 years. For recommissionings, the MTA should classify all of its major facilities by age, system operations, and other factors to determine which can be recommissioned for optimal efficiency. As part of its facilities review, the MTA should plan to increase the percentage of its energy base load generated by on-site, renewable sources, both to reduce the carbon footprint of its building portfolio and as a hedge against rising energy costs and power failures. Specific technologies proven to have quick payback, such as high-efficiency lighting and motion-sensor based controls, should be fast-tracked for implementation while the comprehensive Facility Database and Recommissioning schedule is finalized.

Recommendation 4. Adopt Green Lifecycle Analysis for MTA Buildings

The Commission recommends that the MTA adopt a form of green Lifecycle Analysis (LCA) to track the upfront costs and long-term savings from high-performance design features – the same type of LCA process recommended in the Materials Flow chapter of this report. LCA will support the previous recommendations by identifying and justifying long-term savings in new building designs, in renewable on-site energy sources and in the renovation and recommissioning of existing structures.

Green Ideas from MTA Employees



"A predictive maintenance program using infrared thermography can help find incipient electrical problems before they affect operations. This can help reduce energy waste, save on maintenance costs and increase safety."

— Anthony Salamone, Metro-North Railroad

Right: This is an example of how a LEED standard (LEED 2009 for New Construction) is being adapted for use in the MTA Green Building Guidelines. This example illustrates how some, but not all, LEED criteria are applicable to MTA substations. It also includes examples of MTA-specific environmental criteria that will be used in the facility design process.

MTA Green Building Guidelines New Construction/Major Renovation

Project Scorecard for Substations – Selected Credits

Sustainable Sites		Substations Applicable
Prereq 1	Construction Activity Pollution Prevention	Yes
Credit 1	Site Selection	Yes
Credit 2	Development Density & Comm Connectivity	No
Credit 4.2	Alt Transportation – Bicycle Storage	No
Credit 4.4	Alt Transportation – Parking Capacity	No
Credit 5.2	Site Development, Maximize Open Space	Yes
Credit 6.1	Stormwater Design, Quantity Control	Yes
Credit 7.1	Heat Island Effect, Non-Roof	No
Credit 8	Light Pollution Reduction	Yes
Water Efficiency		
Prereq 1	Water Use Reduction, 20% Reduction	Yes
Credit 3	Water Use Reduction	No
Energy & Atmosphere		
Prereq 1	Fundamental Commissioning of Bldg Energy Systems	Yes
Prereq 2	Minimum Energy Performance: 10% NC/5% EB	Yes
Prereq 3	Fundamental Refrigerant Management	Yes
Credit 1	Optimize Energy Performance	No
Credit 2	On-Site Renewable Energy	No
Credit 3	Enhanced Commissioning	Yes
Credit 6	Green Power	Yes
Materials & Resources		
Prereq 1	Storage & Collection of Recyclables	Yes
Credit 1	Building Reuse	Yes
Credit 2.1	Construction Waste Management, Divert 50% from Disposal	Yes
Credit 3.1	Materials Reuse, 5%	Yes
Credit 4.1	Recycled Content, 10% (post-consumer + 1/2 pre-consumer)	No
Credit 5.1	Regional Materials, 10% Extracted/Processed/Manufactured	Yes
Credit 6	Rapidly Renewable Materials	No
Credit 7	Certified Wood	No
Environmental Quality — Indoor/Outdoor		
Prereq 1	Minimum IAQ Performance	Yes
Prereq 2	ETS Control	Yes
Credit 1	Outdoor Air Delivery Monitoring	Yes
Credit 2	Increased Ventilation	Yes
Credit 3.1	Construction IAQ Management Plan, During Construction	Yes
Credit 3.2	Construction IAQ Management Plan, Before Occupancy	Yes
Credit 4.1	Low-Emitting Materials, Adhesives & Sealants	Yes
Credit 4.3	Low-Emitting Materials, Flooring Systems	No
Credit 5	Indoor Chemical & Pollutant Source Control	Yes
Credit 8.1	Daylight & Views, Daylight 75% of Spaces	No
MTA Credits		
Credit 1.1	Security	Yes
Credit 1.2	Noise & Vibration	Yes
Credit 1.3	Maintenance of Transit Operations	Yes
Credit 1.4	Visibility/Visual Design Excellence	Yes

NEAR-TERM RECOMMENDATIONS

Recommendation 1. Increase the Number of LEED Accredited Employees

The MTA should aggressively increase the number of LEED-accredited employees, and require 90 percent of new hires to be LEED Accredited Professionals (AP) for facilities design positions. The MTA should provide support for employees preparing for the LEED examination and provide appropriate green training for current employees.

Recommendation 2. Seek LEED-EB Rating for Grand Central Terminal

The MTA should pursue LEED-EB certification for Grand Central Terminal. The greening of MTA's highest-profile facility would provide useful lessons for other agency facility projects and serve an important role in educating the public about green buildings and MTA's sustainability efforts.

Recommendation 3. Accelerate the Use of Green Roofs and High-Performance Roofs

Given the extensive square footage of its building portfolio, the MTA should assess the feasibility of green roofs, white roofs, rooftop renewable energy generation, and other high-performance roof designs across all of its existing facilities.

Recommendation 4. Form an All-Agencies Green Team

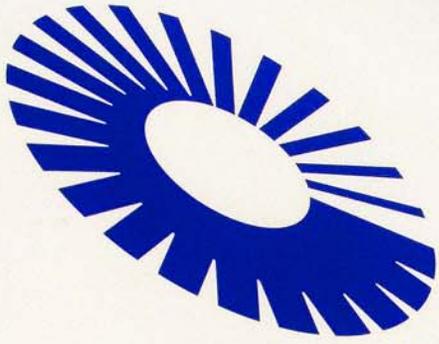
The Commission recommends that the MTA create an All-Agencies Green Team to oversee the final development and implementation of the MTA Green Building Guidelines. The Green Team will also coordinate the development and promotion of the MTA's other sustainability initiatives.

ACHIEVEMENTS TO DATE

Since launching its five-year capital plans in 1980, the MTA has steadily upgraded the energy performance of its new and existing buildings. The ongoing energy retrofits described in the Energy/Carbon chapter will result in MTA energy savings of greater than 78,000 megawatt hours (approximately \$9.4 million) per year by 2010. Many facility rehabilitation plans now include high-performance roofs, energy management systems, and other green features. Among the MTA facilities that have pioneered innovative green designs are the following:

- The NYCT Corona Yard Maintenance Shop, North America's first LEED-certified transit facility, featuring natural ventilation and lighting, recycled train wash water, a rainwater capture system, photovoltaic cells, a fuel cell, and heat recovery units.
- The Coney Island-Stilwell Avenue Terminal, featuring interior day lighting and a majestic station canopy integrating the largest building-integrated photovoltaic (BIPV) installation in any transit station, generating 250 kW of clean power.
- The Roosevelt Avenue-74th Street Station, Queens, produces 65 kW of power using two PV systems: a conventional system is on the roof; the second system, comprised of thin-film solar panels, is mounted to the metal standing seam canopy on the elevated subway platform.
- The Gun Hill Bus Depot, the first NYCT depot to use solar panels, draws 40 percent of the facility's power from photovoltaic cells, making it one of the largest PV facilities on the East Coast.
- For more facts on MTA's recent state-of-the-art facilities, visit www.mta.info.

Right: The fuel cell at the Corona Car Maintenance Facility converts hydrogen and oxygen into electricity and heat to save energy.



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"Today's housing, financial, and energy crises all create an extraordinary opportunity and a vital imperative. We must build the next generation of homes and businesses within walking distances of train and bus stations, all equipped with solar energy, green design, and bicycle-friendly facilities that reduce carbon emissions and protect us from the impacts of climate change. The MTA and Governor Paterson, in partnership with the Obama Administration, must seize the moment to create jobs, revitalize the economy and ensure a sustainable future for all New Yorkers."

- Ned Sullivan, president, Scenic Hudson
Chair, Smart Growth/TOD Group



Smart Growth/TOD

Land use planning, transit access, and transit-oriented development

Smart growth and transit-oriented development (TOD) go to the heart of the MTA's mission. They also represent the MTA's greatest contribution to regional sustainability. By expanding the reach and deepening the localization of its transit network, the MTA reduces the fossil-fuel consumption and the carbon footprint of the entire region. By enabling more clustered, transit-rich development, the MTA helps to mitigate the underlying causes of global warming while promoting more livable, sustainable communities.

Emerging trends make this the right time for the MTA to redouble its TOD efforts. The MTA's "Strategic Regional Review" projects a population increase in the service area of over 4 million by 2030. The Commission urges that the MTA work diligently with communities, developers, and government officials to direct this growth away from auto-dependent sprawl toward transit-centered development. The MTA should seek to capture two-thirds of this new growth. That is, the MTA transit network should strive to attract two-thirds of the additional vehicles miles traveled (VMTs) due to new growth between now and 2030; and the MTA should encourage public and private planners to cluster two-thirds of the new development within a quarter-mile to a half-mile of MTA transit access.

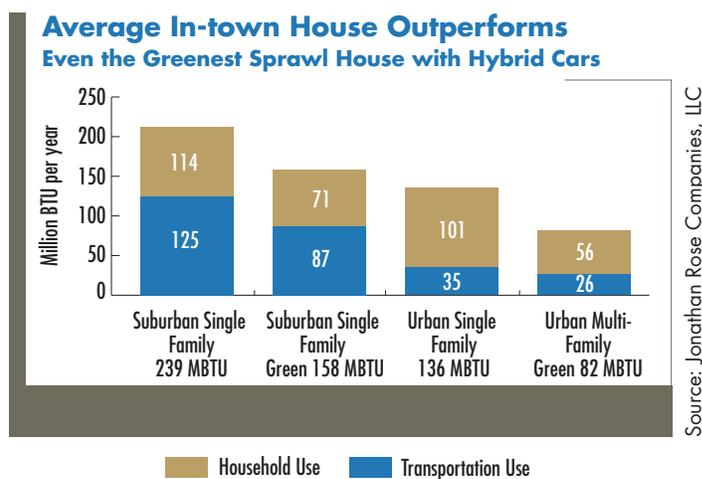
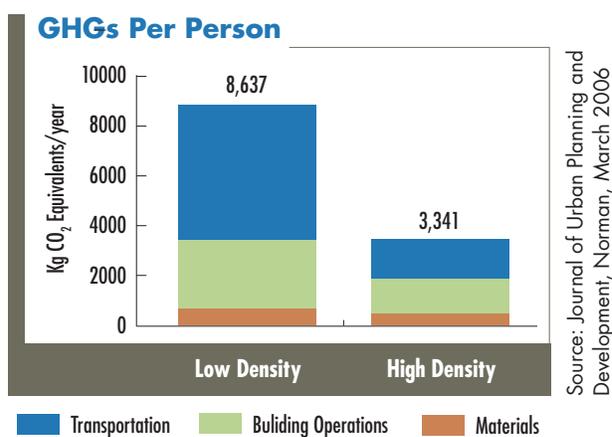
Recessionary economic trends also argue for expanded TOD initiatives. The Commission recommends that the MTA strengthen all efforts to promote the environmental, economic, and lifestyle benefits of transit access to local communities, developers, legislators, and officials. Numerous studies, including those cited in this report, prove the positive correlation between TOD and property values. Local transit access widens employment opportunities, links commercial centers, reduces family fuel bills and helps create the livable, walkable communities that homebuyers increasingly seek.

The Commission sees a prime opportunity for the MTA to take ownership of what many refer to as the "last mile" problem. The MTA should apply its resources and regional overview to eliminate the remaining home-to-destination gaps in the regional transit network through feeder/distributor corridors, which includes feeder service (home to station), distributor service (station to employment centers), light-rail, bus rapid transit, shuttle service, bike routes and bike facilities, and other transit modes.

Left: Metro-North is leading the Be in Beacon project that is encouraging transit oriented development near Beacon Station through a partnership with the State of New York, Dutchess County, the City of Beacon, and other stakeholders

Public policy trends also look favorable for expanded Smart Growth and TOD initiatives. From the Obama Administration to state and local governments, a renewed emphasis on economic stimulus, infrastructure, and sustainability all play to the MTA's strengths. In pursuing TOD projects with public officials and local stakeholders, the MTA brings many powerful tools and incentives to the table. The MTA now has a portfolio of successful TOD projects, extending from New York City boroughs to Long Island suburbs and Hudson Valley communities. All involve successful, long-term collaborations with multiple stakeholders. Examples include recent partnerships in Yonkers, Tarrytown, Beacon, Hudson Yards, the Atlantic Avenue hub, and TODs and downtown revitalizations with several Long Island communities.

Given these trends, the Commission sees excellent opportunities for the MTA to leverage the proven economic, environmental, and lifestyle values of transit-oriented development through federal, state, and local partnerships.



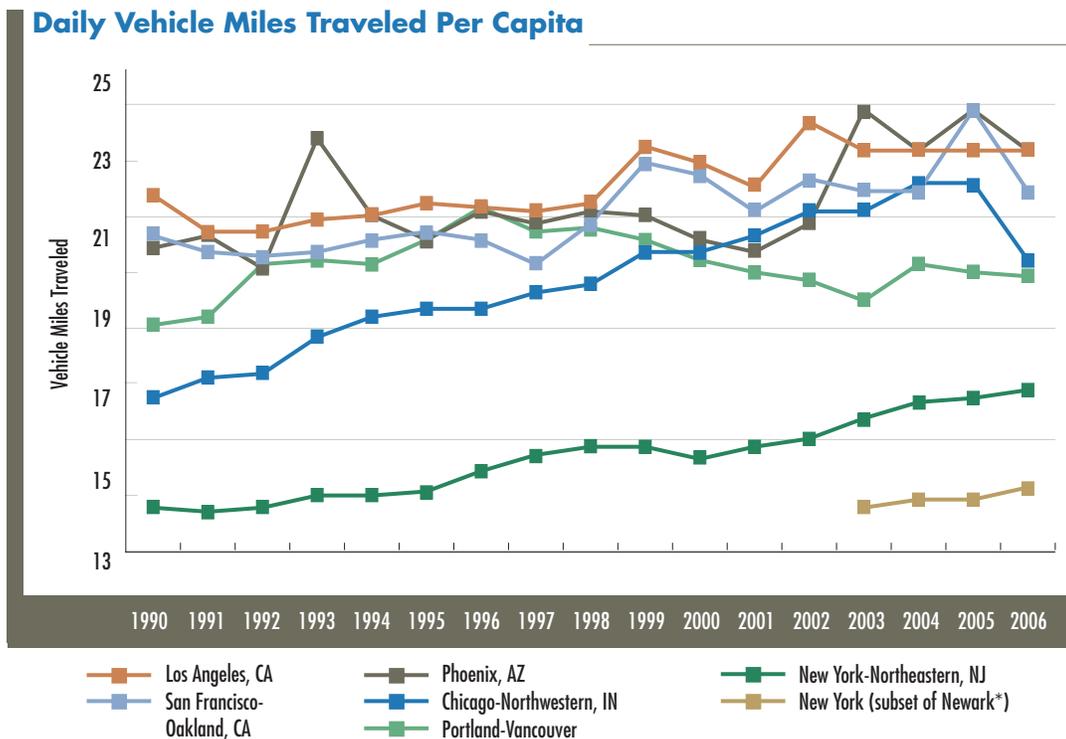
Smart Growth

For half a century the U.S. enthusiastically built up its automobile infrastructure. Today we are choking on our success. Decades of auto growth and transit disinvestment have produced oil dependency, global warming, infrastructure strains, and regional sprawl. Smart Growth is the name given to a nationwide response by urban planners, architects, developers, communities, environmentalists, and grassroots organizations. It seeks to freeze sprawl through concentrated, pedestrian-friendly development. Groups like Smart Growth America measure “sprawl effects” using systematic variables. By planning more compact, mixed-use environments with green space and transit links, Smart Growth increases economic viability while decreasing a region’s energy use and ecological impact. It also encourages more livable towns and cities. For many areas of the country Smart Growth means Transit Oriented Development (TOD), with a focus on pedestrian and bike-friendly transit access, downtown revitalization, and community links. See additional information on Smart Growth at www.smartgrowthamerica.org and at www.reconnectingamerica.org.

BASELINE

The MTA system covers a 5,000-square-mile area fanning out from New York City through Long Island, southeastern New York State, and southwestern Connecticut with approximately 15 million residents. The metropolitan region contains varied geography and nearly every type of development pattern, from some of the world’s highest density, mixed-use development in the center of Manhattan to nearby suburbs, small towns along the Hudson, Long Island and Connecticut suburbs, and dispersed housing in upstate New York and Connecticut. Within this service area, the MTA system provides some 8.5 million passenger trips daily, removing an estimated 3 million automobiles from the roads each day. More information on the MTA region and related topics may be found at www.mta.info.

Comparison of Daily Vehicle Miles Traveled (VMT) Per Capita In Large U.S. Cities*



Due to the high-density, transit-based development in the New York metropolitan area, New York City has the lowest (most favorable) vehicle miles travelled (VMT) of all large U.S. cities.

*U.S. Federal Highway Administration, Highway Statistics, Table HM-72, "Urban Areas-Selected Characteristics," 1990-2006 and HPMS Historical Data Spreadsheet, NY DOT and Annual Estimates of Resident Population US, NYS and Counties April 1, 2000-July 1, 2007.

TRANSFORMATIONAL RECOMMENDATIONS

Recommendation 1. Capture Two-Thirds of Additional Vehicle Miles Traveled (VMT) in the MTA Region

The MTA should work collaboratively with New York State, Connecticut, counties, cities, local communities, and other partners throughout its service region to create the conditions that will enable the MTA to capture two-thirds of all additional vehicle-miles traveled (VMT) between 2009 and 2030. These additional trips would be taken on the MTA's transit network rather than on the metropolitan road network. The MTA should identify and research the best practices that will advance this goal. Clustering residential and commercial development around the MTA network will not only achieve environmental benefits, it will also expand the lifestyle choices of residents and newcomers. The MTA, in collaboration with its governmental and local partners, should work to create communities that reduce automobile usage, encourage pedestrian and bicycle travel, and enable the development of households and businesses with lighter environmental footprints.

The Two-Thirds Target For Greener Regional Growth

The MTA's greatest contribution to sustainability comes directly through the "mode shift" from single-passenger automobile traffic to rapid transit. This shift, in turn, brings a significant net decrease in regional greenhouse gas emissions and other air pollutants through denser development that allows pedestrian, bicycle, and other non-automotive travel, while also reducing traffic congestion. For the MTA the most effective way to promote this mode shift is by capturing shares of new growth, both in increased commuting and in green community development. For that reason, the Commission recommends that the MTA seek to capture two-thirds of all new growth in both categories by 2030. That means capturing two-thirds of the additional vehicle miles traveled (VMTs) in the MTA service area between now and 2030. It also means working with public and private partners. The MTA should foster conditions so that two-thirds of all new development through 2030 is within a quarter-mile to a half-mile of MTA bus or rail stations.

Recommendation 2. Cluster Two-Thirds of New Development Near MTA Access

The MTA, in collaboration with New York State, New York City, the State of Connecticut, suburban counties, and local communities, should encourage the clustering of two-thirds of new residential and commercial development in its service region within a quarter-mile to a half-mile of MTA network access. The MTA should employ its geographic reach, influence, and expertise to assist communities in establishing greener land-use patterns throughout its service area. Eliminating gaps between residential areas and the transit network will allow the MTA to "capture" additional regional development. Acting as a consultant to local communities, the MTA should identify routes for station feeder systems, identify links between transit, residential neighborhoods, and employment centers, and improve synchronization of bus and rail schedules to optimize transit access.

A Look at the California Model: SB 375

Few ideas make as much "green sense" as smarter links between transportation and land development. That's the aim of California's new SB 375. The law provides incentives for development patterns that reduce driving and GHGs. It builds on existing law that requires all regional transportation plans to include a development plan. It then uses that development plan to achieve regional GHG reduction targets set by the region's air quality regulatory agency, the California Air Resources Board (CARB).

The law requires CARB to set regional GHG reduction targets. It then adds new smart growth incentives to the Regional Transportation Plan (RTP); new land use policies to decisions that implement a Sustainable Communities Strategy, new modeling provisions to account for the transportation impacts of land use decisions, and a new provision for determining the regional housing needs consistent with the Sustainable Communities Strategy.

Recommendation 3. Position and Promote Transit as a Climate-Stabilization Strategy

While the role of energy-efficiency and renewable-energy sources in reducing GHGs is now widely understood, the powerful greening effect of transit systems is not. Transit dramatically reduces GHGs by reducing automobile VMTs and promoting more clustered residential and commercial development. The MTA, in collaboration with the American Public Transportation Association (APTA), should intensify its efforts to educate legislators, regulators, industry leaders, and the public on the role of a major transit system like the MTA as a leading climate stabilizer – what experts call a climate-stabilization wedge.

Recommendation 4. Take Ownership of the “Last Mile” Conundrum

Using its unique overview of regional transportation, the MTA should take the lead in closing the “last mile” transportation gap between residential locations and final rider destinations. The MTA should help localities identify more feeder/distributor corridors linking homes to transit hubs through feeder service (home to station), distributor service (station to employment centers), light-rail, bus rapid transit, shuttle service, bike routes, and other transit modes. An opportunity to demonstrate this exists in establishing a public transportation link between Metro-North Railroad’s Port Jervis line, Stewart Airport, downtown Newburgh, and the City of Beacon’s waterfront and train station. Successful MTA network examples of this include Metro-North Railroad’s Hudson Rail Link feeders/ferries and a station-based rental car program. Examples at Long Island Railroad include synergies with MTA Bus at the Mineola Intermodal Center and elsewhere.

Recommendation 5. Link Land Use and Transit Funding through State Policy and Legislation

The Commission sees an overwhelming need and opportunity for state policy and legislation that links land use and transportation. The MTA should work diligently with New York State to implement policy and enact legislation similar to the recently passed California SB 375. Such policy and legislation will reduce GHGs in New York State by directly linking commercial and residential development with air quality goals and transportation resources.

NEAR-TERM RECOMMENDATIONS

Recommendation 1. Support TODs and Increase Trip Capture through System Extensions

The MTA should work with state and local partners to expand access with intermodal transportation services, including such options as feeder service (home to station), distributor service (station to employment centers), light-rail, bus rapid transit, shuttle service, bike routes, and other transit modes. The Commission recommends that the MTA examine the potential benefits of increasing service on currently underutilized rail lines and of establishing bus rapid transit which can feed into TODs or station hubs. Examples are listed below by way of illustration. The following list provides a guide to assets in the MTA region that could be used to pursue smart growth and TOD.

Possible TOD and Smart Growth Initiatives

- Reactivation of the Maybrook Branch, which connects the Metro-North stations of Beacon (Hudson line), Brewster (Harlem line), and Danbury (New Haven line)
- Extension of Metro-North’s Port Jervis line to Stewart Airport, downtown Newburgh, and Beacon
- Integration of public transit components in plans for the Tappan Zee Corridor along with TODs in the corridor (BRT, LRT, and a Metro-North line)
- Integration of public transit components into the Nassau Hub project, including the examination of a reactivation of the Long Island Rail Road Garden City spur into the hub
- Integration of public transit components into the Pilgrim State project
- Construction of the third track on the Long Island Rail Road’s Main Line
- Construction of double track from Farmingdale to Ronkonkoma on the Long Island Rail Road’s Main Line
- Construction of double track on the Port Jervis line and the expansion of the line’s rail yard facilities west of the Hudson River
- Establishment of a green bus feeder corridor connecting Beacon Station to Main Street, Beacon, and other key TOD locations
- Establishment of a ferry service from Glen Cove to Manhattan
- Establishment of Bus Rapid Transit (BRT) corridors in all MTA sub-regions – New York City, Long Island, Westchester/Putnam/Dutchess counties, Rockland/Orange counties, and Connecticut. Potential BRTs could include: Nassau Hub (Nassau County), Route 110 corridor (Suffolk County), Central Avenue (Westchester County), Hylan Boulevard (Staten Island-Brooklyn), Nostrand Avenue (Brooklyn), 21st Street (Queens), and Greenwich-Norwalk (Connecticut)
- Establishment of Greenport to Riverhead (Long Island) BRT
- Reactivation of the Staten Island North Shore line (rail or BRT)
- Reactivation of the West Shore line in Orange and Rockland counties

The Commission recommends that the MTA agencies make a thorough examination of underutilized capacity throughout the network to identify potential projects and investments that could eliminate choke points and increase capacity.

Recommendation 2. Develop a Systemwide TOD Program

The MTA should develop a systemwide TOD program that articulates the principles and guidelines for TOD project development and should assist communities, developers and stakeholders throughout the region in planning these community-based initiatives. The program should proactively identify current and potential sites for TOD planning and development with smart-growth initiatives throughout the MTA service region. Each agency must be provided the funding and resources to advance this project. NYCT and Long Island Rail Road should develop in-house smart growth/TOD units.

Recommendation 3. Ensure Highest Standards of Sustainability

The MTA should continue to work with communities, developers, and others to ensure that TODs meet the highest standards of sustainability with respect to energy and water conservation, building materials and project design, and mitigation of and adaptation to the anticipated effects of climate change.

Recommendation 4. Develop a TOD Handbook

The MTA should immediately develop a handbook and online guide to support and articulate the principles and guidelines of TOD project development. This document and online resource will provide information, guidance, and contact information that will assist local officials, developers, and stakeholders throughout the region in planning community-based TOD initiatives. This guidance will also lay out the expectations and/or requirements for TODs to meet high standards for green design and CO₂ reduction goals, to adapt to the anticipated impacts of climate change, to use renewable energy, to recycle materials, and to access the full range of incentives available from NYS agencies such as NYSERDA.

Recommendation 5. Work with the New York State Smart Growth Cabinet

The MTA should work with Governor Paterson's Smart Growth Cabinet to examine the TOD opportunities associated with all transportation projects under development, including the Tappan Zee Bridge/I-287 Corridor Mass Transit project, the Stewart Airport expansion, Long Island Rail Road's Main Line Corridor Improvements, and East Side Access. The State and the MTA should collaborate to make available the capital necessary to enhance the viability of these projects. Additionally, more partnering between NYSDOT, the Empire State Development Corporation, and Metro-North Railroad/Long Island Rail Road will be essential to advance regional TODs.

Together, the MTA and New York State should establish a process for providing the capital investments needed for MTA-supported TODs. These can include structured parking, bike access, shuttle buses, and related facilities at or near transit stations that can facilitate TODs, non-auto station access, and enhanced transit usage. The following list provides some illustrations:

Potential TODs in the MTA service region.

- West-of-Hudson: Metro-North service area: Harriman, Middletown, Pearl River, Spring Valley, Nanuet, Owen Mills (in connection with Stewart Airport and downtown Newburgh)
- East-of-Hudson: Metro-North service area: Beacon, Harrison, Tarrytown, Ossining, Croton Harmon, Cold Spring, Peekskill, Poughkeepsie, Purdy, Mount Vernon, Tenmile River
- Connecticut: Metro-North service area: Stamford, Georgetown-Redding, West Haven, New Haven
- Long Island Rail Road service area: Ronkonkoma, Port Jefferson, Stony Brook, Bellport, Hicksville, Farmingdale, Freeport, Central Islip, Hempstead, West Hempstead, Glen Cove, Flushing, Mineola, Huntington, Babylon
- New York City service area: Morris Park, Sheepshead Bay, St. Albans, Williams Bridge, Station/Gun Hill Road, University Heights Station/Fordham Road, Mott Haven/E. 149th Street, Bedford Park Yards, Wakefield Station/E. 241st Street, Melrose Station/E. 162nd Street, Woodlawn Station/E. 233rd Street

Recommendation 6. Increase Passenger Access at Stations

To increase the capacity of train station parking lots, the MTA should expand the investment in parking programs and station access, adding spaces if possible, working closely with NYSDOT and NYS; the MTA should create more Park-and-Rides with feeder and connecting services. Incentivizing car pooling would also be beneficial, and the MTA should consider dedicating at least 5 to 10 percent of the best spaces for car-pool use only. Additionally, the MTA should consider the development of intermodal parking facilities at train stations. These facilities will not only increase parking availability, they will coordinate transportation services, improve pedestrian/vehicular circulation and improve parking management. The MTA should also review parking pricing as part of broader incentive strategies and expand facilities for those who want to bike to stations. Any investment in parking programs and station access should be part of a general strategy to discourage further sprawl.

Recommendation 7. Improve the Integration of Stations into Communities

The MTA should develop better integration of stations into the surrounding communities through improved facilities, bike and pedestrian access, and other station access plans. Train-to-trail linkages should be enhanced through collaboration with the New York State Office of Parks Recreation and Historic Preservation and local and regional organizations. The MTA should explore a range of intermodal transportation services and links along MTA feeder corridors, including light rail, bus rapid transit, streetcars, bike facilities, and ferries. It should work with public or private partners to provide bus or other transit services linking stations to suburban villages or hamlets not on train lines, helping to increase more compact, efficient development.

Recommendation 8. Support Bicycles as a Transit Link

The MTA should play a prominent role in promoting cycling for commuters and recreational cyclists. The inclusion of bicycling as a mainstream mode of transportation has become a national objective, and the Commission recommends that it become a priority of the MTA.

Bicycles as a Transit Link

To encourage and facilitate the use of bicycles as part of the MTA passengers' travel from point of origin to the final destination, the Working Group recommends that the MTA:

- promote and facilitate bike parking at stations;
- promote and facilitate bike transport on trains and buses;
- promote and facilitate bike storage at MTA work sites;
- provide consolidated and easily accessible bike information; and
- act as an advocate and partner in promoting the use of bicycles as a sustainable link in urban and regional transit.

See additional information on Biking as a Transit Link, prepared by Ned Sullivan, George Beane and the Smart Growth/TOD Working Group, in the Appendix of this report.



TOD Case Study: NJ Transit Village Initiative

The Transit Village Initiative (TVI) is a program sponsored by New Jersey Transit and the New Jersey Department of Transportation (NJDOT). It uses a smart-growth approach to redeveloping and revitalizing communities near transit facilities and making them more appealing places for people to live, work, and play, thereby reducing auto dependence and congestion and improving air quality. Under the TVI, municipalities must apply to a Transit Village Task Force for Transit Village designation. Municipalities selected for Transit Village designation are those that have demonstrated a commitment to revitalizing and redeveloping the area around their transit facilities as a mixed-use neighborhood with a strong residential component. Much of the planning takes place prior to application. The Transit Village Task Force is comprised of 11 statewide agencies, including NJ Transit and NJDOT. Selections are made by the Task Force based upon a specific set of criteria, which includes:

- A commitment for growth in jobs, housing, and transportation
- A transit facility rail or light rail station, ferry terminal, a bus hub or bus transfer station
- Vacant land and/or underutilized or deteriorated buildings within walking distance of transit where redevelopment can take place
- An adopted land-use strategy (a redevelopment plan or zoning ordinance) for achieving compact, transit-supportive, mixed-use development within walking distance of transit
- A strong residential component

Ready-to-go projects:

- Pedestrian and bicycle friendliness
- Transit station as the focal point of the community, which can use its station plaza as a gathering place for community activities such as festivals, concerts, public ceremonies, and farmers' markets
- Station area is in a station area management plan, in a special improvement district (SID), or part of a Main Street New Jersey designation
- Maximizing the appeal of transit through special features such as concierge service
- Commuter parking for residents and non-residents
- Support local arts and culture
- Support the historic and architectural integrity of the community
- Incorporate affordable housing

The benefits of Transit Village designation include a commitment from the State of New Jersey to the municipality's vision, coordination among the various state agencies that comprise the Task Force, priority funding from some state agencies, technical assistance, and eligibility for grants from NJDOT's \$1 million annual funding. Additional TOD Case Studies are located in the Appendix of this report.

ACHIEVEMENTS TO DATE

The MTA has a long history of investing in mixed-use development around transit stations – the most famous example being Grand Central Terminal, where the railroad created the swath of prime real estate along Park Avenue by leveraging the air rights over the terminal's rail infrastructure – a model that the MTA can continue to replicate today.

A more contemporary example is the "Be in Beacon" project, a smart-growth partnership between Metro-North Railroad and the City of Beacon on the Hudson Line. The project arose out of collaboration between Metro-North, New York State, Beacon and 20 other stakeholders, facilitated by the railroad. With its riverside setting and a burgeoning arts community, this waterfront town is undergoing a renaissance in which Metro-North is playing a key role. In October 2007, Metro-North issued a Request for Expressions of Interest (RFEI) relating to the "Be in Beacon" TOD projects, along with eco-friendly housing, riverfront development, and more. Other TOD projects in various stages of development by Metro-North or other partners include Harrison, Harriman, the Town of Amenia, Poughkeepsie, Mount Vernon, and several opportunities in the Bronx and suburban counties.

The Long Island Rail Road has also extended its involvement in local smart-growth initiatives. Using a \$25 million Federal Transit Administration grant, the LIRR approached several townships with plans for intermodal projects. The result was a revitalization plan for Mineola centered on a new intermodal transit facility on the LIRR right-of-way – a short walk from the LIRR train station. Designed, scaled, and sited to enhance the downtown area, the facility earned several local smart-growth awards. The project also included plans for local business development, helping to concentrate growth around the LIRR station. In other projects, MTA and LIRR are working with officials from the Town of Brookhaven on a mixed-use, pedestrian-friendly commuting hub at the Ronkonkoma station. In addition, the MTA is partnering with the New York State Housing Finance Agency to identify TOD projects throughout Long Island, all aimed at concentrating future growth near rail and/or transit hubs.

Other Current Initiatives at the MTA

At the instigation of the MTA and the Commission, the MTA and Governor Paterson's Smart Growth Cabinet have established a partnership and package of incentives to support TOD development. For additional Smart Growth/TOD information, see Appendices. Additionally, the MTA has established a single point of contact on its website www.mta.info/environment for communities in the MTA service area that express interest in Smart Growth/TOD projects.



Materials Flow

Greening procurement, minimizing waste, and maximizing savings

Given the scale and diversity of its operations, the MTA must procure and dispose of thousands of tons of material goods each year. Collectively, the MTA agencies purchase some \$2 billion worth of products and services annually in an operating budget of about \$11 billion. In addition, the MTA must manage its customer-generated waste, process-generated waste, office waste, and construction and demolition debris. To improve its materials flow oversight, the MTA should link the procurement and disposal ends of its operations into a unified tracking process. It must then reduce both its intake of raw materials and its waste, reuse materials wherever possible, and recycle increasing percentages of the total flow.

On the procurement end, the Commission sees new opportunities to integrate and expand the MTA's existing green programs into a more unified system. The MTA is in the process of developing an All-Agencies Green Procurement Action Plan for precisely such purposes. In addition to reducing waste at the front end, green procurements can achieve multiple aims. These include screening toxins, reducing carbons in manufacturing and delivery, minimizing packaging, supporting green industries, services, and regional suppliers, and much more. In the bigger picture, green procurement also extends to the innovative materials used to lighten the MTA rolling stock or enhance green building designs and energy-efficient equipment, fixtures, and vehicles. To unify these multiple aims, the MTA should adopt a lifecycle analysis (LCA) process to help staff identify, price, and track sustainability value in agency purchasing decisions. Once implemented, these steps should ultimately produce sizeable savings.

From a sustainability perspective, all procurements are future disposals. On the waste management and disposal end, the MTA already runs a variety of reclamation and recycling programs. These range from green office policies and site-separation of station waste to MTA Capital Construction's reuse of worksite construction materials and excavated soil. The Commission believes that the MTA can capture more value at the disposal end, both through material reuse within the MTA and from salvage revenues. In a good economy, salvaged scrap at NYCT can generate some \$3.7 million annually and the MTA should be able to tap emerging markets in scrap, oils, and organic waste energy for additional revenues. To manage its large volume of station

waste, the MTA now uses both post-collection and source-separation recycling. The Commission recommends that wherever possible the MTA transition to source-separation bins, which have the added benefit of encouraging New Yorkers to recycle. Likewise, the MTA should take advantage of its wide public reach to promote recycling and other green habits among its customers and employees.

Measuring, tracking, and greening a materials flow on the scale of the MTA's is inevitably an ongoing task. To provide perspective, the Commission surveyed other transit agencies and extracted best practices for green procurements and disposals from two major agencies, London and Toronto, both comparable in function to the MTA and known for high environmental standards. The survey confirmed that the MTA currently equals the London and Toronto systems on many green practices and it identified some key areas for improvement. In transit agencies, as in all large organizations, what gets measured, gets managed. By better quantifying its materials flow, the MTA will have a powerful tool for reducing waste, adding revenues, and managing one of the 21st century's most important sustainability issues.

Scrap Commodity Management and Recycling

New York City Transit's Asset Recovery Unit manages a program that provides for the environmentally responsible recycling of all NYCT's retired or obsolete buses. When buses are ready for retirement, they are sent to the Gershow Recycling Center in Medford, New York. At this center, MTA buses are first cut into pieces by giant industrial shears, and then placed on a conveyor belt leading up to a recycling machine. This recycling machine consists of 16 1,100 pound hammers which rotate on a drum and render the bus into silver-dollar size pieces of metal. As the crushed material travels on the conveyor belts, a series of magnets and vacuum lines separate the ferrous metal, which is later sold on the scrap market, from the non-ferrous metal, plastic, wood, and fiberglass materials.

Reduce...Reuse...Recycle

New York City Transit recycles tons of scrap each year, including heavy steel, copper, brass, scrap rail, subway car wheels, motors, generators, lead acid batteries, even whole subway cars and buses. In 2007 alone, NYCT recycled 396,248 gallons of waste oil and sold 17,735 tons of scrap material for over \$3.7 million.



"Procurement and waste disposal

are not discrete and independent activities but rather parts of an integrated whole. Adopting this perspective at the MTA will result not only in a range of environmental benefits, but also create opportunities for significant cost savings."

- Marcia Bystryn, president, New York League of Conservation Voters
Chair, Materials Flow Group

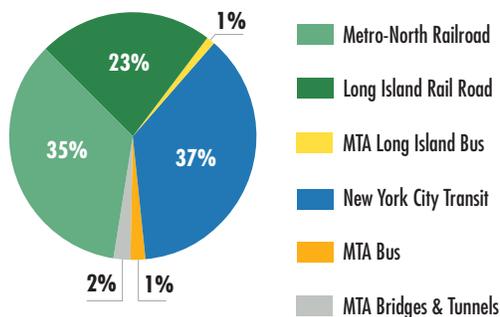
BASELINE

The MTA, like its peers, currently lacks the capacity to provide baseline data for procurements and disposals systemwide. The MTA agencies do run various “green office” and other procurement programs relating to sustainability. The MTA’s All-Agencies Procurement Council, in which agency representatives meet monthly to discuss costs, vendors, and other procurement issues, has taken the lead in sharing and expanding its existing green ideas and opportunities.

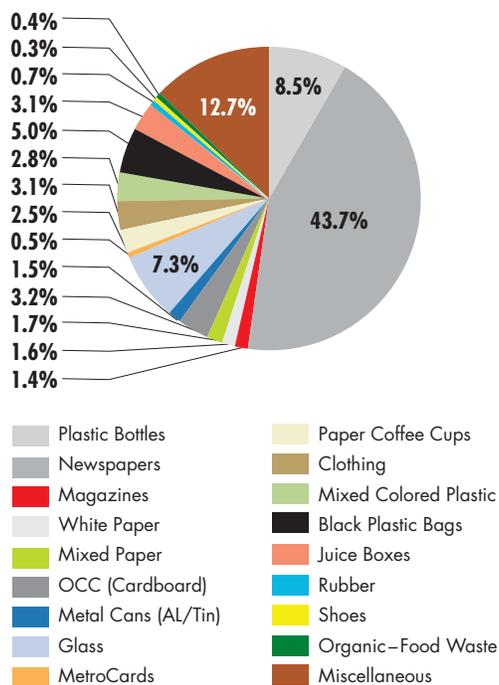
In 2006, the MTA established a baseline for some areas of materials flow, focusing on water, hazardous/commercial waste, railroad ties, paper, batteries, fluorescent bulbs, and scrap metal. From this analysis, the MTA determined that all transit agencies are purchasing Energy Star® equipment and several have more extensive green procurement plans underway.

On the disposal side, the MTA runs a large number of successful recycling, salvage, and other programs through its operating agencies. All MTA transit and rail agencies manage various types of recycling, reclamation, and scrap salvage programs.

Waste Generated at MTA Agencies 2006¹



Sampling of MTA NYCT Subway Waste 2008²



Handling Transit’s Industrial Waste

Charged with clearing and/or recycling transit’s nonhazardous industrial waste, the NYCT Asset Recovery Unit removed more than 1,626 tons of nonhazardous industrial waste in 2007, including spent chemicals, oily rags, ether canisters, paint and paint booth residue, contaminated soil, and sludge from subway track drains. The team also recycled nearly 143,000 gallons of antifreeze from buses and nonrevenue vehicles in 2007. The unit also helps extract value from other MTA waste, including commercial refuse, scrap commodity waste, and more.



¹Baseline waste data is based on estimated waste and includes significant gaps as no formal agency-wide waste management tracking system is currently in place. Metro-North’s estimated waste includes generation from Grand Central Terminal, where the numerous tenants add to the solid waste volume. Estimated 2006 total was approximately 252,000 tons.

²The above MTA NYCT subway waste categorization is based on a sample of subway waste taken in summer 2008 (resulting in the collection of 75,260 lbs of refuse). NYCT subway’s refuse profile is subject to numerous factors and can vary day by day.

TRANSFORMATIONAL RECOMMENDATIONS

Recommendation 1. Quantify and Track the MTA's Materials Flow

The Commission calls on the MTA to develop a unified baseline of the materials flow across all agencies. This baseline should facilitate the development of a system for tracking and managing systemwide materials flow information, including procurement, waste disposal, and recycling. The system should eventually connect MTA procurements at one end with MTA waste recycling and disposal at the other, treating procurement, waste management, and recycling as parts of an integrated whole. The procurement goal should be to classify, green, lighten, minimize, and recapture a significant percentage of the MTA's annual materials procurements. On the disposal side, the goal should be to quantify and track MTA waste in four categories: (1) customer-generated waste, (2) process-generated waste, (3) construction and demolition debris, and (4) office waste. By developing consistent metrics and steadily merging the procurement and disposal sides, the MTA will evolve a valuable system for reducing costs, recapturing materials, and greening its entire operation.

Recommendation 2. Green the MTA's Procurements and Operating Budget

To begin action on Recommendation 1, the MTA should review the nearly \$2 billion spent annually on material and service procurements, identifying purchase categories that can be greened, reduced, or recaptured. To further systemize its present green programs, the MTA should plan to unify policies and practices as recommended above. The plan should incorporate ongoing programs, while further specifying green materials, purchasing practices, performance standards, and contracts.

The All-Agencies Procurement Council and the new MTA Businesses Services Center are natural places to begin this process. The plan should include:

- A unified electronic system for gathering data for convenient procurement tracking and an annual Sustainability Progress Report. Wherever possible, the plan should convert projects into units of "carbon avoidance," using the SROI model presented in this report.
- An MTA Environmental Champions Program, in which each MTA facility or department designates a volunteer Environmental Champion responsible for sustainability education, outreach, and motivation. This program could be coupled with employee incentives, including awards for green ideas and achievements.

Recommendation 3. Institute a Systemwide Green Lifecycle Analysis (LCA) System to Manage Materials from Procurements Through Disposal

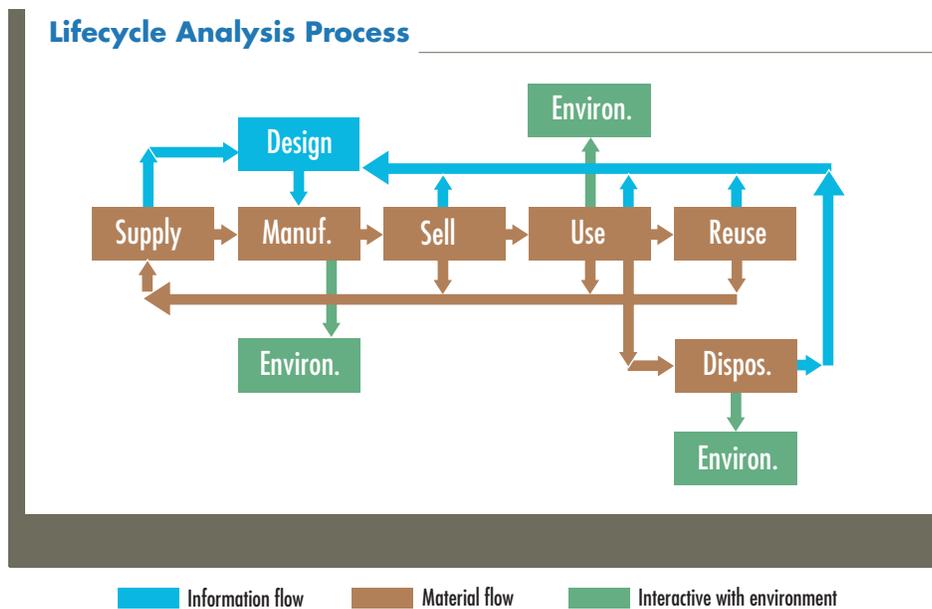
In accordance with the previous recommendation, the Commission suggests that the MTA institute a Lifecycle Analysis (LCA) system to manage materials from procurements through disposal. This LCA system will allow the MTA Agencies to accurately price and justify green procurement opportunities. The LCA would rationalize costs over the full lifecycle of the materials, products, or services, taking account of designated sustainability benefits. Examples include the lower maintenance cost associated with LED lighting or the lower CO₂ output from rail shipping of excavation soil. The LCA plan should include:

- Software models for efficient tracking and analysis, along with examples of current LCA programs. The MTA could use an off-the-shelf quantitative lifecycle software program (such as CMLCA, BEES, and others) or environmental management systems (such as the ISO 14044/14048 standards) to develop its own LCA system. Currently NYCT's CPM is ISO 14001 Certified.
- Develop an LCA Scoring System: Environmentally Preferable Purchasing (EPP) and Product Evaluation Model. The model would include six procedural steps: (1) compare off-the-shelf products categorized by product end-uses on a lifecycle basis, (2) determine product categories and subcategories, along with weighted decision criteria, (3) identify candidate products for the EPP list evaluation, using a range of screening tools, (4) assign positive procurement scores within the EPP+ lists, (5) gather information and score candidate products, and (6) promote the use of EPP+ lists.
- Develop a method for identifying and quantifying cost savings – both dollar savings and carbon avoidance savings – from green initiatives.

Developing LCA for Transit Systems

Lifecycle Analysis (LCA) assesses products all the way from raw materials through manufacturing, transportation, and disposal to determine the total environmental and CO₂ effects. An LCA process can be found in the subsections of the ISO 14000 environmental management standards. ISO 14040:2006 provides the definitions, principles, and framework for LCA. ISO 14044:2006 specifies requirements and guidelines. The ISO standards offer a good starting point for the MTA's LCA program. Additionally, a survey of transit agencies undertaken by the Commission identified a new transit-based LCA plan with 14 goals introduced by the Toronto Transit Commission (TTC) in July 2008. The MTA is reviewing both the ISO 14000 plans and the new TTC plan to begin developing an LCA plan that can be used by other transit agencies as well.

- Develop a form for requesting “end-of-cycle” plans from MTA suppliers and contractors.
- Develop an extension or adaptation of the LCA plan for rating MTA facilities, as recommended in the Facilities chapter of this report.
- Develop special guidelines based on materials analysis used by the MTA Smart Fleets Task Force to reduce car weights and traction power, as described in the Energy/Carbon chapter of this report. Such analysis of vehicle materials and components can eventually be integrated into the overall materials flow plan.



Source: <http://www.congex.nl/08c13/presentations%5Cpde2008-30-vanExel.ppt>.

Recommendation 4. Seek More Revenue and Energy Potential from MTA Waste

As it develops a unified materials baseline, the MTA should identify more opportunities to turn parts of its waste stream from a liability into an asset. The MTA should enhance its efforts to expand markets for its waste and pursue the potential for generating revenue from customer and industrial waste. The Commission also recommends that the MTA explore opportunities to turn its non-recyclable organic waste into energy by using Anaerobic Digester Gas (ADG) or other systems to generate electricity on a renewable basis, possibly in partnership with NYSERDA or other partners.

Recommendation 5. Flex Market Power to Promote Green Goods

The MTA should flex its market power to spur the creation of green goods and services in New York State, Connecticut, and the mid-Atlantic states. The MTA should procure fleets, equipment, and materials with energy-efficient technologies to aid in the reduction of CO2 emissions and hazardous materials and to fuel innovation in the development of sustainable technologies. This would extend to rail, bus, and car fleets, as well as to lighting fixtures, water appliances, and other equipment. The MTA should also use its market power to demand the reduction of unnecessary packaging in the products and materials it purchases. As a large regional consumer, the MTA’s procurement criteria can help drive green production throughout the mid-Atlantic region.

Green Ideas from MTA Employees



"We've done a lot of interesting work on investigating new products and materials to make rolling stock into more sustainable, smart fleets. The trick is lightweighting subway cars to reduce traction power without compromising safety. The MTA needs to stay out front on this kind of materials research that will allow us to reduce our energy usage and carbon emissions."

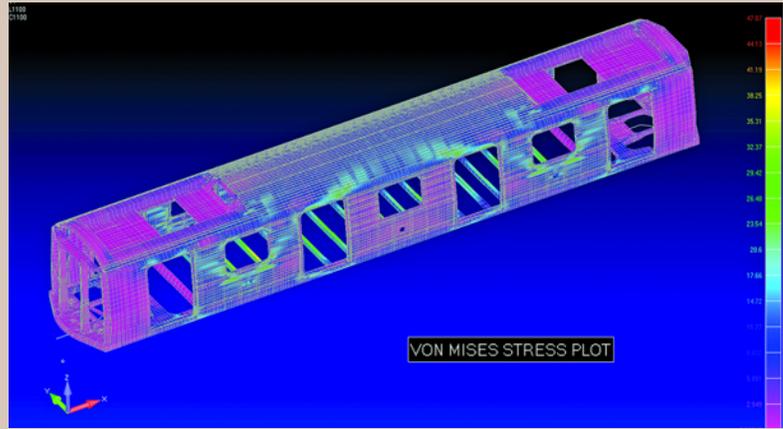
— Gene Sansone, New York City Transit

“What Gets Measured Gets Managed” – The MTA Green Action Plan

The MTA’s recently conceived Green Procurement Action Plan will identify material cycles with the greatest measurable impact on the MTA’s ecological and carbon footprints. To be launched by the end of 2009, the initial plan will aim to reduce consumption of office paper, toner, plastics, and ink and identify recycled and other green products. The Plan will also provide guidance for standardizing and managing green office policies across all MTA agencies. It will help procurement departments define terms, evaluate products, and justify price premiums for greener products.

Materials Flow Goes Beyond Procurement and Disposal

Sustainability planning depends on analyzing many interrelationships. Materials analysis, for example, figures in the ongoing research projects of the MTA Smart Fleets Group, where lighter materials can help reduce traction power, the MTA's largest energy cost. While it is primarily covered under traction power issues, the Smart Fleets projects can also be integrated into systemwide materials tracking.



Source: <http://www.sumitomometals.co.jp/e/osakasteelworks/syarin/index.html>

Summary of Lightweighting Technologies	Mass Impact (kg)	Fleet-wide Annual Electrical Demand Impact (kWh)	Cost Per 10 Car Train (\$k)	Payback Period (Years)	Technology Maturity	Ease of Implementation
One Free Axle on 1 non-motorized truck replacing OSMES (speed measurement)	3636	3,708,720	0	0	●	◐
Floor pans stamped on R160 (540lbs) vs. fabricated on R143 design (600lbs)	282	1,036,611	0	0	●	◐
Eliminate OSMES, brackets and equipment	327	763,996	0	0	●	◐
Eliminate flip up seats	164	409,268	0	0	●	●
Eliminate unnecessary structural redundancy: secondary center collision posts (2 per A-car)	327	333,785	0	0	●	○
Eliminate 1 of 2 coupler adapters on all NMTs units	200	254,908	0	0	●	●
Advertisement card clips – changed from metal to plastic	45	53,631	0	0	●	●
Investigate using Giga Cell Battery with alternative battery box	1658	7,514,129	4.5	0	●	◐
"Utilize single draft gear (tube style) link bar (used at B-Car link bar interfaces only) "	1189	3,988,605	1.5	2	●	◐
Corrugated Wheels / Lightweight Wheels	2545	4,491,430	5	6.4	●	◐
Composite instead of plymetal panel flooring	3118	12,546,309	15	7	●	◐
Reduction in heater grill weight	36	77,374	0.5	36	●	●
Reduce number and load on air compressor – Utilize Oilless Compressor concepts	445	2,018,598	12.5	37	●	◐
Redesign of trip cock linkage – (reduce weight from 53 lbs/truck on R142A/R143 design)	145	263,925	0.5	38	●	◐

● Highly Rated ◀▶ ○ Low Rated

NEAR-TERM RECOMMENDATIONS

Waste Management Best Practices at the TTC

The Toronto Transit Commission (TTC) currently uses its own compactor trucks and internal services to collect waste and recyclables from stations, which are then turned over to a private contractor for sorting, processing, and sales. The contractor keeps the proceeds from sales, which offsets the costs of running a transfer station and disposals. By using internal collection with offsite private sorting, TTC avoids the need for permits and other costs of maintaining waste transfers operations. Waste collections are simplified by the use of different colored plastic bags.

Recyclable and Reusable MetroCard

In keeping with Recommendation 4, the MTA should implement a Reuse/Refill Incentive Program by charging a green fee for each newly purchased MetroCard. This reusable/recyclable MetroCard could be created from 100-percent recycled polyester and constitute a potential revenue source. This program could encourage commuters to reuse/refill their MetroCards, eliminate littering of MetroCards on station platforms, reduce maintenance operating costs, and drastically cut MetroCard inventory requirements and costs. In conjunction with a vigorous public awareness campaign, this program could have a great impact on commuter behaviors.

Saving Forests One Tie At A Time



The MTA has formed a Sustainable Railroad Tie Task Force, with both Track and Procurement representatives from three MTA rail agencies to work toward increasingly sustainable railroad tie solutions. One of the types of sustainable railroad ties being introduced and field tested is made from a composite of recycled plastic, waste tires, waste fiberglass, and structural mineral fillers. Innovations in technology and MTA's adoption of them will substantially reduce the use of conventional, non-renewable railroad ties.

Recommendation 1. Adopt Waste Management Targets

The MTA should adopt robust recycling and waste management targets across agencies for its customer-generated waste, process-generated waste, construction and demolition debris, and office waste. These metrics can be developed with current agency standards and with best practices based on the Commission's survey of transit systems. Using this baseline information, the MTA can determine realistic recycling and waste minimization goals for various operations.

Recommendation 2. Introduce Source Separation of Waste in NYCT Subways

The MTA should introduce the source separation of recyclable materials in NYCT subway stations. The MTA should seek opportunities to partner with New York City and others on such programs, possibly through street-level collections by the city. The MTA should also partner with regional organizations in order to promote consistent recycling practices and ensure consistency in program design and branding to achieve greater customer recycling understanding and practices.

Recommendation 3. Reduce Inventory and Warehouse Storage

The MTA should reduce its inventory and warehouse storage needs and costs. The MTA should explore the potential for adopting an agency-wide inventory management system to reduce materials flow, costs, and energy consumption related to material management and warehousing.

Recommendation 4. Promote MTA Rider and Employee Conservation

In addition to existing programs and the recommended "Environmental Champion" program, the MTA should identify more opportunities for using its visibility and reach to promote daily conservation of water, materials, paper, fuels, and more among its millions of riders and more than 70,000 employees.

Recommendation 5. Increase Sustainable Waste Management

The MTA should continue to reduce landfill waste and reduce demand for new materials by expanding its reuse of MTA building materials and purchasing other used or recycled materials.

Recommendation 6. Minimize Materials Packaging

The MTA should continue to minimize materials packaging by revisiting procurement specifications to require alternative or reduced packaging, incentivizing reduced packaging and shipping weights among MTA vendors and contractors, and specifying a percentage reduction of packaging as criteria to evaluate procurement bids.

Recommendation 7. Encourage Use of Low-Carbon Local Materials at all MTA Agencies and by Vendors

The MTA should continue to encourage the use of low-carbon, local materials at all agencies and by vendors. Current MTA procurement statutes provide for New York State content to be given priority consideration on procurements for rail cars, buses, and other materials. Public Authorities Law Section 2879 includes provisions for tracking in-state and out-of-state vendors. However, the MTA should be more explicit in encouraging procurements that avoid the carbon and other GHG emissions associated with long-distance shipping. The same should apply to MTA contractors and vendors.

Recommendation 8. Increase the Use of Sustainable Railroad Ties

The MTA should expand the procurement of sustainable railroad ties at all rail agencies. Initial goals should include reducing the purchase of tropical hardwood ties whenever possible, prioritizing alternatives, such as oak and composite plastic. A similar policy should apply to MTA vendor contracts. To the degree that the MTA must use tropical hardwood in some contexts (e.g. in switches and in areas prone to flooding), the MTA should only procure Forest Stewardship Council (FSC) certified or other sustainably harvested tropical hardwood.

Recommendation 9. Evaluate Repair-Return-Leasing Opportunities

The MTA should evaluate the potential for increasing leased products to reduce materials flow. Vendor contracts could require recycling and reuse of materials and products. The MTA is already using this approach in the leasing of bus tires and Metro-North M2 converters. MTA should pursue this cradle-to-grave concept and expand like-leasing opportunities when feasible.

ACHIEVEMENTS TO DATE



Since MTA materials flow programs have traditionally been undertaken and managed on an agency basis, the Commission surveyed the MTA agencies on recent initiatives. Examples of notable achievements are summarized below.

- For recycling, NYCT uses both source-separation at facilities and offices and post-collection programs in stations. In 2007, source-separation recycling at NYCT facilities removed 466 tons of recyclables from over 100 locations. Post-collection at 469 subway stations yielded 8,931 tons of recyclables, nearly 50 percent of all system refuse, one of the highest recycling rates in the U.S.
- At construction sites, NYCT Capital Program Management (CPM) has implemented strict environmental and sustainability standards through its Environmental Management System (EMS), which governs energy efficiency, water and natural resources, waste and recycling, local purchasing and transport, and much more.
- Bus salvage for spare parts is underway at the Eastchester Depot in the Bronx, where spare parts and functional systems are identified for salvage before the bus is sold for scrap metal.
- Metro-North operates a source-separation recycling program with recycle bins at the majority of its stations. In addition, Grand Central Terminal collected 642 tons of newspaper from over 90 recycling bins in 2007. The newspaper is collected by an MTA recycling vendor, who pays the MTA the per-pound market rate. Metro-North is also expanding the source separation of its passenger waste at its stations.

• Since 2006, Long Island Rail Road has collected more than 6,000 gross tons of scrap using a high-rail crane equipped with a giant magnet. Mostly abandoned track rails, the scrap also includes old train wheels and axles, metal shavings, copper wire and railroad tie plates and fasteners. Metals salvaged as of 2006 brought in more than \$3 million. Long Island Rail Road is also expanding the source separation of its passenger waste at its stations.

• At its major expansion project worksites, MTA Capital Construction (MTACC) currently recycles approximately 80 percent of worksite debris, either as recycled waste or reused construction materials. MTA Capital Construction has also diverted thousands of tons of traditionally landfill-bound construction waste for recycling.

• MTA Bridges and Tunnels manages a green office and procurements program, using third-party benchmarks, such as Green Seal, EcoLogo, Energy Star, and LEED. Green product and policy standards include remanufactured toner cartridges, 100-percent post consumer waste (PCW) chlorine-free paper, double-sided printing, electronic distribution of documents, and digital filing. In 2007, MTA Bridges and Tunnels achieved a 19 percent reduction in paper usage. MTA Bridges and Tunnels also provides source-separation bins in offices, with recycle or disposal contracts for lighting refuse, batteries, computers, and other electronic equipment.

A high-rail crane equipped with a giant magnet clears scrap metal from Long Island Rail Road tracks. The sale of scrap metal salvaged by the LIRR has brought in more than \$3 million since 2006.



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Water Management

Water resources management, conservation, and protection

"As one of the world's leading transportation authorities and one of New York City's major water users, the MTA is uniquely positioned to set a global standard for innovative water resource management. By significantly reducing its use of potable water, guarding against future flooding risks, and making beneficial use of ground and storm water to run its operations, the MTA can become a sustainability leader while addressing the challenges of a warming climate and saving the authority and its customers money."

– Alex Matthiessen, Hudson Riverkeeper and president, Riverkeeper
Chair, Water Management Group

While the public is unlikely to associate the MTA with water issues, water management plays a distinct role in the authority's sustainability efforts. Given the scale of its operations, the MTA is a major consumer of the metropolitan area's potable water. Its daily operations also include pumping out groundwater to keep its track and tunnels dry. In addition, many MTA properties and rights-of-way border wetlands and waterways that serve vital ecological functions and that should be protected. The MTA must also manage wastewater and runoff from its properties and operations during intense storms, when flooding can both disrupt service and endanger local water quality by overwhelming sewer systems.

At present, MTA operations are estimated to use roughly 2.6 billion gallons of potable water per year, of which a large share, estimated between 1.2 and 1.4 billion gallons, is used in the flow process to cool NYCT subway system transformers. Washing vehicles also accounts for a significant share of the MTA's overall water use. The Commission looked at ways to reduce the MTA's potable water consumption, including expanded use of greywater and rainwater for nonpotable needs such as washing vehicles. A preliminary study undertaken by the Commission indicates that, in addition to incremental conservation measures, there are

a number of plausible options for significant reduction in the MTA's use of potable water. Depending on which mix of programs and technologies proves feasible, the MTA should be able to reduce its use of potable water by up to 75 percent by 2020.

Research conducted by the Commission concluded that many transportation agencies place a relatively low emphasis on water-reduction targets. By significantly reducing its water consumption, the MTA would be viewed as an industry leader in sustainability. Globally, water is increasingly understood as a precious but diminishing resource, vital for life and economic prosperity.

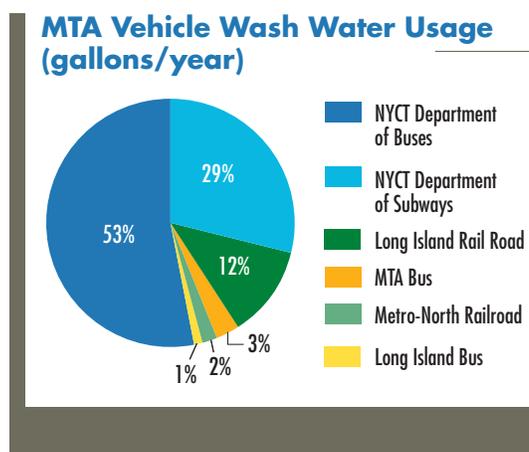
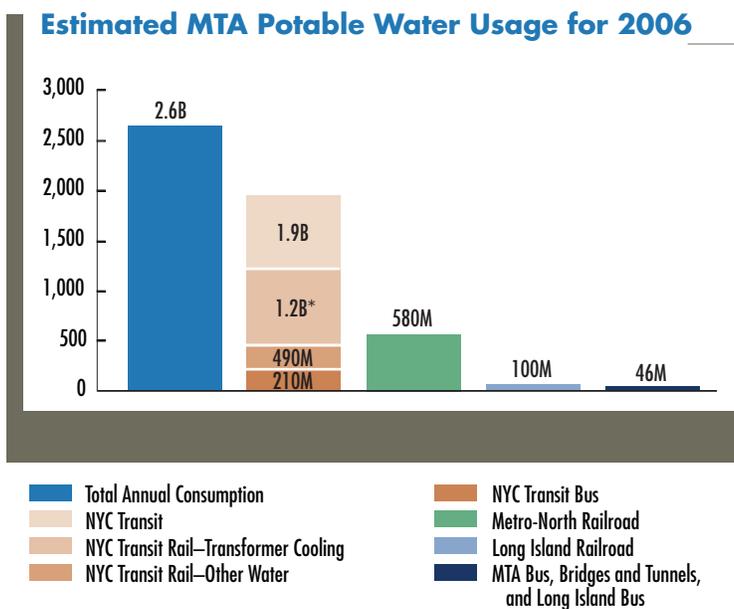
An important first step will be to implement consistent, systemwide water-metering and submetering at MTA facilities, which the Commission has cited as a top priority in its Interim Report. Conservation measures would then include a range of strategies, from staggered vehicle wash schedules to harvested rainwater and water-saving fixtures in public stations. Water management also plays a large role in facilities design. Among the green features of the MTA's LEED-certified Corona Maintenance Facility is a 40,000-gallon rainwater capture system to supply water for washing subway cars. Several other MTA facilities operate vehicle wash systems using recycled greywater to reduce strain on potable water systems, while water-control innovations such as green roofs are part of the design of MTA facilities.

One of the more intriguing water management ideas involves the use of groundwater. The MTA currently pumps some 8 million gallons of groundwater per day out of its subway tunnels on a dry day and up to 13 million gallons per day during storms. Once regarded as a nuisance, groundwater has a number of potential uses. From a global perspective, this water should be seen as a valuable resource latent in MTA properties. Possible uses include thermal exchange heating and cooling in MTA facilities or nearby buildings. The Commission is currently identifying potential uses near current groundwater pump sites.

Left: A rainwater collection system on the roof of the Corona Maintenance Shop in Queens drains rainwater into a 40,000-gallon underground storage tank that supplies water to a subway car washer.

BASELINE

While many MTA facilities do meter water, the MTA does not currently do systemwide metering and submetering, creating gaps in its overall water usage baseline. The following charts show the larger breakdowns in MTA water consumption, according to the best available figures provided to the Commission.



To better evaluate areas for water conservation, the Commission graphed usage patterns based on aggregate volumes. The MTA uses approximately 2.6 billion gallons of potable water per year.¹ Of this total, NYCT uses approximately 1.9 billion gallons, of which roughly 1.2 to 1.4 billion gallons are used to cool NYCT transformers, based upon engineering estimates of system capacity.

The Fine Art of Flood Response



The MTA has introduced raised-grate street furniture to prevent subway flooding. This one, in front of 151 West Broadway between Worth and Thomas streets, provides benches and bicycle racks and represents a design that will be replicated at 15 locations along West Broadway between Chambers and Leonard Streets and on Varick Street between Leonard and Franklin streets.

Green Roofs

In urban areas hungry for green space, rooftops offer acres of possibility. The "green roof" is a simple design idea that serves multiple functions. The design entails sealed roofing, insulation, and a drainage bed, above which sits a blanket of planting medium. Vegetation can range from gardens to low-maintenance desert plants. While beautifying skylines, cooling buildings, and sponging CO₂ out of the air, green roofs also serve a "hidden" function. The drainage bed delays stormwater runoff, helping to prevent the sewer overloads that chronically threaten urban water systems. The MTA is exploring green roof designs at the MTA Bus Company's Far Rockaway Depot and the Queens-Midtown Tunnel Service Building Annex.



¹The MTA does not currently collect data on the potable water used to cool transformers. The potable water consumption for NYCT transformer cooling is based upon engineering estimates. The "engineering" estimates are based upon calculations of systems capacity and operational circumstances such as peak/off-peak load factors. According to such estimates the transformers use approximately 1.2 to 1.4 billion gallons in 2006.

TRANSFORMATIONAL RECOMMENDATIONS

Recommendation 1. Reduce Potable Water Used to Cool Transformers

The Commission recommends that the MTA seek a significant reduction in its use of potable water by up to 75 percent by 2020. This target is based on engineering estimates rather than actual measurements and may be revised when more accurate data are available. The most dramatic reductions would come from innovations in the NYCT transformer cooling systems. The MTA currently draws between 1.2 to 1.4 billion gallons of potable water per year to cool subway transformers, at a cost of roughly \$1 million annually. This water is currently used for once-through cooling and then discharged into storm or sanitary sewers. While nonpotable after use, the cooling water is relatively clean and could be recovered by the MTA or a private entity. It may also be possible to capture and use heat from the spent cooling water. The water could be directed to a manufacturer or other private ventures for reuse.

If feasible, the MTA could purchase chilled water from buildings near substations with coolers and excess capacity. The chilled water would be piped down to the substations, then piped back up to the building systems. This strategy, recommended by the Commission, could result in significant potable water reductions in a shorter period of time than the MTA Capital Program's current plan to upgrade subway system substations by converting to air-cooled transformers by 2048.

Recommendation 2. Seek Innovative Uses for Pumped Groundwater

On a dry day, New York City Transit pumps some 8 million gallons of groundwater from underground streams and other subterranean sources to keep subway tunnels dry. The Commission believes the MTA could turn this liability into an asset by developing geothermal and other beneficial uses of the groundwater. The MTA should work with the NYC DEP to research and develop greywater resources for possible use in MTA subway stations and bus depots, geothermal uses for new residential construction, hospitals, businesses, and city agencies. Program steps would include:

- Identify and map significant groundwater flows in subway tunnels and match to potential customers. The MTA has deep-well stations in East New York, Flatbush, Williamsburg, and Harlem.
- Conduct feasibility studies to assess potential supply and demand; engineering and distribution feasibility; cost/benefit analysis; sustainable return on investment SROI (for SROI, see the chapter on Transit's Triple Bottom Line); potential partnerships, carbon trade, and funding opportunities.



Flood-prone locations in the NYCT system and other locations where flooding or water entry into the system occurred in the past.

MTA Flood Response

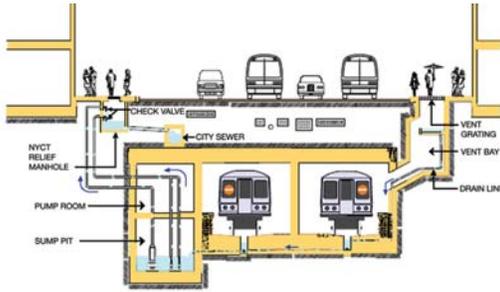
MTA water policies include coping with the kind of weather-related disruptions likely to be aggravated by climate change and rising sea levels. Most recently, a storm in August 2007 brought widespread flooding.

Subways and low-lying rights-of-way were submerged; pumps were overwhelmed; debris blocked drains. As a result, much of the MTA rail system ceased to operate for several hours, while bus service saw disruptions across New York City and Nassau County. Bridges and Tunnels experienced traffic backups from localized flooding. In all, over 2.5 million transit customers were affected. In response, the MTA issued a comprehensive storm report and MTA agencies are now working with local communities to anticipate flood areas, prepare alternative routes, improve communications, deploy increased pump capacity, and other measures. For more on MTA storm response and related issues, see the Climate Adaptation chapter in this report or go to www.mta.info/environment. The water management recommendations in this chapter will improve the MTA's ability to deal with storms and their effects in the future.

Groundwater: From Old Nuisance to New Resource

Like many subway systems, the MTA spends energy pumping groundwater out of tunnels, up to 8 million gallons per day on dry days. Once a nuisance, this water should be regarded as a valuable resource for thermal-exchange cooling and heating, washing vehicles and other non-potable uses.

Typical Subway Drainage and Pumping System



Rainwater Collection at Corona

A rainwater collection system on the roof of the Corona Maintenance Shop in Queens drains rainwater into a 40,000-gallon underground storage tank that supplies water to a subway car wash. Approximately 80 percent of the wash water is then collected as greywater and recycled, with potable water used only for the final rinse.

MTA Impacts Wetlands and Vice Versa

Wetlands filter pollution found in stormwater, serve as groundwater recharge zones, protect land from coastal erosions and against storm surges, and provide habitat for wildlife. These benefits, if lost, are extremely costly to recreate. With many rights-of-way along wetlands, the MTA and its partners have a responsibility to protect and rehabilitate wetlands. Since wetlands buffer sea surges, the MTA also has a vested interest in such protection. In its systemwide sustainability planning, the MTA should include the value of wetlands, especially in relation to climate change impacts on the coastal environment. Dying wetlands in and around the city and Jamaica Bay could hasten erosion, disrupt wild bird flyways, and decrease land buffers to storm surges, which in turn threaten the MTA's operations and long-term sustainability.

NEAR-TERM RECOMMENDATIONS

Recommendation 1. Implement Systemwide Metering and Submetering

The MTA should install additional water meters to develop an accurate database covering various categories of water use, including washing buses, washing rolling stock, parts washing, employee usage, and transformer cooling. Metering would measure and track usage and would be useful in developing effective conservation strategies. It would be helpful in evaluating and monitoring effectiveness of new technologies installed. The introduction of metering should proceed in the following phases:

- **Phase One.** Begin data collection on all major water demands using metering and submetering, supported by detailed estimates based on numbers of vehicles, pump capacities, and other data, as stated in the Commission's Interim Report. This would include a leak-detection program.
- **Phase Two.** Evaluate data to identify cost-efficient options for reducing water use. Collect supporting information, including the proximity and quality of alternative water sources and capital projects. Based on these analyses, set water reduction targets.
- **Phase Three.** Prioritize and implement a schedule for achieving targets, beginning with the most affordable and least disruptive steps. In addition, the MTA should assess the value of joining the DEP automatic meter reading initiative.

Recommendation 2. Improve the Efficiency of Vehicle Washes

Washing vehicles represents about a fifth to a third of the MTA's water use. MTA agencies should make greater use of stormwater, as is already done at the Corona Maintenance Shop. The MTA should consider the following steps for wash facilities and operations:

- Minimizing wash cycles and detergents, reducing wash frequency, cutting the amount of rinse water, shorter wash cycles, lower pump capacities, and using alternative water sources.
- Using advanced wash water treatments, such as: automated bus washing, water quality sensors and automation, multimedia filters, and chemical coagulants.
- Using nonpotable water, such as treated groundwater to wash buses.

Recommendation 3. Improve Stormwater Control and Reduce Stormwater Runoff

Uncontrolled runoff from storms can overwhelm sewer systems, causing Combined Sewer Overflows (CSOs) and polluting waterways. Climate change is likely to exacerbate these problems, as discussed in the Climate Adaptation chapter of this report. In response, the Commission recommends that the MTA improve management of stormwater on MTA roofed facilities, parking lots, and other non-permeable properties, targeting a 25 to 50 percent reduction in storm runoff by 2020. The Commission recommends the following steps.

Green Ideas from MTA Employees



All MTA agencies should use hot/cold water coolers that filter tap water instead of purchasing drinking water, where feasible. This would result in cost, storage and

transportation savings plus added carbon emissions reductions for the MTA.

— Patricia McDonnell-Riggio, Long Island Bus

- Phase One. Map stormwater flows, outfalls, and sewershed on and near MTA properties. Identify properties where stormwater drains to both storm sewer and waste sewer systems. These facilities should be prioritized for retrofits to maximize the on-site retention and flow management.
- Phase Two. Develop design guidelines for new facilities and renovations, specifying stormwater management systems and minimizing impervious surfaces.
- Phase Three. Develop ways to minimize stormwater discharge from parking lots and other impervious surfaces into the regional water systems, while also controlling pesticides, fertilizers, salt, and other pollutants in runoff.

Recommendation 4. Set an MTA Agenda for Ecosystem and Wetlands Management

Since many MTA facilities, properties and rights-of-way border forestland, watersheds, and wetlands crucial to regional water systems with important scenic, ecological, and recreational values, the MTA should develop more explicit guidelines for land and wetlands protection. The first steps are to educate the MTA workforce, identify proximate ecosystems and wetlands, and collect best practices for ecosystem wetlands protections, including control of runoffs, catching toxins, and other steps that apply generally to stormwater management. The Commission recommends that the MTA approach wetlands with more explicit commitments and schedules developed along with community and governmental partners.

- Phase One. Work with NYC Department of Environmental Preservation (DEP) and NYS Department of Environmental Conservation (DEC) to identify and map critically important ecosystem wetlands adjacent to MTA properties, then commit to a protection plan. Work with both agencies to integrate guidelines for ecosystem and wetlands management, including impact on coastal lands and waters.
- Phase Two. Partner with public and non-governmental entities on land preservation, ecosystem conservation enhancement and related projects, such as a pilot study with Queens College to improve water quality in the Flushing Bay watershed near Corona Park, the protection of high-priority coastal properties in the MTA service area, and a project with NYC DEP to develop an ecological design for a tidal wetlands area near the Metro-North's Spuytin Duyvil train station.

Recommendation 5. Improve Water Fixtures and Conservation at MTA Facilities

The MTA should continue to expand and systemize its effort to improve water conservation at facilities, through water-efficient designs, water-saving fixtures, and employee programs. One simple approach would be to adopt the EPA "Water Sense" certified fixtures, a program similar to the Energy Star program. In addition, the MTA should increase the use of low-flow or no-flow fixtures, such as waterless urinals, systems for recycling flushed water, blue roofs (rainwater-retentive roofs), water-smart landscaping, and other facilities-level conservation measures. Also, as the Commission stated in its Interim Report, the MTA should encourage the use of local drinking water by its 70,000 employees to minimize bottled water consumption.

ACHIEVEMENTS TO DATE

Washing the MTA's enormous vehicle fleets requires millions of gallons of water weekly. By harvesting rainwater and recycling greywater, the MTA minimizes the use of potable water and the impact on the city sewer system. Water management features at new facilities such as the LEED-certified Corona Maintenance Shop are cutting potable water consumption using a rainwater capture system and wash-water recycling.



Climate Adaptation

Preparation for rising sea levels, storms, and other climate changes

Climate change policies are frequently divided into two categories: mitigation and adaptation. Mitigation refers to policies intended to reduce carbon emissions and other GHGs, the primary cause of global warming. Mitigation policies constitute the primary focus of the Commission's work and the substance of this report. Adaptation, as the term implies, refers to organizational planning, modification of built assets, and increased operational preparedness to address the anticipated effects of climate changes already underway. These are the topics briefly described in this chapter.

While the MTA network, like other legacy systems (London Underground and Paris Metro) is constantly adapting to a host of demographic, technological, and environmental changes, the onset of global warming due to rising levels of GHGs represents a new and potentially dire challenge, for which the MTA system is largely unprepared. A number of climate changes have been measured in the MTA service area, and altered weather patterns are already impacting the MTA infrastructure, primarily through increased storm activity and related flooding.

After assessing the potential effects of climate change and the MTA's level of preparedness, a team of climate and economics experts identified three key trends significantly impacting MTA operations: higher average temperatures, rising sea levels with related coastal surges, and increased storm activity with more severe precipitation events and related flooding. While long-term forecasts are imprecise, all three trends can already be measured in the MTA service area. In terms of average temperatures, models project increased summer highs, with the number of days over 100°F rising from an average of two days per summer before 1990 to eight days per summer under low GHG emissions and up to 28 days under high GHG emissions around 2070. This trend will place added strain on vehicle and facility cooling systems, with corresponding demands on energy consumption and higher risks of power failures – issues that affect energy planning at all of the MTA agencies.

Sea level rise (SLR) and the risk of related coastal storm surges are also on an upward trend in the MTA region. Regional SLR may approach or even exceed three feet in the current century, bringing increased risk to large portions of the MTA infrastructure. Recent evidence suggests that the severity of coastal storms may increase with warming ocean

surface temperatures. Flood areas will definitely increase as a result of SLR, regardless of storm violence. The increased risk of storm surges will affect many areas of MTA operations, from emergency planning and facilities design to the protection of rolling stock and insurance programs. Since the MTA coordinates emergency evacuation plans with New York City, adaptation to coastal storm surges must integrate evacuation plans with the relocation and protection of MTA rolling stock and other assets during storms. Other obvious adaptation steps include inspection of existing or planned facilities within the expanded flood areas and reevaluation of the MTA's internal "captive" insurance programs. Since MTA insurance risks are concentrated, outside insurance programs may offer better risk structuring. Because SLR will also elevate groundwater levels, plans for utilizing pumped groundwater as described in the Water Management chapter of this report can also have adaptation benefits.

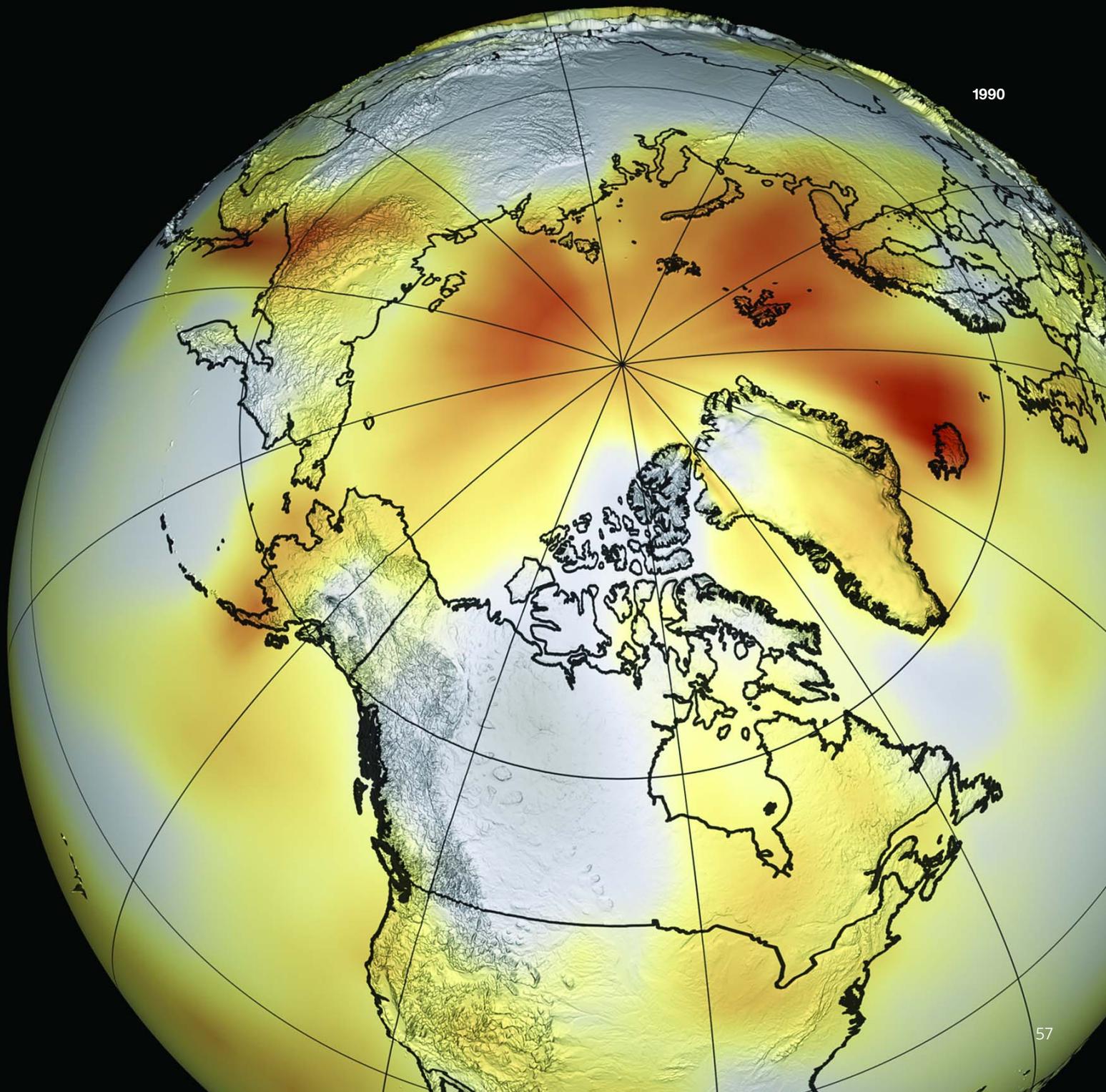
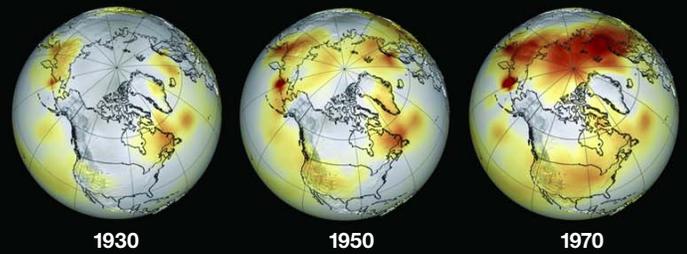
SLR and coastal surge risks will have their greatest impact on the MTA at subway system stations and tunnels below water level. Listed in the chart on page 58 are the subway lines with the lowest critical elevations measured in feet above the National Geodetic Vertical Datum 1929 (NGVD/29). The lower the elevations, the more likely operations will be jeopardized by the SLR surge risks. Short-term adaptation strategies may include increased fixed-station pumping capacity, raised subway entrances, curbing and ventilation grates, and additional tunnel sealing. Long-term adaptation strategies could include sealing ventilation openings in high-risk sections of the subway and flood projection assessments for subway expansion projects currently in process. The creation of strategic storm barriers for the NYC harbor and estuary is a long-term possibility that may be evaluated with city, state, and federal agencies. The risks of increased rainfall and non-coastal rainstorms due to global warming would be similar to those posed by the SLR surge risks, with the most immediate impact on tunnels, tracks, and pumping capacities. Aside from the subway lines, other flood-risk points within the MTA system include Bridges and Tunnels Queens Midtown and Brooklyn-Battery tunnels; the Long Island Rail Road East River tunnels, Hunters Point Station, Long Beach Branch and Atlantic Avenue tunnels; the Metro-North's Hudson and New Haven Lines; and a number of specific low-elevation bridges and causeways.

Right: Tropospheric Ozone Impacts Global Climate Warming – Arctic Dissolve. Using the best available estimates of global emissions of gases that create ozone, the GISS computer model study reveals how much this single air pollutant and greenhouse gas has contributed to warming in specific regions of the world in 1990. Source: NASA/Goddard Space Flight Center Scientific Visualization Studio.

¹An unabridged version of the paper that informed this chapter, *MTA Adaptations to Climate Change – A Categorical Imperative*, prepared by Klaus Jacob (Lamont-Doherty Earth Observatory) and Cynthia Rosenzweig, Radley Horton, David Major and Vivien Gornitz (Center for Climate Systems Research, Columbia University), can be found on the MTA website at www.mta.info/environment.

"To understand the challenge of Climate Adaptation, let me quote John F. Kennedy: There are risks and costs to a program of action. But they are far less than the long-range risks and costs of comfortable inaction."

- Klaus Jacob, Lamont-Doherty Earth Observatory, Columbia University
Chair, Climate Adaptation Group

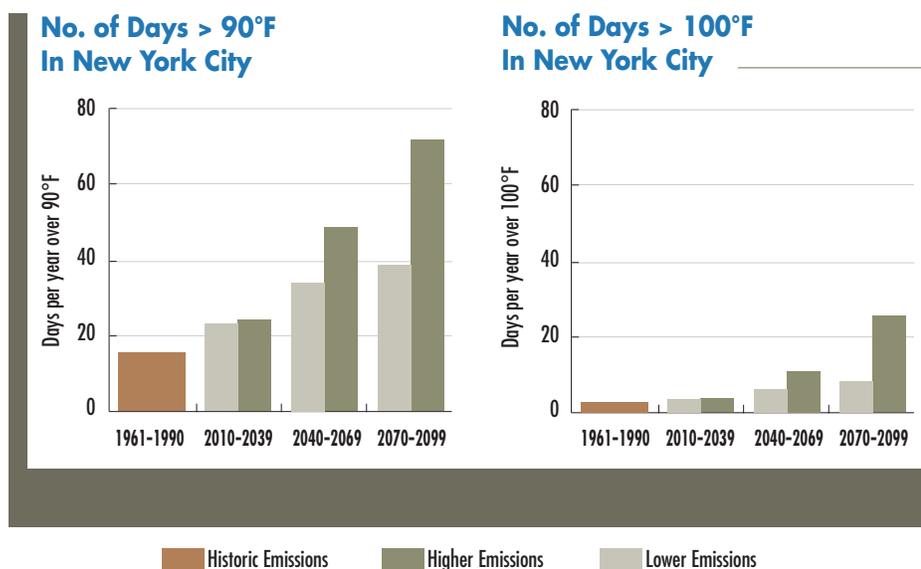


BASELINE

The Commission’s adaptation study indicates that storm protections, facility redesigns, and other adaptation policies are currently being carried forward in an ad hoc manner by the various MTA agencies. The MTA has yet to develop a unified climate adaptation plan and lacks staff with specific expertise in climate projections and analysis. However, many of the recommendations in this report, particularly in the areas of energy-efficient cooling systems and water management, clearly have added value in terms of adaptation. Since flooding due to SLR, coastal surges, and increased rainfall are the most significant risks from climate change, the MTA’s current storm policies will also be useful for adaptation programs.

In addition, the MTA is participating in three related government task forces: the New York State Sea Level Rise Task Force, the NYSERDA-sponsored ClimAID Project Task Force, and the New York City Climate Change Adaptation Task Force. The MTA is also coordinating strategies with Con Edison and other major regional partners. This report recommends that the MTA develop a comprehensive Climate Change Master Plan by 2015. The plan should integrate ongoing climate forecasts, emergency response plans, a decision-making matrix, extensive mapping of system elevations and flood risks, evaluation of facilities design, climate-risk assessment for TOD programs and expansion projects, target elevations for new construction, assessment of MTA insurance programs, and other adaptive strategies. Clearly, such strategies must be integrated into MTA Capital Programs and coordinated with other public and governmental entities from the local to state and federal levels.

The MTA has undertaken a thorough review of systemwide storm vulnerabilities and policies in response to the storm of August 8, 2007 (see August 8, 2007 Storm Report published September 2008, at www.mta.info). Remedial measures are being implemented and scheduled through an internal tracking system. The storm report lists 17 major initiatives, with more than two dozen projects that fall into three major categories: operations, engineering, and communications. In operations, projects include the establishment of early warning and response capabilities, procedures, and teams; the creation of an MTA emergency response center (ERC); and a revision of the agency storm operating protocol. The engineering initiatives include corrective engineering and procedural measures at some of the most notorious flood-prone locations, often involving close cooperation with and capital expenditures by the New York City DEP and DOT. Communications initiatives include a contract to install wireless communication capabilities that will allow the use of cell phones in subway stations. Six subway stations are scheduled to be cell-operational by the end of 2010 and all 270 underground stations should be cell-accessible by 2014. In addition, personnel at Long Island Rail Road, Metro-North Railroad and Bridges and Tunnels were equipped with additional communications devices to ensure communication redundancy in emergencies. The storm-response measures, combined with climate trend projections and the agency surveys, provide a useful starting point for the MTA’s first systemwide climate adaptation strategies.



Forecast of number of days/year in New York City with temperatures exceeding 90°F (left) and 100°F (right) for different decadal periods and for two GHG emissions scenarios. The orange bar represents observed occurrences prior to 1990. (Source: NECIA, 2006)

MTA Subway Lines Lowest Critical Elevations(LCEs)	
A C Lines	7.0 feet
M N R Lines	7.5 feet
1 Line	9.1 feet
2 3 Lines	9.1 feet
4 5 6 Lines	9.9 feet
E F Lines	10.0 feet
B Q Lines	12.7 feet

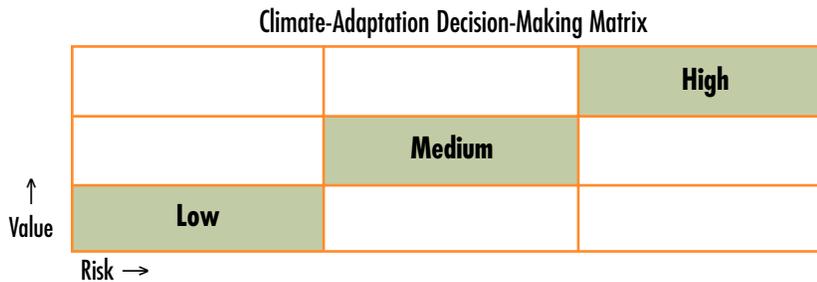
Elevations measured in feet above the National Geodetic Vertical Datum of 1929 – NGVD’29. Source: Jacob et al. (2000)²

²Jacob, K.H., N. Edelblum, and J. Arnold (2000). Risk Increase to Infrastructure due to Sea Level Rise. Sector Report: Infrastructure for Climate Change and a Global City: An Assessment of the Metropolitan East Coast (MEC) Region. 58 pp. & Data Appendices. http://metroeast_climate.ciesin.columbia.edu/reports/infrastructure.pdf.

TRANSFORMATIONAL RECOMMENDATIONS

Recommendation 1. Develop and Implement a Climate-Adaptation Decision-Making Matrix

Over the next three to five years, the MTA should apply a climate-adaptation decision-making matrix/process to identify options for protecting vulnerable rapid transit infrastructure from storm surge, extreme heat, and other manifestations of climate change that have already occurred and cannot be mitigated by other strategies. In light of the scale of the climate-adaptation risks and vulnerabilities for subway lines at or below sea level, commuter rail lines, and bridges and tunnels, the MTA, like other rapid transit agencies around the nation, must look to the states and federal government for financing to make long-term climate adaptation investments, many of which should ideally begin now, with significant adaptations completed or underway no later than 2030.



Facilities that have a great impact on the system are deemed high-value and those that are low-lying or otherwise vulnerable are considered high-risk. For instance, an elevated station could be considered low-risk and, in the absence of a system-wide impact, considered low-value and may be placed in the bottom left-hand cell, whereas a trainyard on the water's edge, with system-wide impact and vulnerability may be put into the top right-hand cell.

NEAR-TERM RECOMMENDATIONS

Recommendation 1: Adopt MTA Climate-Adaptation Policy Position

By mid-2009, the MTA should have a basic adaptation policy in place. In effect, the policy should state the following. (1) The MTA is aware that adaptation to climate change is a necessity without which a stable, prosperous, and sustainable economy of the region and a reliable functioning of its transportation infrastructure cannot be achieved. (2) The MTA is committed to developing a strategic adaptation master plan with basic performance standards and milestones to achieve them. (3) The MTA will coordinate its adaptation efforts with those of other infrastructure operators, utilities, and local and regional planning efforts to foster a coherent action plan for the region, in which the transportation sector cannot proceed in isolation. (4) The MTA is committed to taking a leading role and setting a national example for making the largest mass transit system in the nation resilient to the challenges of climate change. (5) The MTA recognizes that both mitigation and adaptation strategies need to be balanced and pursued to achieve a sustainable future.

Recommendation 2: Implement Operational Climate Change Database

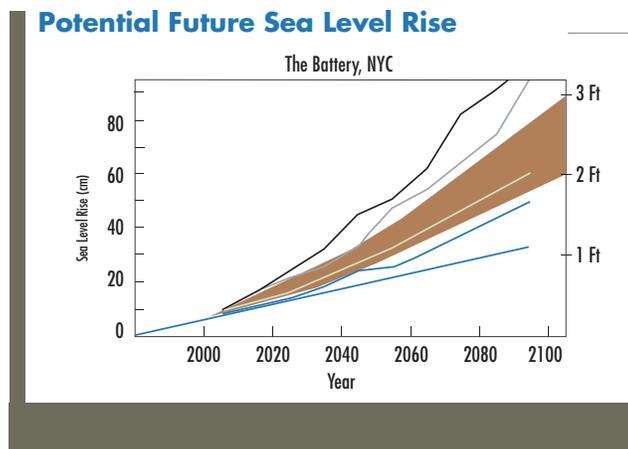
By the end of 2010, the MTA should have established a climate change database (or secured access to such a database). It should contain information on future trends of climate parameters, including but not limited to temperature, precipitation, floods, storms, and coastal storm surge patterns, as well as sea-level-rise (SLR) forecasts, for which it needs to undertake meaningful adaptation measures. The information should be in a form that provides a sound scientific-technical foundation for making the best strategic, operational, engineering, and management decisions for adaptation policies. Both mean trends and parameter variability (quantifying the magnitude and frequency of extreme weather and climate events) should be included. This compilation of climate forecasts should be updated on a regular basis at least every five years, or earlier when important new scientific data or forecasts become available. It should have enough spatial resolution, must serve the entire MTA service area, and should include forecasts out to at least 100 years and in some cases longer, to the extent that this is scientifically feasible. An essential part of the effort is to quantify the uncertainties by providing a measure of confidence for the provided forecasts and for different time horizons. The climate forecast data should be readily accessible to MTA staff, preferably online and in standard formats (where applicable for use in GIS or CAD applications) to allow ready use for day-to-day decisions. The MTA should partner with other infrastructure operators in the region to coordinate regional databases and may want to do this in cooperation with the NYC Climate Change Adaptation Task Force and its New York Panel on Climate Change (NPCC), or equivalent state-based efforts.

Recommendation 3: Complete a Quantitative Vulnerability and Risk Assessment

By 2012 at the latest, the MTA should have completed a thorough, quantitative vulnerability and risk assessment of the system's climate hazards, including the assets, facilities, operations, and income streams of the MTA operating agencies, as well as its centralized insurance program. This assessment should include the climate vulnerability of the existing systems and of all new capital projects in their various stages of construction or design. The vulnerability and risk assessment should be both scenario-based for typical expected events but must also be performed probabilistically to allow estimates of annualized losses integrated over the range of climate-event magnitudes and probabilities and over the current and planned range of all MTA assets and operations. The assessments should be made for the current asset inventory and for the inventory and climate conditions as projected for the 2020s and 2050s. For major system elements most vulnerable to SLR and coastal storm surge flooding, such as tunnels, rail beds, and subways near or below sea level, additional risk assessments beyond the 2050s to the end of this century should be produced.

Recommendation 4: Develop a Climate Change Adaptation Master Plan

By 2015, the MTA should have completed a strategic climate change adaptation master plan detailing how the MTA envisions the transformation of its transit system to cope with the progressive demands from climate change, including cost estimates. The master plan should take into account the results originating from Recommendations 2 and 3 (climate database and vulnerability risk assessments, respectively) as a basis for arriving at optimal adaptation measures along various decision paths and time horizons, projecting out at least 100 years. Though the specificity of this master plan will decrease the further out the projections, the MTA will need some basis for fundamental decisions on long-term capital projects. In particular, the MTA will have to make complex decisions on whether those transit systems that rely on tunnels and rails now at or below sea level can be made resilient in their existing locations, or whether they may require a fundamental redesign and more elevated siting. If elevations are feasible and necessary, they must be planned to account for the continuing reach of SLR and expanding flood zones. Part of such a strategic master plan will be to decide whether or not the New York and New Jersey harbor estuary should and can be protected by storm surge barriers, and whether such barriers might fail under the most extreme storm conditions and eventually become ineffective and unsustainable. It should be noted, that portions of MTA mass transit systems operating in Brooklyn, Queens, and Long Island and in Westchester and Connecticut would not be protected by the barriers as currently conceived.



Range of projected local sea level rise (SLR) for New York City as optional input for precautionary planning purposes. The different lines represent projections for various atmospheric greenhouse gas scenarios and climate models. The orange band depicts a range of optional SLR planning scenarios during this century, implying 2ft SLR as a minimum scenario, and 3 ft by the end of this century as precautionary target planning scenario. (Source: Modified from Jacob et al, 2007).

Recommendation 5: Establish a Pre-Disaster Plan for Post-Disaster Redevelopment (PDP-PDR)

By 2015, the MTA should establish a framework Pre-Disaster Plan for Post-Disaster Redevelopment (PDP-PDR), in concert with local, state, and federal governments and with input from communities and the public and private sectors. While an earlier completion date is desirable for a PDP-PDR internal to the MTA, such plans need to go far beyond the MTA's principal mission to provide efficient, safe, reliable, and affordable public transportation to the region. Apart from dealing with scientific, technical, and engineering issues, basic land use, urban design, economic and social issues are at stake. For this reason a PDP-PDR may have to be developed in conjunction with the regional adaptation master plan of Recommendation 4. Again, the opportunities provided in conjunction with PlaNYC and other initiatives should be used as far as possible. The purpose of the PDP-PDR is to transform a disaster into a one-time opportunity for collecting information and realizing design and planning gains which are less achievable in advance through incremental steps. Without such institutional preparedness, the learning opportunities an actual disaster provides can be easily squandered.

Recommendation 6: Create an Adaptation Priority Task Force (APT)

By mid-2009, the MTA should establish an Adaptation Priority Task Force (APT) that identifies unique opportunities for adaptation measures. Some current and ongoing projects may provide unique one-time opportunities for new construction during the operational maintenance cycle, or during the ongoing design and planning stages of capital projects to which the MTA is currently committed. Such critical opportunities to include adaptation measures to the extent still possible

should not be missed. The Adaptation Priority Task Force should act on a fast track and must not be held back by the more fundamental and time-consuming initiatives proposed under Recommendations 2 to 5, although APT must establish a strong working liaison with these other initiatives.

Recommendation 7: Assign an MTA-Internal Adaptation Team (AT)

The MTA should assemble a designated internal Adaptation Team (AT). This can be done immediately and should be completed by March 2009. The AT has a twofold purpose. First, it should represent the MTA outside its institutional and regional jurisdictions in efforts to determine policies, performance standards, research projects, and so forth that serve the needs of diverse stakeholders in the region. The second objective of the AT will be to perform a much-needed interface and educational role among the MTA agencies. The AT should partner with experts in academia, professional organizations, and technical fields for these “in-reach” efforts. The AT will need an operating budget and established goals for its activities not later than mid-2009. It should be operative for a period of at least three years and be reviewed in its third year for possible continuation depending on its achievements and effectiveness, and on the challenges that still need to be tackled.

Recommendation 8: Prepare Adaptation/Mitigation Cross-Impact Checklists

Each mitigation project the MTA undertakes needs a checklist indicating how it affects adaptation according to short- and long-term horizons. Each adaptation project needs a checklist to show how it enhances or hinders mitigation and energy conservation efforts and improves environmental performance. Depending on identified adverse cross-impacts, the project designs and implementation plans must seek modifications to strike a well-justified, documented balance if the outcomes are still mutually incompatible and no viable alternatives can be found.

Recommendation 9: Implement Climate Adaptation Resiliency Evaluation Procedure (CARE Trigger Elevation)

By the end of 2009, the MTA should establish, preferably in concert with local governments, a procedure called CARE (Climate Adaptation Resiliency Evaluation). It would be triggered when any new projects or major alterations are undertaken where critical structural components are located in present or potential coastal surge flood zones. The procedure would be triggered at a given Elevation X to be formulated, probably at not less than 15 feet above the mean-lower-low-watermark (MLLW), for example in the year 2000 at the Battery tide gauge. A trigger elevation substantially higher than 15 feet, at least for some regions of high risk exposure, may be advisable based on precautionary principles. The MTA should promote the development of CARE procedures and guidelines internally and externally, recommend its usage in Smart Growth/TOD projects, and should definitely adopt the CARE procedures for all MTA projects and in-house planning.

Recommendation 10: Provide Visible MTA Leadership on Climate Change Issues

The MTA should assume a highly visible leadership role in tackling the enormous challenges of adaptation. It should take a strong stand on climate change issues on the local, state, federal, and even global levels. It should be consistent and forceful in pursuing adaptation and mitigation policies, becoming a national voice on behalf of the country's vital infrastructures, particularly in urban centers. It should seek institutional credibility through strong implementation of such policies, while balancing limited resources in pursuit of either mitigation or adaptation strategies. The MTA has made a clear start by enlisting the Blue Ribbon Commission on Sustainability and the MTA. This marks an important beginning. Achieving adaptation measures for the New York metropolitan region will demand the energy, innovation, and leadership characteristic of New Yorkers. The MTA can and must lead in preparing for this unavoidable and critical challenge.

SUMMARY FINDINGS AND NEXT STEPS

Without an adequate investment in adaptation measures, climate change will have even greater adverse impacts on the MTA's vital infrastructure, operations, and revenue streams in the future. The chief risks to the metropolitan region and the MTA service area stem from more extreme heat and precipitation events, coastal storms and storm surges, flooding, and, in the longer term, rising sea levels. Preparation will mean a forward-looking plan for necessary redesigns, construction programs, and changes to operational procedures, including emergency preparedness. As such, the MTA will need to institutionalize adaptation measures over a wide range of operations and facilities. The most immediate threat will come from increased storm surges and SLR encroaching on existing facilities, especially those below sea level.

The MTA should have a climate change adaptation master plan in place by 2015, one that includes realistic time tables and financing options. As it assesses the 10 recommendations above, the MTA should proceed to harden its system against more severe storms through regular maintenance and capital expenditures, while recognizing that major capital expenditures will be required to safeguard the system by or before 2050.



An aerial photograph of the Manhattan Bridge, showing the roadway and suspension cables. In the foreground, there is a complex network of metal scaffolding and pipes, likely for maintenance or construction. The bridge spans across a body of water, with a cityscape visible in the background under a clear blue sky.

Strategy for the 21st Century
Legislative and Policy Recommendations

Strategy for the 21st Century Legislative and Policy Recommendations

This chapter outlines a sustainability action agenda for federal, state, regional, and local decision-makers. It identifies legislative and policy actions which the Commission believes will be necessary to assure the sustainability and future well-being of the MTA network and the New York metropolitan area. In addition to these recommendations, the Commission strongly supports the findings and recommendations of the Ravitch Commission, which will be critical to the financial viability of the MTA transit network. This Commission joins the Ravitch Commission in calling for significant increases in transit funding and investment. Such investments will be crucial if the New York metropolitan area is to retain its high levels of productivity and its position as a global economic power.

At present, our national infrastructure investments lag far behind those of our global competitors. The United States is currently investing only 2.4 percent of GDP in major infrastructure initiatives, as compared to 5 percent in Europe and 9 percent in China.¹ In addition to maintaining competitive advantage in the future, more robust transit funding will also help to stimulate the regional job growth and economic activity needed to meet the present financial crisis. David Lewis' initial assessment of the current recommendations

described in this report indicate a possible yield of 105,500 net new jobs per year, employment income of \$5.1 billion a year, and regional economic output of \$17 billion per year for the period from 2010 to 2019. These figures reinforce recent economic analyses conducted by the MTA and the Port Authority of New York and New Jersey which indicate that every \$1 billion in MTA capital spending generates an estimated 8,500 jobs, \$440 million in total wages, and \$1.5 billion in total sales or economic activity in New York and the surrounding region.

The time to pursue this important agenda is now. We now have a clear convergence of priorities at every level of government. President Obama's environmental commitments and his stated focus on infrastructure investment are matched by the strong environmental records and economic priorities of Governor Paterson, Governor Rell, and Mayor Bloomberg, creating an unprecedented opportunity to advance an ambitious sustainability agenda. The Commission believes that the legislative and policy actions recommended in this chapter will not only strengthen and green the MTA system, they will have a positive, lasting impact on sustainability and economic recovery – regionally, nationally, and globally.

FEDERAL GOVERNMENT'S ROLE

1. Establish new funding sources for transit.

- Pass a green infrastructure stimulus bill with a large allocation to mass transit and renewable energy projects. Investments should target 21st century transit and renewable energy projects in major metropolitan areas. Priority should be given to new projects that can demonstrate climate-stabilization benefits and high priority “state-of-good-repair” projects that extend the useful life of existing infrastructure, safeguarding these major public investments.
- Pass a climate/energy bill establishing a market for carbon emissions avoidance, allocating at least 25 percent of auction revenues to transit. Institute rules to define carbon avoidance as a measurable, verifiable, and tradeable commodity. For the MTA, carbon avoidance results from: (1) avoided car trips through mode-shift from automobiles to transit; (2) reduced traffic congestion, which reduces tailpipe emissions from idling and stop-start traffic; and (3) denser land-use patterns, which shorten the distances and travel times between daily destinations.
- Raise the federal gas tax by 40 cents over the next five years, index it to inflation and fund the transition to a mileage-based user fee. The federal gas tax should be increased 8 cents per gallon per year for the next five years and then be indexed to inflation. Although not a long-term solution based on a concerted effort to move away from carbon-based transportation solutions, gas tax revenues will remain a critically important transportation funding source for at least the next 10 years. Commit a portion of the new revenues to fully developing the technologies and policies that will enable the implementation of a mileage-based user fee.
- Allow transportation projects to receive funding through other federal bills in areas such as housing and the environment. Align federal capital investments in housing and other infrastructure to compliment sustainable transportation goals and objectives.

¹The Cracks are Showing, *Economist*, June 26, 2008.

2. Authorize the next federal transportation bill at \$1 trillion for 2010-2015.

- Create a robust state-of-good-repair program. Target the rehabilitation and preservation of existing infrastructure investments in areas where the environmental and economic benefits are the greatest.
- Reform the way in which funds are distributed. Move away from formulas and categories toward objectives and outcomes. Prioritize funding for green climate mitigation and adaptation projects in smart-growth locations in metropolitan areas in order to achieve environmental, economic, and equity goals.
- Develop performance measures that recognize existing conditions. Transit investments in densely developed areas with a high transit-mode share serve to maintain existing densities and ensure riders do not divert to auto use. Measures must account for projects in these areas as well as projects aimed at attracting new riders and/or development.
- Incentivize regional coordination, intermodal projects, and pricing. Provide incentives for the planning and development of regional transportation services which connect multiple jurisdictions and systems. Encourage pricing strategies to generate revenues and manage demand.
- Streamline federal processes and procedures. Guarantee that authorized funds are appropriated annually by October 1 and then received in a timely manner through enforceable timelines for grant review.
- Require transit agencies seeking federal funds to commit to a baseline of green standards. The American Public Transportation Association (APTA) should work with the MTA and other transit agencies to develop these minimum standards.

3. Pass a federal version of California's SB 375, which links efficient land use with transportation infrastructure investment in order to reduce GHG emissions.

A federal version of this bill would: (1) establish GHG reduction targets for metropolitan areas; (2) require regions to develop a land-use pattern and a transportation network that achieve the necessary reductions in emissions from cars and light trucks; and (3) provide federal infrastructure funding as an incentive for metropolitan areas to implement the regional plans. The bill should take into account conditions in New York City of existing high density and existing high transit mode share.

4. Provide leadership and funding for climate adaptation.

Establish a lead federal agency to coordinate federal, state, and local efforts and funding for climate adaptation plans, programs, and strategies.

5. Increase the monthly commuter tax benefit to \$230 per month for commuters using transit and index both the transit and parking benefits to inflation.

Increasing the allowable tax-free amount to \$230 per month for transit commuters will create equity between transit and commuter parking pre-tax benefits. This increase will provide a greater incentive for employers to offer pre-tax commuter benefits and for more employees to utilize these programs. The MTA will benefit by increasing revenues and lowering the costs associated with cash handling and individual fare transactions. The region's employers also benefit through additional payroll tax savings.

6. Provide incentives to lenders and financial institutions that offer Location-Efficient Mortgages (LEMs).

LEMs use available transportation-related savings and flexible qualifying ratios to add thousands of dollars of home buying power to the budgets of people looking for homes well-served by transit—in what have been called “location efficient” communities. If homebuyers purchase homes in areas that are well served by transit, they are assumed to be saving money by foregoing auto expenses. This money is counted as income, thus allowing them to qualify for a mortgage and buy housing closer to transit. LEMs can be structured in various ways including lower interest rates or better debt-to-equity ratios and better down-payment terms.

By increasing housing opportunities in location-efficient communities, LEMs achieve three main environmental goals: (1) they reduce fuel consumption; (2) they decrease the demand for sprawling developments and new road infrastructure; and (3) they lower pollution from automobiles. Additionally, LEMs are an excellent opportunity to make affordable housing available to more people.

7. Provide incentives to developers who design and construct to LEED-Neighborhood Development (ND) Standards and achieve a Gold rating.

LEED standards, including LEED-ND, do not adequately account for the greening effects of transit and should be modified to reflect the strong per-capita GHG reduction that transit generates.

8. Modify and/or expand existing funding programs to increase funding for transit.

- Based on the growing demand for transit and high ridership levels, more resources from Section 5307² and 5309³ programs are needed for maintenance, routine replacement, and expansion projects. These programs provide guaranteed funding for transit.
- Congestion Mitigation Air Quality (CMAQ). The eligibility should be revised so that vehicle miles traveled (VMT) reduction is not the sole criterion. Certain types of transit projects should be automatically eligible for CMAQ if significant transit mode share is demonstrated. Public transit benefits air quality and should be eligible for any funds whose objective is to improve the environment.
- Surface Transportation Program (STP). Additional funding for enhancement programs under STP could be used for bike, pedestrian, and transit station access improvements.

9. Reform federal processes and procedures to advance the MTA's federally-funded transit projects as expeditiously as possible.

The Commission recognizes the importance and necessity of federal oversight, but in some cases, processes and procedures should be revised so that projects can advance as quickly as possible in order to provide sustainability benefits to the New York metropolitan region.

- Expand the categorical exclusion list to include more transit projects. All federally funded projects are subject to the National Environmental Policy Act (NEPA), which requires project sponsors to consider the environmental impacts of their proposed actions. Categorical exclusions (CEs) are projects that, based on past experience, do not individually or cumulatively have significant environmental impacts. These projects require neither an environmental assessment nor an environmental impact statement and can move ahead more quickly. The list should be expanded to include the rehabilitation of transit stations and other facilities that do not require additional property. This addition will align the list of categorically excluded transit projects with the list for highway projects, which includes improvements to existing rest areas and truck weigh stations, where no additional property is needed.
- Develop single regulatory process for multi-modal projects. A single process for the Federal Transit Administration (FTA) and Federal Highway Administration (FHWA) to follow for multi-modal projects will allow for faster implementation of projects that provide connections between modes and highway projects that include a transit component. Better connections between modes will encourage transit use.
- Make procedural changes to expedite grant awards for state-of-good-repair projects. Minor procedural adjustments would allow for more timely grant awards. FTA should not wait to begin reviewing grants online while required project documents (e.g., project management plans, force account plans) are being completed. These documents can be reviewed on a parallel track. When a project is funded through multiple grants, FTA should allow grantee to refer to FTA Quarterly Reports and/or prior grants for basic project description information. Concurrent internal review of grants by FTA departments would allow for more timely grant approval. When grants are not approved in a timely manner, they must be updated continually and re-reviewed by FTA.
- Make procedural changes to the New Starts/Small Starts project development process that would decrease approval-related delays. The FTA's New Starts program provides discretionary funding for major capital investment transit projects, such as MTA's Second Avenue Subway and East Side Access projects. The FTA has developed detailed eligibility criteria to ensure that only the most meritorious projects receive New Starts funding. Project information is reviewed and approved at several points during design before final funding commitment from the FTA is granted. Because the cost of delay is particularly acute for large-scale construction projects, the New Starts process should be adjusted so that work never has to come to a stop while a project awaits an FTA approval. The Commission is confident this can be done without compromising the FTA's ability to ensure compliance. For example, a single joint (FTA/grantee) risk assessment could be conducted prior to project grant agreement, replacing multiple risk assessments at different points of design.

²Section 5307 makes federal resources available for transit capital investments to urbanized areas with population over 50,000.

³Section 5309 provides capital assistance for fixed guide way modernization, bus and bus facilities and major capital investments (New Starts/Small Starts).

- Make changes to the New Starts/Small Starts project eligibility criteria. The criteria should be expanded to encourage TOD, pedestrian and bike links, and multi-modal transit systems. A “warrants” approach should be applied so that projects in areas with high existing population/employment density do not need to prove environmental benefits.
- Expand the list of projects that can advance in event of an air quality conformity lapse. The Clean Air Act establishes target levels for specific pollutants for designated future years. Reaching these conformity targets is a condition of federal funding and the responsibility of Metropolitan Planning Organizations (MPOs), which use a computer model to project future pollutant levels in their regions. If the model shows that any of the conformity targets are not anticipated to be met (a “conformity lapse”), the region must adjust the mix of projects in order to meet the targets. Under current regulations, only in-kind replacement projects may proceed in the event of a conformity lapse. Since transit is beneficial to regional air quality, additional transit projects should be allowed to advance as well. While all efforts should be made to ensure a conformity lapse does not occur, in the event of a lapse, transit projects that enhance capacity, convenience, and/or reliability should be allowed to proceed since they make transit a more attractive travel option.

TEN REGIONAL GREENHOUSE GAS INITIATIVES (RGGI) STATES' ROLE

1. Establish a multi-state regional gas tax with the revenues dedicated to transit.

Institute the first regional gas tax by using the framework of cooperation and governance established by the states participating in the first mandatory, market-based effort to reduce greenhouse gas emissions in the United States. A regional approach to the gas tax takes away the competitive disadvantage problem that might exist when a state institutes a tax on its own. The ten RGGI participating states are Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont. If successful, look to expand this model to additional states and the eastern provinces of Canada.

STATE OF NEW YORK'S ROLE

1. Establish new funding sources for transit.

- Pass a Regional Mobility Tax to provide funding to the MTA. Pass legislation to enact a Regional Mobility Tax of one-third of 1 percent of wages paid in the 12-county MTA service area, as recommended by the Ravitch Commission. The proceeds of this tax would be dedicated to funding the MTA.
- Authorize tolling and variable pricing strategies to fund transit. Pass legislation, also called for by the Ravitch Commission, to authorize state authorities and public benefit corporations with transportation responsibilities and cities to implement a range of tolling and variable pricing strategies as a means of reducing traffic congestion, improving air quality, and raising critical funds needed for transit. Legislation should specify that revenues in excess of operating and maintenance costs of the systems and/or crossings will be designated for transit improvements and expansion, in line with the recommendations of the Ravitch Commission.
- Encourage the use of pension funds and endowments to fund transit projects. Explore socially responsible policies and practices of state and city pension funds, endowments of universities, foundations, and other entities as potential funding sources. This could include the dedication of between 0.5 percent to 2 percent of fund portfolios be invested in bonds to fund MTA sustainability projects. Consider supporting legislation that requires such investments.
- Allocate Regional Greenhouse Gas Initiative (RGGI) auction revenues to VMT reduction strategies, including transit. Dedicate a portion of the proceeds from auction revenues to VMT reduction strategies annually.
- Establish a clean air surcharge. Create a clean air surcharge and/or increase the annual vehicle inspection fee (safety and emissions fees) to compensate for carbon emissions created from owning a car or light truck. A surcharge or fee could be charged on a flat-fee rate, or on a sliding scale based on vehicle mileage, vehicle weight, engine type, and resultant emissions. These revenues would be collected from vehicles within the region and dedicated to the MTA.

2. Pass legislation that will put an enforceable limit on statewide greenhouse gas (GHG) emissions.

The bill should require that the limit would not be greater than statewide emissions for the year 2000 and that the statewide limit be reduced each year in order to reach 80 percent below the 2000 level by 2050. The Department of Environmental Conservation (DEC) should be charged with adopting regulations to require the reporting and verification of statewide GHG emissions and monitoring and enforcing compliance with this program. The use of both regulatory and market-based approaches should be encouraged to achieve the reduction levels necessary. The emissions reductions needed in the transportation sector to reduce statewide levels will in effect steer investment in and promote use of transit. It should be pointed out that the overall reduction goal may result in an increase in mass transit emissions.

3. Pass legislation to link efficient land use with transportation infrastructure investment in order to reduce statewide GHG emissions by adapting California's SB 375 for New York.

The need for higher density development and more efficient land use, which leads to less driving, will be critical to reaching statewide GHG reduction targets. This bill would do the following: (1) establish regional GHG reduction targets; (2) require regions to develop a land-use pattern and a transportation network plan that achieves the necessary reductions in emissions from cars and light trucks; (3) provide state infrastructure funding as an incentive for cities and counties to implement the regional plans; and (4) make improvements to environmental review processes for more compact development projects that conform to the regional plan. The bill should take into account conditions in New York City of existing high density and existing high transit mode share.

4. Pass legislation to reform the Tax Increment Financing (TIF) law to promote greater use of TIF for developments near transit.

TIF is a way to utilize the increased tax revenues that will come from redeveloped properties within a defined district to pay for the costs of infrastructure improvements. TIF has not been used in New York as widely as in other states because increases in school property taxes are excluded in the current legislation. Reforming New York State's General Municipal Law to allow school districts to include all or some portion of the school tax increment in the funding formula would enable widespread use of TIF as a tool for financing infrastructure improvements. Additionally, the criteria for defining TIF development districts and eligible projects should be amended to increase its applicability for use on projects concentrated near transit.

5. Create an MTA Regional Bus Authority (RBA) responsible for comprehensive and coordinated bus service throughout the MTA service territory.

The purpose of the RBA would be to integrate existing disparate services resulting in a more seamless and efficient regional bus system. This action would authorize but not require counties or other government entities within the MTA District to enter into agreements to have MTA run services on their behalf. The RBA would accelerate the implementation of Bus Rapid Transit (BRT) services throughout the region as well as coordinate routes, schedules, and fares more closely with the commuter railroads and other transit options to improve service levels. The RBA, a key proposal of the Ravitch Commission, is essential if New York City and the region expect to reap the full benefits of smart growth policies and TOD.

6. Develop a state-sponsored partnership program with the MTA, counties, and local municipalities to fund development and ongoing operation of transit feeder and distributor services.

This program will provide funding for improving access and connections to transit, especially in areas with existing low-density development. By improving feeder systems (buses, shuttles, trolleys, ferries, vans, etc.) to commuter rail stations as well as distributor systems from stations to employment centers, it will address the "last mile" problem. This initiative should consider all aspects of improving transit connections, including: types of vehicles; scheduling; fares; the provision of real-time customer information and way-finding signage; the condition and quality of bus stops, shelters, and stations; and car sharing and car pooling systems.

Additionally, local projects that improve transit and station access through sidewalks, "smart streets," and pedestrian ways, bike lanes and paths; bike parking; park and ride lots; and roadway improvements should be a part of this effort. This program will: (1) increase transit use; (2) help alleviate the growing demand for commuter rail parking; and (3) prevent environmentally damaging automobile "cold starts" and short auto trips to rail and/or bus stations.

7. Through Governor Paterson's Smart Growth Cabinet, work with the MTA to establish a regional Transit-Oriented Development (TOD) program that would provide leadership, funding, and incentives to encourage development near transit within MTA's service area.

The Smart Growth Cabinet should:

- Work with the MTA to identify Transit Development Districts which would serve as state designated areas to focus TOD resources and efforts.
- Ensure that State investments are coordinated to promote economic development and growth in Transit Development Districts by giving transit supportive projects priority over investments which facilitate sprawl.
- Identify and allocate new and existing state funding sources to provide grants to local governments for station area planning and consensus building, zoning change analysis, and land development assistance as well as tax incentives in order to generate support and investment in TODs.
- Work with the MTA and other partners to develop model TOD ordinances, training materials for local governments and planning officials, and other resources on TOD benefits to encourage more development near transit.

8. Pass legislation to authorize cities to utilize automated camera enforcement of bus lanes.

Bus speeds in New York City are the slowest of any large city in the country. As the MTA and city begin to expand Select Bus Service and pursue other initiatives to improve bus mobility, keeping bus lanes clear is essential to make buses a fast and reliable transit option for more New Yorkers. As the miles of bus lanes expand, enforcement by police alone will be cost prohibitive. Automated enforcement has proven effective in cities around the United States and throughout the world.

STATE OF CONNECTICUT'S ROLE

1. Establish rail station parking goals for all towns that currently control rail parking under leases with the Connecticut Department of Transportation (ConnDOT).

This effort would expand the number of parking opportunities at Metro-North rail stations and leave it to towns how to provide for meeting their assigned capacity goals. Where a town does not meet its goal to create new or additional parking capacity, ConnDOT should terminate the rail station operating lease and re-take control of rail parking to provide more spaces and parking opportunities. Parking solutions should include: pricing; satellite parking and feeder services; bike, car-share, and carpool parking; and other station access efforts such as pedestrian and bicycle improvements. The expansion of parking at commuter rail stations is the quickest way to reduce GHG emissions, since it will allow hundreds of light-duty vehicles to be removed from the highways in Fairfield and New Haven Counties. It will insure that commuter rail, particularly on an intrastate basis, is a viable alternative to driving for home-to-work trips.

2. Provide funding and assistance to municipalities to increase development of TODs using the principles developed by Governor Rell's Responsible Growth Task Force.

This should include grants to local governments for station area planning and consensus building, zoning change analysis, and land development assistance as well as education and training efforts to generate support and investment in TODs.

3. Finance more multi-family and mixed-income housing near transit stations through the Connecticut Housing Finance Authority (CHFA) and the HOMEConnecticut program.

The Executive branch and the Legislature should: (1) prioritize the allocation of Low-Income Housing Tax Credits, State Housing Tax Credits, and other instruments to subsidize the appropriate level of affordability around transit; (2) promote and monitor the HOMEConnecticut program, which was created in 2007 to provide incentives to municipalities that develop mixed-income housing at higher densities near transit stations. This has the potential to be a key program for developing TODs along Metro-North lines throughout the state.

4. Expand transit options through flexible feeder and distributor services and Bus Rapid Transit (BRT) routes, and improve station access and coordination with Metro-North, Amtrak, and long-haul bus services.

ConnDOT should work with Connecticut Transit and local transit districts to provide more reliable and seamless transportation services between home and work including feeder and distributor services as well as BRT routes. This initiative should consider all aspects of improving the connections to rail stations, including: the types of buses (shuttles, vans, etc.); scheduling; fares; the provision of real-time customer information and way-finding signage; the condition and quality of bus stops, shelters, and stations; sidewalks and pedestrian ways; bike lanes and paths; and bike parking. BRT routes should both complement and connect to rail services. These efforts will increase transit use and remove automobiles from Connecticut's roadways, thereby reducing GHG emissions.

NEW YORK CITY'S ROLE

1. Create an All-Agencies Transit-Oriented Development (TOD) task force to work with the MTA to develop in-city TODs.

The purpose of the task force would be to coordinate all city agencies that have land-use powers so that they work more closely with the MTA on TOD plans and projects. This effort would focus on supporting TOD at transportation centers in the five boroughs, enabling both New York City and the MTA to leverage underutilized assets through public/private partnerships. The task force would explore rezoning districts around stations to encourage TOD; offering developers specific density bonuses for incorporating TOD; and potential funding for construction of platforms over MTA right-of-way to prepare sites for TOD. By concentrating new development around existing transit hubs, TOD can also support neighborhood revitalization efforts and contextual zoning initiatives.

2. Implement on-street parking-pricing strategies to better manage parking demand and keep lanes clear for buses.

New York City's Department of Transportation's PARK Smart NYC is a pilot program that charges higher rates at peak hours for city parking spaces, to encourage motorists to park no longer than necessary – thereby increasing turnover and reducing congestion by the amount of time motorists spend cruising for parking spaces. Additionally, effective curb management reduces the amount of double parking and thus congestion. PARK Smart and other parking pricing and management strategies should be expanded as they serve both the interests of the city and the MTA.

3. Scale up comprehensive street management programs citywide.

Expand and fund street-management programs to reduce congestion, improve safety, and allow buses to travel faster and more reliably. New York City's Department of Transportation has begun to implement a series of new measures, including parking and lane management, signal prioritization and physical improvements. Other actions include increased enforcement of double-parked vehicles and vehicles blocking bus lanes and loading zones. Buses must be considered first among equals in city traffic flow. The Commission recommends continued collaboration and action by NYC DOT, NYPD, and the MTA.

SUBURBAN COUNTIES AND CITY GOVERNMENTS' ROLE

1. Institute zoning ordinances and TOD-friendly parking policies, and create station area plans that will encourage development at transit supportive densities.

Land-use decisions remain under local control and this means it is up to local municipalities to make zoning changes that will encourage improved linkages between land use and transportation. Parking policies such as reduced minimum parking requirements and allowance of shared parking can make TODs more viable. Comprehensive station area planning generates community acceptance and buy-in while attracting investment in TOD.

2. Work with the MTA to implement Bus Rapid Transit (BRT) routes, Light Rail Transit (LRT) routes, and last-mile services region-wide.

The MTA is working closely with the NYC DOT on an extensive BRT network, but many opportunities exist in the surrounding suburban counties as well. In partnership with the MTA, counties and cities should assist in: running the services; establishing right-of-way and/or converting general purpose lanes for bus-only lanes; signal prioritization; and enforcement. BRT opportunities exist for north/south corridors in Nassau and Suffolk Counties, east/west corridors in Rockland, Westchester, and Putnam Counties, as well as corridors in Fairfield and New Haven Counties in Connecticut. Address the “last mile” problem by improving feeder systems (buses, shuttles, trolleys, ferries, vans, etc.) to commuter rail stations as well as distributor systems from stations to employment centers. This initiative should consider all aspects of improving transit connections, including: types of vehicles; scheduling; fares; the provision of real-time customer information and way-finding signage; the condition and quality of bus stops, shelters and stations; car sharing and car pooling systems; and pedestrian and bicycle improvements.

3. Implement parking pricing strategies to better manage parking demand.

On-street market-priced parking will encourage motorists to park no longer than necessary, thereby increasing turnover and reducing congestion and the blocking of lanes by reducing the amount of time motorists spend cruising for parking spaces. Market-priced parking at rail stations will also serve to increase capacity by promoting alternate ways of accessing the station.

4. Implement street management programs to keep lanes clear for buses.

Implement a series of measures including parking and lane management, signal prioritization, and physical improvements. Other actions include increased enforcement of double-parked vehicles and vehicles blocking bus lanes and loading zones.

5. Take steps to support and promote safe bicycle use throughout cities in the region and on public transit.

Support and promote safe bicycle use throughout cities in the region and on public transit within the MTA service area to improve pedestrian and bicycle safety and security.

Sustainability Contribution Fund Green MetroCard, Ticket and E-ZPass

The MTA is committed to lowering its carbon emissions and reducing its impact on the regional environment. To help expand this public commitment, the MTA is investigating the concept of a “green” MetroCard contribution program. The program would allow the riding public to make voluntary, tax-deductible donations to fund innovative, green aspects of sustainable capital and operating projects at the MTA.



Transit's Triple Bottom Line

David Lewis, senior VP, national director, Economics and Financial Services, HDR Inc. and
Stephane Larocque, principal economist, HDR Inc. and
Justin Beaudoin, economist, Economics and Financial Services, HDR Inc.

Pricing carbon avoidance is a necessary step towards a more sustainable economy and a natural part of MTA's mission. For the MTA, this may eventually lead to carbon offset trades in established markets. For the present, the Commission recommends the development and introduction of a Sustainable Return on Investment (SROI) model that can be used to select green initiatives in a manner compatible with the MTA's standard accounting practices (see first figure on p. 73). Akin to Cost-Benefit Analysis, SROI-like frameworks are already in use at a number of major public organizations, such as the federal Office of Management and Budget. The SROI is based on a standard economic ROI calculation (which accounts for the benefits outlined above), but factors in the estimated amount of carbon averted as a result of a particular green initiative, valued at the real opportunity cost of carbon.

To illustrate, consider the hypothetical option of adopting photovoltaic technology to heat and cool an MTA office building. Under traditional ROI, the MTA might consider the capital costs of installing the equipment and the future costs of operating and maintaining it. It would compare the present day value of these costs with the present day value of the electricity saved. Unless the comparison of present-day costs and cost savings works out to a rate of return above the "hurdle rate" (or equivalent pay-back criteria), the project is deemed financially infeasible. Under an SROI calculation, however, an estimate is made of the annual quantity of carbon emissions averted by switching the building out of fossil fuels. This quantity would be valued at the real opportunity cost (say, \$30 to \$50 a ton) and the present-day-value of this saving (calculated over the life of the building) would be added into the ROI calculation. If the resulting SROI exceeds the hurdle rate, the project can be deemed worthwhile, even though it fails the traditional ROI test.

The Commission sees the SROI model as a means by which the MTA can ascertain the value proposition of initiatives in each of the two recommended sustainability tracks, namely "greening the region" (through initiatives to increase ridership and transit-oriented development) and "greening the system" (through steps to reduce the internal energy and resource footprints of MTA facilities, equipment, and operating modalities).

Rate of Return on Greening the Region: Although SROI calculations must be viewed with considerable caution due to uncertainty in underlying data and assumptions, evidence

is indicative of transit's potentially significant value proposition. Summarized in the second figure on p. 73, a 2002 federal report found that the strongest transit investments are those which expand the reach of existing systems. Adding more nodes and interconnectivity among routes was found to generate SROIs in excess of 50 percent among a sample of completed projects. Investment in the modernization of existing facilities and equipment was found to yield SROIs of more than 30 percent. These rates of return do not include the additional output and employment related to construction activity. As indicated earlier, building and modernizing infrastructure facilities will not necessarily create new jobs and income if the economy is already strong. But in today's extraordinary economic climate, the \$75 to \$100 billion spending program contemplated in this report for period 2010-2019 could yield 105,500 net new jobs per year, employment income of \$5.1 billion a year, and regional economic output of fully \$17 billion per year. It is important to note that studies of individual projects indicate the possibility of much lower SROIs, some not high enough to warrant the investment. In short, every investment must be evaluated on its merits.

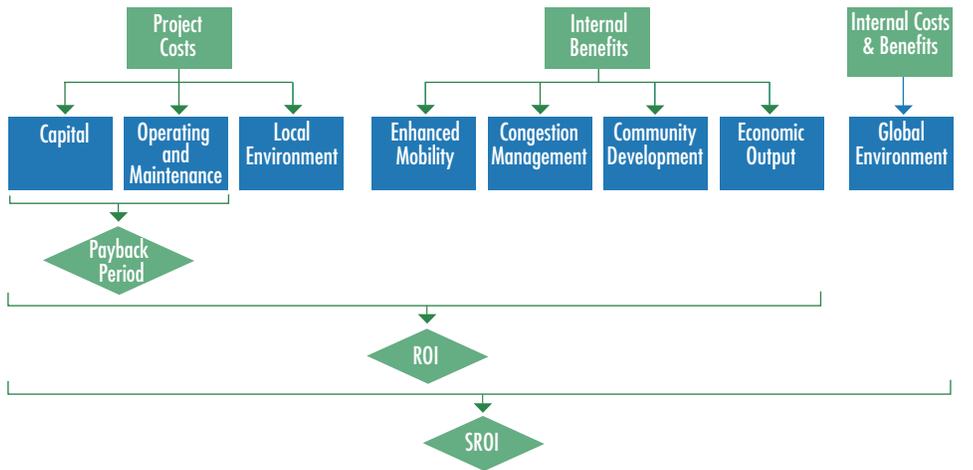
Related evidence of transit's value proposition comes from models of the economically optimal level of transit investment. Taking account of the congestion costs created but not borne by autos and trucks and the role of transit in abating such costs, one recent study finds that transit capacity (vehicle-miles and route-miles) would need to be increased by at least 50 percent nationally in order to maximize the economic contribution of public transportation in the United States.¹

Rate of Return on Greening the System: Many of the near-term and transformative investments proposed in this report involve steps to make existing facilities more environmentally efficient. Two initiatives considered in this report, Examples 1 and 2, illustrate how the SROI approach can be implemented for system-greening initiatives in practice. The illustrations demonstrate that the SROI model may possibly justify some green investments that might not pass traditional financial tests. It is important to note that not every green idea will emerge as a worthwhile investment, even under the SROI test – SROI is not a green light to every green idea. Indeed, the Commission believes that green investment proposals, like all investments, must be subject to the discipline of reasoned analysis and benchmarks of success.

¹American Public Transportation Association, *The Optimal Level of Transit*, (prepared by HDR|Decision Economics), 2008.

²Adapted from U.S. Department of Transportation, Federal Transit Administration, *The Value of Mobility Improvements in Fixed Guideway Transit*, May, 2002.

Framework For Measuring Sustainable Return On Investment



Estimated Economic Rates of Return on a Sample²

CATEGORY OF TRANSIT INVESTMENT	ECONOMIC RATE OF RETURN	RISK ANALYSIS	
		LOW	HIGH
Additional Capacity to Existing Systems	54%	39%	64%
New Rail Transit Systems	35%	15%	52%
Modernization	32%	13%	55%

Assumptions Used in the SROI Illustrations

Each project in Examples 1 and 2 is examined over its expected duration in order to fully evaluate its impact over the long run and to assess the degree to which each project contributes to the sustainability of the MTA's operations.

A discount rate of 4 percent is applied in order to convert future costs and benefits into present value terms. This rate is consistent with common practice,¹ and the MTA's internal financing costs and is necessary in order to ensure that costs and benefits arising over different periods of time are compared on a common footing.

The calculation of each initiative's financial return for the MTA is relatively straightforward and involves comparing the marginal costs and marginal revenues of each project (where the term marginal refers to changes in costs and/or revenues that are attributable to the initiative being considered). In addition, the SROI framework requires the inclusion of the external impact of each initiative – in the two initiatives considered here, the external impact is the environmental benefit concomitant with each initiative.

Environmental impacts are called “non-market” effects (also known as “externalities”). Since no complete market exists for these impacts, no observed price is available to signal the true value of their effects. In order to add the costs and benefits of externalities to the anticipated financial effects, “shadow prices” are necessary in order to monetize the effects of the externalities. In the two initiatives, the shadow prices employed are the social costs of carbon and the shadow price of water.

The social cost of carbon reflects the full long-run cost that a ton of carbon emissions imposes on society. Nordhaus estimates that the social cost of a ton of carbon is \$27 per ton (US 2005), with the cost projected to increase 2 percent to 3 percent each year (in real terms). This social cost of carbon is used to value the social benefit of reduced carbon emissions over time. The social costs of nitrogen oxides (NO_x), sulphur dioxide (SO₂), volatile organic compounds (VOCs) and particulate matter (PM₁₀) are also used, with the amount of each of these five emissions being estimated on a per kilowatt-hour basis. The shadow price of water reflects the long-run social cost of water (a value of \$0.015/gallon is used in these evaluations) and is used to value the social benefit of reduced water consumption.

The two initiatives are framed according to the SROI framework illustrated in the first figure on page 73. Three evaluation metrics are used to illustrate how the SROI framework differs from the typical approach to project evaluation:

Payback period: The period of time required for the return on an investment to recover the sum of the original investment.

Return on investment (ROI): The ratio of the net value of an investment relative to the cost of the investment, including only internal financial impacts.

Sustainable return on investment (SROI): The ratio of the net social value of an investment relative to the full social cost of the investment, including both internal financial impacts and external impacts.

¹See, Nordhaus, William *A Question of Balance: Weighing the Options on Global Warming Policies*. Yale University Press, 2008.

Example #1: Energy Efficient Lighting

Project description:

In Grand Central Terminal, 1,700 light bulbs have been replaced with energy-efficient compact florescent light bulbs (CFLs). Of these 1,700 light bulbs, 700 have been switched from 60W to 15W CFL bulbs and 1,000 have been switched from 100W to 20W CFL bulbs. The new CFL bulbs require replacement on an annual basis, whereas the previous bulbs required monthly replacement. The impacts are evaluated over a 10-year time frame.

Financial impact:

There are two financial impacts involved in the switch of light bulb type – the annual expense of purchasing light bulbs and the annual electricity cost. The CFL bulbs are more expensive than the previous type of bulb: \$6.50 per CFL bulb versus \$0.50 for the old bulbs. The annual cost of purchasing CFL bulbs, accounting for the differing frequency of replacement, exceeds that of the previous bulbs (\$11,050 per year versus \$10,200 per year). However, there are substantial cost savings with the CFL bulbs in terms of the annual cost of purchasing electricity – nearly \$147,000 per year.

External impact:

In addition to the financial benefit to the MTA, the switch to CFL bulbs also generates a positive externality through a reduction in environmental emissions. While carbon emissions have the greatest impact, the reduction in electricity consumption also leads to a decrease in the amount of nitrogen oxides (NO_x), sulfur dioxide (SO₂), volatile organic compounds (VOCs) and particulate matter (PM₁₀). This initiative reduces the annual consumption of electricity by nearly 980,000 kilowatt-hours each year, which is equivalent to 294 tons of carbon emissions. Over the 10-year timeframe, this is equivalent to a reduction of nearly 3,000 tons of carbon. The social benefit of this reduction in carbon emissions is valued at \$8,500 in the first year and increases to \$11,100 per year by the 10th year after the switch is undertaken. Over the 10-year period, the value of the other reduced emissions is an additional \$15,000.

Evaluation:

Over the 10-year time frame, the switch to CFL light bulbs is estimated to result in a total cost savings of \$1.46 million. The total social value of reduced emissions is estimated at an additional \$115,000 over this period, \$100,000 of which is attributable to carbon. The cost of the CFL light bulbs is recovered immediately and the social return is substantial:

Payback period:	Immediate
Return on investment (ROI):	17,872%
Sustainable return on investment (SROI):	19,243%
Net present value (NPV), financial:	\$1.2 million
Net present value (NPV), sustainable:	\$1.3 million

Conclusion:

The shift to CFL light bulbs pays immediate dividends, both financially and on the broader social level. The traditional financial evaluation tools recommend this initiative and the SROI framework is able to quantify the additional social value of the environmental benefit.

Example #2: Rainwater Harvesting and Water Reclamation

Project description:

At the Corona Maintenance Shop, a rooftop rainwater collection system has been installed. The system drains into a 40,000-gallon underground storage tank that supplies water to a subway car washer. Eighty percent of the wash water is then collected as greywater and recycled, with potable water being used only during the final rinse stage. The impacts of this project are evaluated over a 30-year time frame, which is the expected lifespan of the rainwater and greywater systems.

Financial impact:

The initial installation costs of the rainwater and greywater systems were \$480,000 and \$250,000, respectively. It is assumed that an annual maintenance cost equivalent to 3 percent of the initial cost will be required to keep the system functional in the future. The system is designed to save the MTA 2.5 million gallons of potable water each year -- based on the current and projected cost of water, this saves the MTA \$8,000 in the first year, and the cost savings increase over the project's lifecycle as the cost of water increases. Over the 30-year time frame the projected total savings in the cost of purchasing water will be \$1.6 million.

External impact:

The savings in the amount of water purchased by the MTA also results in a social benefit insofar as this water is then available for other uses. With 2.5 million gallons of water being saved each year, this amounts to a total reduction of 75 million gallons over the 30-year timeframe. Given an external social valuation of \$0.015 per gallon, the social benefit from the initiative is equivalent to \$37,500 each year and \$1.125 million over the project lifespan.

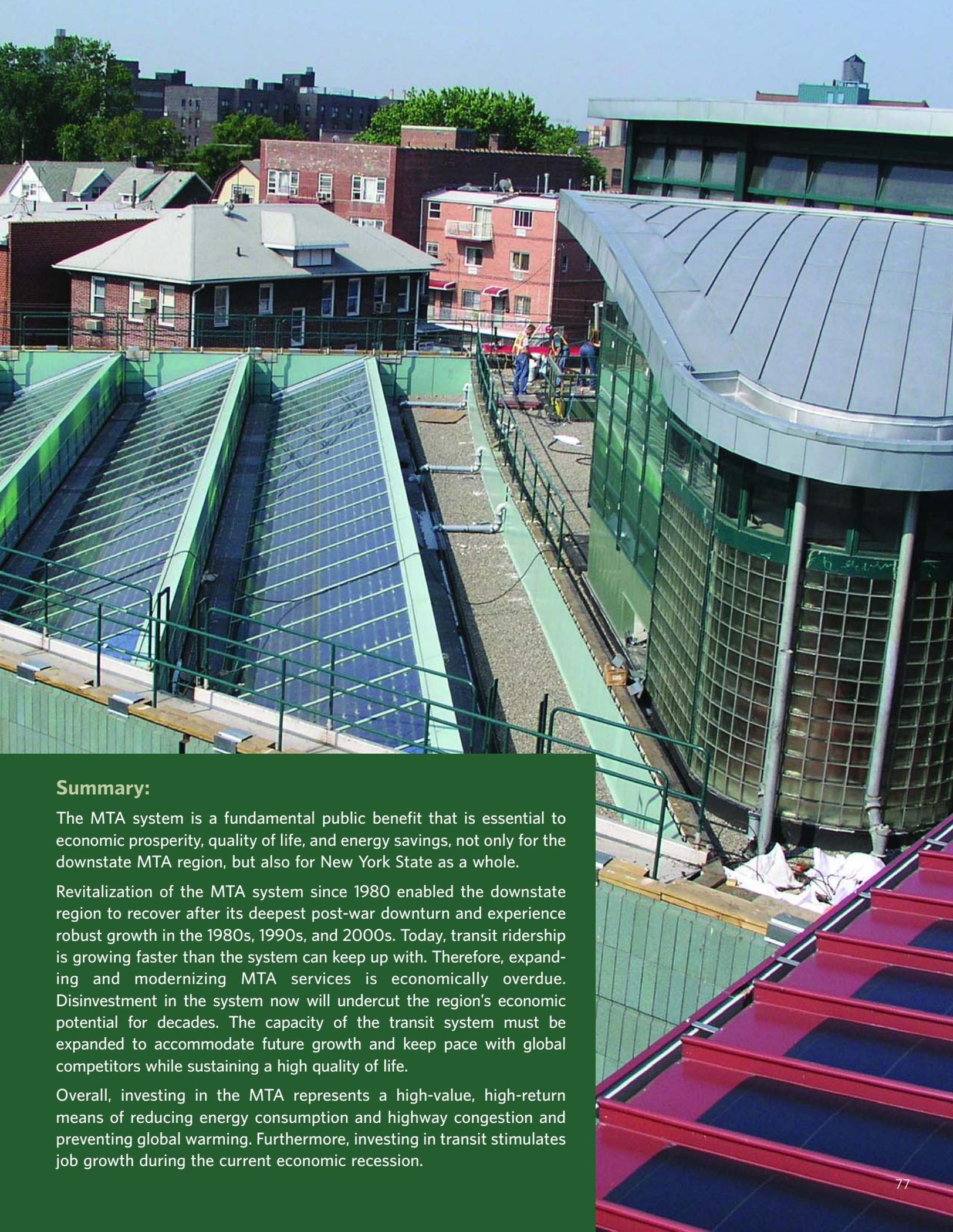
Evaluation:

The rainwater harvesting and reclamation initiative provides an illustration as to how the SROI framework can provide a different recommendation than that of the typical financial-based analysis. Although the initial investment costs are recovered after 12.5 years, in present-value terms the net value of the project is \$0.4 million if only the financial implications are considered. However, including a valuation of the broader social impact of the savings of potable water leads to a positive net present value of \$0.3 million over the project's duration:

Payback period:	12.5 years
Return on investment (ROI):	-52%
Sustainable return on investment (SROI):	41%
Net present value (NPV), financial:	-\$0.4 million
Net present value (NPV), sustainable:	\$0.3 million

Conclusion:

Although the installation of the rainwater harvesting and water reclamation system is not viable from the perspective of traditional decision criteria (payback period and financial return on investment), it does emerge as a very strong project in terms of sustainable return on investment. The initiative thus provides an important illustration of the perspective that the SROI model would bring to MTA decision-making regarding potential green investments.



Summary:

The MTA system is a fundamental public benefit that is essential to economic prosperity, quality of life, and energy savings, not only for the downstate MTA region, but also for New York State as a whole.

Revitalization of the MTA system since 1980 enabled the downstate region to recover after its deepest post-war downturn and experience robust growth in the 1980s, 1990s, and 2000s. Today, transit ridership is growing faster than the system can keep up with. Therefore, expanding and modernizing MTA services is economically overdue. Disinvestment in the system now will undercut the region's economic potential for decades. The capacity of the transit system must be expanded to accommodate future growth and keep pace with global competitors while sustaining a high quality of life.

Overall, investing in the MTA represents a high-value, high-return means of reducing energy consumption and highway congestion and preventing global warming. Furthermore, investing in transit stimulates job growth during the current economic recession.

Acknowledgments

Pro Bono Experts

Amanda Eaken, Natural Resources Defense Council
Amy Coffman, Cook+Fox Architects
Andy Haughwout, Federal Reserve Bank of New York
Angela Licata, NYC Department of Environmental Protection
Anthony Perl, Simon Fraser University
Bill Dornbos, Natural Resources Defense Council
Brad Tito, Nassau County, County Executive's Office
Brandi Colander, Natural Resources Defense Council
Brendan Sexton, Sexton Co.
Bruce Schaller, NYC Department of Transportation
Buz Paaswell, University Transportation Research Center
Carlton Brown, Full Spectrum NY
Chris Garvin, Cook+Fox Architects
Chris Jones, Regional Plan Association
Cynthia Rosenzweig, Center for Climate Systems Research, Columbia University
David Lewis, HDR Inc.
David Major, Center for Climate Systems Research, Columbia University
Donna DeCostanzo, Natural Resources Defense Council
Edward Linky, Environmental Protection Agency
Emily Yuhas, NYC Office of Long-Term Planning and Sustainability
Eric Hesse, TriMet
Eric Rothstein, eDesign Dynamics
Franco Montalto, eDesign Dynamics & Drexel University
Gary Prince, King County Metro
George Beane
Gil Quinones, New York Power Authority
Helle Maide, New York Power Authority
Janice Wells, Permanent Citizens Advisory Board
Jason Bram, Federal Reserve Bank of New York
Jessica Taylor, NYC Department of Transportation
Jim Leitner, New York Power Authority
Jim Orr, Federal Reserve Bank of New York
John McLaughlin, NYC Department of Environmental Protection
John Williams, HDR, Inc.
Jon Orcutt, NYC Department of Transportation
Jonathan Drapkin, Pattern for Progress
Josh Nachowitz, New York League of Conservation Voters
Justin Beaudoin, HDR Inc.
Kathleen Fortino, Scenic Hudson
Kevin Law, Long Island Power Authority
Klaus Jacob, Lamont-Doherty Earth Observatory
Larry Levine, Natural Resources Defense Council
Lisanne Altmann, Long Island Power Authority
Margaret Newman, NYC Department of Transportation
Marko Bradica, New York Power Authority
Munsun Park, Jonathan Rose Companies
Mysore Nagaraja, former president MTA Capital Construction
Neal Parikh, NYC Office of Long-Term Planning and Sustainability
Paul Beyer, NYS Director of Smart Growth

Peter M. Iwanowicz, NYS Department of Environmental Conservation
Radley Horton, Center for Climate Systems Research, Columbia University
Rae Rosen, Federal Reserve Bank of New York
Rae Zimmerman, New York University
Richard M. Cicciari, Citi
Rino Trovato, New York Power Authority
Robert Yaro, Regional Plan Association
Shelley Poticha, Reconnecting America
SolMarie Jones, Sustainable Long Island
Stephane Larocque, HDR Inc
Stephanie Puzo, NYC Office of Long-Term Planning and Sustainability
Stephen Hammer, Columbia University
Tim Papandreou, San Francisco Municipal Transportation Agency
Val Menotti, Bay Area Rapid Transit
Vincent Gil, New York Power Authority
Vivien Gornitz, Center for Climate Systems Research, Columbia University
Walter Hoefler, Long Island Power Authority
Will Carry, NYC Office of Long-Term Planning and Sustainability
William Solecki, Hunter College, City University of New York
Zac Frank, NYC Department of Transportation

MTA Executive Director & Agency Presidents

Elliot G. Sander, Executive Director & CEO
David Moretti, former acting president, MTA Bridges & Tunnels
Helena Williams, president, Long Island Rail Road
Howard H. Roberts Jr., president, NYCT
Howard Permut, president, Metro-North Railroad
Joseph J. Smith, senior vice president, NYCT Dept of Buses, and president, MTA Bus Company, and Long Island Bus
Michael Horodniceanu, president, MTA Capital Construction
Susan Kupferman, president, MTA Bridges & Tunnels

MTA Executive Staff

Ben Fernandez, director, Labor Relations
Chris Boylan, deputy executive director, Corporate and Community Affairs
Ernest Tollerson, director, Policy and Media Relations
Gary Dellaverson, Chief Financial Officer
Hilary Ring, director, Government Affairs
James Henly, deputy executive director, General Counsel
Linda Kleinbaum, deputy executive director, Administration
Michael Fucilli, Auditor General
Myrna Ramon, Chief of Staff
William Morange, deputy executive director, Director of Security
William Wheeler, director, Special Project Development & Planning

MTA Headquarters – Policy & Media Relations

Ernest Tollerson, director, Policy & Media Relations
Joe Chan, Strategic Initiatives
Kirke Stanfield, Strategic Initiatives
Melissa Bain, Strategic & Sustainability Initiatives
Nathan Gilbertson, Special Assistant for Policy

Pate Felix, Policy & Media Relations
Peter Bass, director, Agency Wide Environmental & Energy Policy
Projjal Dutta, director, Sustainability Initiatives
Steve Toth, Strategic Initiatives

Agency Liasons

Audrey Heffernan, MTACC
Collette Ericsson, NYCT,
MTA Bus & LI Bus

Janet Lanphier, NYCT
Jennie Mandelino, NYCT,
MTA Bus & LI Bus

Karen Timko, MNR
Ken Ragone, LI Bus
Kieth Lambrestge, MNR

Paul Manske, LIRR
Roy Parks, B&T
Thomas Abdallah, NYCT

Other MTA Headquarters Staff

Alicia Martinez
Angie Hacker
Darren Jurgens
Debra Pollack
Gordon Johnson

Jennifer Badali
Lara Muldoon
Larry Fleischer
Michelle Woods
Naomi Renek

Natatia Griffith
Patrick Cashin
Rick Osborne
Risa Williams
Robert Paley

Sarah Rios
Theresa O’Loughlin
Tom Savio

MTA Agency Staff

Adam McCool, LIRR
Afshin Hezarkhani, LIRR
Al Muir, MNR
Alan Stapler, MNR
Andrew Bata, NYCT
Anthony Bombace, MNR
Anthony Greco, MNR
Anthony Muratore, NYCT,
MTA Bus & LI Bus
Benton Levons, NYCT
Bernadette Humphrey-Nicol,
NYCT
Christine Lema-Foley, LIRR
Clare Sammon, NYCT
Connie Crawford, NYCT
Daniel Donahue, MTA Bus
Daniel Hom, NYCT
Daniel O’Connell, MNR
David Cannon, MTACC
David Henley, NYCT
Dennis Mahon, LIRR
Dennis Ramdahin, NYCT
Dennis Varley, NYCT
Derek Braithwaite, NYCT
Derek Piper, MTACC
Elissa Picca, LIRR

Elizabeth DeLuca, NYCT
Frank Jezycki, NYCT
Frank Payton, NYCT
Gary Feil, NYCT, MTA Bus
& LI Bus
Gary Waclawski, B&T
Gene Sansone, NYCT
George Bassil, B&T
George Menduina, NYCT,
MTA Bus & LI Bus
Gloria Russo, LIRR
Howard Matza, NYCT
Jacqueline Bertone, B&T
Jay Sherman, NYCT
Jeannie Kwon, NYCT
Jennifer Barry, MNR
Jennifer Wuotinen, NYCT
Jesse Samberg, Business
Service Center
Joanne Reilly, MNR
Joel Brill, NYCT
John Brennan, LI Bus
John Dellas, NYCT
John Grzelewski, NYCT
John Hoban, NYCT
John Melnichuk, LIRR

Joseph Sardo, NYCT
Joseph Yurman, NYCT
Joy C. Bennett, MTA Bus
Judith Kunoff, NYCT
Kate Aglitsky, NYCT
Kenneth McHale, MNR
Lancelot Anderson, LIRR
Larisa Baronova, NYCT, MTA
Bus & LI Bus
Larry Gould, NYCT
Lew Wunderlich, MTACC
Linda Corcoran, MNR
Linda Weiburg, LIRR
Lisa Blugh-Willis, MTACC
Michael Chubak, NYCT
Michael G. Zacchea, NYCT
Michael Iorino, NYCT
Mindy Giberstone, B&T
Neil Yellin, LIRR
Nejat Haim Hooshang, NYCT
Patrick Parisi, B&T
Philip Cross, NYCT
Rachel Weisslitz, NYCT
Randall Fleischer, MNR
Rashmin Shah, NYCT
Richard Bagala, NYCT

Robert Cumella, NYCT
Robert Iorizzo, NYCT
Robert Maclagger, MNR
Robert Schmitt, NYCT
Robert Walker, MNR
Ryan Flaim, LIRR
Scott Howell, LIRR
Shelley Prettyman, NYCT,
MTA Bus & LI Bus
Sheryll Navarro, NYCT
Silvana Salas, NYCT
Stanley Grill, NYCT
Steve Stroh, MNR
Timothy McCarthy, MNR
Tom Robertson, LIRR
Tom Young, NYCT
Vanessa Pettiford, NYCT
Veronique Hakim, MTACC
Wendy Johnston, MNR
William DeSantis, NYCT
William DeTore, NYCT
William Keenan, MTA Bus
Zafira Lateef, NYCT

Consultants

David Erne, Booz Allen Hamilton Inc.

Gary Rahl, Booz Allen Hamilton Inc.

Nelson Smith, freelance writer

Appendix

Profile of The Metropolitan Transportation Authority

Energy/Carbon - Traction Power Report

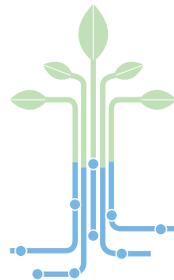
Energy/Carbon - Renewable Energy Report

Smart Growth/TOD: Bicycles as a Transit Link

Smart Growth/TOD: Case Studies

Smart Fleets Report

Climate Adaptation Report



Elliot G. Sander, MTA Executive Director and CEO

The MTA is North America's largest mass transit network, serving 14.7 million people across a 5,000-square-mile region straddling downstate New York and Southern Connecticut. The MTA is governed by a 17-member board nominated by the Governor of New York and confirmed by the New York State Senate. MTA trains, subways and buses carry over 8.5 million riders per day; MTA Bridges and Tunnels handle over 857,000 daily crossings. The MTA system provides over 2.6 billion customer trips per year.

The MTA provides over 8.5 million passenger trips daily with an energy efficiency equivalent to 100 mpg, over twice the efficiency of today's most advanced hybrid cars.

MTA Agencies

MTA New York City Transit operates a subway system with 26 lines, 468 stations and 6,485 cars; a bus system with 4,576 buses and 243 routes; and Staten Island Railroad with 22 stations and 64 cars. Ridership is approximately seven million daily and over 2.3 billion annually.

MTA Long Island Rail Road the largest commuter railroad in North America, operates 11 rail lines with 124 stations and 1,153 cars. Ridership is approximately 289,000 daily and over 82 million annually.

MTA Long Island Bus operates one of North America's largest all-CNG fleets with 330 buses on 54 fixed routes. Ridership is approximately 109,000 daily and over 32 million annually.

MTA Metro-North Railroad includes five rail lines with 120 stations and 1,195 cars. Ridership is approximately 265,000 daily and over 80 million annually.

MTA Bridges and Tunnels operates two tunnels and seven bridges. Vehicle crossings are approximately 857,000 daily and over 304 million annually.

MTA Capital Construction manages the construction of the MTA's major expansion projects, including East Side Access, Second Avenue Subway and 7 Line Extension, as well as the "Downtown Mobility Projects," the Fulton Street Transit Center and South Ferry Terminal.

MTA Bus Company, formed out of seven private lines in 2006, operates 1,354 buses on 81 local and express routes. Ridership is approximately 368,000 daily and over 109 million annually.

 **Energy/Carbon - Traction Power Report**

MTA traction power use is significant. Traction power alone comprises approximately 2,800 GWh per year, at an electricity cost of approximately \$294 million annually. MTA NYC Transit consumes about 80% (2,240 GWh) of the annual MTA traction power usage. Technologies and other innovative operating techniques to reduce this energy consumption (and subsequent significant CO2 emissions) are examined. The methods utilized to reduce traction energy consumption are broken down into two categories:

- Regenerative energy management techniques
- Mass reduction of train car components

Regenerative energy management techniques include on-board energy storage, trackside energy storage, operational enhancements such as start/stop synchronization, and software modifications for train cars to better utilize regenerated energy. Mass-reduction techniques include elimination of redundant components, substituting lighter materials such as aluminum for steel and developing innovative design optimization techniques to enable identical structural performance with reduced weight.

Additional information on this subject is available at www.mta.info/environment.

 **Energy/Carbon - Renewable Energy Report**

The MTA has established a goal to increase its renewable energy use to 7% by 2015, through both distributed generation and green power purchases (renewable energy credits). This is a significant challenge, as any transit agency has an extremely high energy intensity due to the traction power demands, and MTA is no exception. MTA's power demand was approximately 3.5 million MWh (megawatt hours), approximately 80% of which is traction power demand. MTA currently purchases wind energy renewable energy credits (RECs) from the New York Power Authority (NYPA) and has nearly 500

kW (kilowatts) of self-generation from solar photovoltaic (PV) panels. MTA is estimating the costs to meet 1% of its power demand via renewable power in 2009, gradually stepping up its purchases and self-generation to meet its 7% goal by 2015. In addition to helping New York State meet its renewable goals, renewables can provide MTA with long-term price certainty in an era of increasing fossil fuel prices. Demand for natural gas will continue to increase, driving up prices, particularly with the advent of U.S. greenhouse gas regulations that impose a cost on carbon dioxide emissions. Using natural gas to generate electricity produces much less carbon dioxide than coal-fueled generation with which it competes.

In order to progress towards the goal of increased renewable energy use, MTA tasked Booz Allen Hamilton to review opportunities to develop wind energy on MTA properties and rights of way. Prime wind locations are flat, open areas with consistent wind speeds. The majority of wind development in the northeastern US has been in upstate New York, where Class 4 and higher winds exist.

Additional information on this subject is available at www.mta.info/environment.



Smart Growth/TOD - Bicycles As A Transit Link

MTA Blue Ribbon Commission on Sustainability and the MTA Smart Growth-TOD Working Group
Developed by Ned Sullivan, George Beane and the Smart Growth/TOD Working Group

Introduction

An objective of the MTA is to “develop and implement programs to improve the environment.”¹ The MTA plays a key role in Mayor Bloomberg’s PlaNYC for a Greener, Greater New York² and should, either by interaction or example, play a leadership role in other city and federal transportation improvement programs³ as well.

PlaNYC’s Transportation Initiative 9 calls for the city to promote cycling in various ways including “the implementation of the city’s 1,800-mile bike lane master plan” and “increasing necessary bicycling infrastructure” such as bike racks and lockers. Doubling the number of intra-city bike commuters is a key goal of the NYC Department of Transportation’s strategic plan.⁴ A bill to promote reasonable bicycle access by employees at existing office buildings⁵ has been introduced in the City Council’s Transportation Committee and is being redrafted with input from the Mayor’s office, DOT, and other interested parties. The Department of City Planning intends to propose a Bicycle Parking Zoning Text Amendment requiring appropriate indoor bicycle parking facilities in all new buildings.

There has been an enormous increase in non-recreational cycling in New York and, if the experiences of other cities around the world can be a guide, the number of intra-city cyclists will increase dramatically as cycling becomes safer and more convenient. To reduce traffic congestion and air pollution, the MTA should play a prominent role in promoting cycling for inter- and intra-city commuters and for recreational cyclists who wish to enter and leave the city. The inclusion of bicycling in the transportation mainstream has become a national objective and this Working Group recommends that it become a priority of the MTA.

Bicycle Recommendations

The Smart Growth/TOD Working Group makes the following recommendations to encourage and facilitate the use of bicycles as part of MTA passengers’ travel from point of origin to point of final destination.

1. Promote and facilitate bike parking at stations
2. Promote and facilitate bike transport on trains and buses
3. Promote and facilitate bike storage at MTA work sites
4. Provide consolidated and easily accessible information
5. Act as an advocate and partner in promoting the use of bicycles as a sustainable link in urban and regional transit

¹<http://www.mta.info/nyc/ffacts/ffenvironment.htm>

²PlaNYC: A Greener, Greater New York; Transportation chapter, pp 72-97, pp 150-151.

³For example, The Transportation Equity Act for the 21st Century (TEA-21); U.S. Code, Title 23, Section 217; U.S. Code, Title 49, Section II, Ch. 49-III §5501(3): “The National Intermodal Transportation System shall include significant improvements in public transportation necessary to achieve national goals for improved air quality, energy conservation, international competitiveness, and mobility for . . . economically disadvantaged individuals in urban. . . areas of the United States”; TEA-21 §3037(f): “. . . In awarding grants under this section . . . the Secretary shall consider . . . in the case of an applicant seeking assistance to finance an access to jobs project, the need for additional services in the area to be served by the applicant (including bicycling) to transport welfare recipients and eligible low-income individuals to and from specified jobs, training, and other employment support services . . .”

⁴http://home2.nyc.gov/html/dot/html/pr2008/pr08_024.shtml

⁵NYC Council Intro. 871-2008, The Bicycle Access Bill.

1. Bike Parking at Stations

The MTA does not own the land adjacent to many of its stations and does not have the right to install bike parking racks on land it doesn't own; neither does it have space within many of its stations to provide bike parking. Nevertheless, it is the recommendation of this Working Group that the MTA establish bike parking at its stations as a principal goal; where the MTA does not have room on its own property it should encourage and assist adjacent property owners in providing bike parking.

Railroad Stations:

- Bicycle racks, either fee-based or free, should be placed in visible, centrally located, and preferably sheltered locations at all railroad stations.
 - i) The number of racks depends on the station, but there should always be enough excess capacity to assure potential riders that they will find a place to lock their bikes. Stations in geographically flat communities with a sizeable number of commuters who live within two miles of the station should have more racks than stations in hilly areas, like Yonkers, or where commuters live at great distances from the station, like New Canaan.⁶
 - ii) Visible, centrally located racks are important so that commuters will know the racks are there and to increase protection from theft and vandalism.
 - iii) Some railroad stations have large underused spaces that should be converted to secure fee-based storage with 24-hour access. Fee-based storage provides revenue and reduces the use of the space for dead storage. For example, on MNR, the former taxi entrance to Grand Central Terminal on Vanderbilt Avenue and the area under the stairs from the street to the tracks at the 125th Street Station are two locations where there is both need and opportunity for placement.
 - iv) As bike-link commuting increases, enclosed, as opposed to sheltered, bike racks may become desirable.⁷ Individual, fully enclosed bicycle lockers are available at a number of Metro-North Railroad and Long Island Rail Road stations,⁸ but until bicycle commuting is more popular and there is a demand for rented bike lockers, the cost of providing more individual bike lockers outweighs the benefits.

Subway Stations:

- Bicycle racks should be in accessible, visible, and preferably sheltered locations in⁹ or adjacent to¹⁰ subway stations that serve passengers who do not live or work within easy walking distance of the station.
 - i) Indoor bike storage would be suitable for the mezzanines of some IND stations, including on the A, B, C, D, and F lines. Where bike racks are installed below street level, narrow (wheel width) ramps should be added along a wall at the sides of stairways to facilitate access. Where bike racks cannot be placed on MTA property, the MTA should work with NYC DOT, other city agencies, and local community boards to see that racks are installed nearby.
 - ii) Subway stations by some bridges to other boroughs and at the ends of train lines such as the 7 at Main Street, Flushing, and the 1 at Broadway and 242nd Street (adjacent to Van Cortland Park) should be considered for bike rack installation. In some cases like 242nd Street at Van Cortland Park, end of the line bike storage might be combined with franchised bike shops that offer repairs and sales. Independently owned and operated bike shops are likely to open near stations in commercial areas where there is heavy use of transit-link bike parking.

Bus Stops:

- Bicycle racks should be in accessible, visible, and preferably sheltered locations adjacent to bus stops in sparsely served areas. Where bike racks cannot be placed on MTA property, the MTA should work with NYC DOT, other city agencies, and local community boards to see that racks are installed nearby.

⁶Approximately 90 percent of auto emissions occur in the first mile after a cold start and emissions from one or two mile trips are nearly as great as five to ten mile trips. National Bicycling and Walking Study (1992) Case Study No. 9: Linking Bicycle/Pedestrian Facilities with Transit. FHWA Publication No. FHWA-PD-93-012. Washington D.C. (p. 84).

⁷Bike racks are currently located at about 90 percent of the New Jersey Transit stations and at many other railroad stations throughout the world. The bike parking ramp at Amsterdam's Central Station holds 7,000 bikes. Union Station, Washington DC: DDOT (District Dept. of Transportation) is developing a Bicycle Transit Center (also known as a Bike Station) adjacent to the station. It will provide bicycle parking, rentals, repairs and accessories. See renderings on line at <http://www.ddot.washingtondc.gov/ddot/frames.asp?doc=/ddot/lib/ddot/information/bicycle/pdf/3ds-context.pdf>. Tokyo's Kasai Station has a multi-storey computerized bike parking facility that can accommodate 9,400 bicycles at a fee of about \$1 for a single use or \$17.50 for a monthly pass.

⁸Bike lockers are currently located on the Metro-North line at Cortlandt, Dover Plains, Patterson, Tenmile River, Wassaic, and Pawling Stations. Bike lockers are currently located on the LIRR line at Bridgehampton, Central Islip, Cold Spring Harbor, Copiague, Farmingdale, Greenlawn, Greenport, Hicksville, Huntington, Massapequa, Northport, Oakdale, Patchogue, Port Jefferson, Ronkonkoma, Sayville, Stony Brook, and Wantagh stations.

⁹Chicago Transit Authority has indoor or sheltered bike parking at 83 stations (Chicago Transit Authority). (http://egov.cityofchicago.org/city/webportal/home.do_Traffic & Transportation_Cycling,_Indoor CTA Stations). McDonald's Cycle Center at Chicago's Millennium Park is a 300-space, heated indoor bicycle parking facility that provides lockers, showers, a snack bar, bike repair, bike rental and other amenities. Bicycle parking spaces are available free of charge. (<http://www.millenniumpark.org/generalinformation>). Los Angeles County MTA's Del Mar Gold Line station also provides indoor bike parking. (http://www.metro.net/riding_metro/Del%20Mar%20Station.htm; http://transitguide.caltech.edu,_bikes on public transit).

¹⁰An example of the success of outdoor bike racks can be seen at the Bedford Avenue L station in Williamsburg, Brooklyn. The NYC Dept. of Transportation replaced automobile parking spaces with bike racks in 2007. Bike commuting to the station increased to such an extent that demand exceeded rack space. Bike racks are not needed near stations where most passengers live within easy walking distance, such as on the Upper West Side of Manhattan.

2. Bike Transport on Trains and Buses

- Using a bicycle at the beginning and the end of a journey for commuting and leisure purposes permits MTA riders to combine two modes of transportation and should be encouraged to achieve maximum sustainability. That means, for example, an MTA customer could ride from home to the train or bus, put the bicycle on board, and ride to work at the other end.

- Towns in New York State and elsewhere have begun to promote bicycle tourism.¹¹ MTA railroad trains should be able to accommodate tourists traveling with bikes on trains to weekend and holiday destinations. Policies implementing the transport of bicycles on rail and bus systems have been established by more than 56 cities in the United States.

- Railroad Trains

- i) The MTA should expand its provisions for transporting bicycles on railroad trains.¹² Design specifications for new trains should include space for standard and folding bicycles.

- ii) Permits¹³ and special regulations for bicycles should be eliminated. Instead, the MTA should rely on existing city/state laws and general MTA regulations against unruly and dangerous conduct and on cyclists' own reasonable behavior.

- Subways

The MTA has a progressive policy for on-subway bicycle transport. Cyclists may bring standard frame bikes aboard the New York City subway at any time, but are discouraged from bringing them aboard subway trains that are crowded. As cycling becomes a more popular transit link, it may be necessary to provide priority transport space for bicycles in designated cars, as is the case in some other cities.

- Buses

- i) The MTA should continue its policy permitting folding bicycles inside MTA city buses.¹⁴

- ii) Buses are equipped with passenger-loaded bike racks in many cities throughout the United States.¹⁵ MTA buses should be so equipped on routes that cross bridges without bike paths, such as the Whitestone, Throgs Neck, and Verrazano-Narrows bridges, and where prospective passengers live beyond easy walking distance to a bus stop. As of 2002, more than 40,000 buses operated by over 300 U.S. transit agencies were equipped with bike racks.¹⁶ A bikes-on-buses (BOB) user survey of 15 transit agencies showed that "transit agencies generally view the initial investment and operational costs of BOB to be minimal compared to the return on investment." It also showed that "BOB programs attract new patrons, encourage increased use of transit, and expand the transit service area."¹⁷ Bus-mounted bike racks collapse so that they extend only four inches in front of the bus without bikes;¹⁸ they can be loaded by novices in about 15 seconds and by experienced users in from 4 to 10 seconds.¹⁹

3. Bike Storage at MTA Work Sites

- Bicycle racks should be provided in accessible, visible, and preferably sheltered locations at permanent MTA work sites.
- It should be an MTA policy that indoor storage for employees' bicycles be provided wherever possible.

¹¹Saratoga Springs, although not on a Metro-North line, is an example of a town which is served by a railroad and has begun to promote bike tourism ([www.saratoga.com_search "bike"](http://www.saratoga.com_search_bike)). Local buses have been equipped with bike racks so that people, including tourists who arrive by train (Amtrak), can get out of town onto the area's country roads and bicycle trails.

¹²Bicycles are allowed aboard LIRR and MNR trains at most times except rush hours and major holidays. Bicycles can be brought aboard the Staten Island Railway except on rush-hour trains traveling in the peak direction.

¹³Permits, purchased in advance, are required for conventional bicycles on MTA trains. Folding bikes can be taken on the LIRR without a permit.

¹⁴Folding bicycles are considered luggage and are permitted on local and limited buses at all times. All other bicycles are prohibited. Conventional bikes are not allowed on board buses operated by New York City Transit, the MTA Bus Company, or Long Island Bus.

¹⁵See, for example, San Francisco MTA: <http://www.sfmta.com/cms/bcomm/BikesonMuni.htm>; Seattle: <http://transit.metrokc.gov/tops/bike/bikeride.html>; Boston: http://www.mbta.com/riding_the_t/bikes; Atlanta: <http://itsmarta.com/howto/bikes.htm>; Chicago, Washington DC, and many other cities.

¹⁶Bikes on Transit Database. http://www.bikemap.com/bikesontransit/view_transit.php

¹⁷A Return on Investment Analysis of Bikes-on-Bus Programs, Final Report, Christopher Hagelin Principal Investigator, National Center for Transit Research, National Center for Urban Transportation Research, University of South Florida, June 2005, pg. iii. <http://www.nctr.usf.edu/pdf/576-05.pdf>

¹⁸Sportworks® bike racks for buses. <http://www.bicycleracks.com>

¹⁹A Return on Investment Analysis of Bikes-on-Bus Programs Ibid., pg. 7.

4. Consolidated and Easily Accessible Information

• A consolidated and accessible information system is an extremely helpful way to promote cycling in conjunction with mass transit. Through an enhanced web presence known as “MTA+Bike,” the MTA has consolidated bicycle travel information for each of its transit systems onto one location.²⁰ The websites of transit authorities in other cities provide good examples of how the internet is used elsewhere to encourage and facilitate cycling as a transit link.²¹ The MTA should continue to improve its website and provide useful and regularly updated information. It should include information about MTA transit links to parks, greenways, bike trails and out of town destinations which would be of interest to recreational cyclists.²²

5. MTA as an Advocate and Partner in Promoting the Use of Bicycles as a Sustainable Link in Urban and Regional Transit

- Insofar as possible, the MTA should participate in the early planning stages of Smart Growth/TOD projects within its region to ensure that proposed development includes acceptable facilities for bike-link transit.
- The MTA should work with the NYC DOT and other appropriate agencies to facilitate bike-link transit. This collaboration should include but not be limited to: bike parking adjacent to MTA transit stations; signage clearly marking the way to bike parking; easily accessible bike lanes and redesigned intersections leading to and from and connecting busy transit hubs such as Grand Central Terminal, Penn Station, and the Port Authority Bus Terminal to encourage potential bike-link commuters; and links from the MTA website to related websites, providing additional information whenever possible.
- Bike-sharing²³ is a generic program²⁴ that is being seriously considered for New York City. The central concept is low-cost or free access to bicycles for short trips within the city and the reduction of traffic congestion, noise, and air-pollution. Washington, D.C. recently launched – and is the first North American city to have – a bike sharing program.²⁵ Bike-sharing programs are in place in many other cities around the world,²⁶ including Copenhagen (since 1995) and eleven large cities in France.²⁷ Chicago, Boston, and San Francisco are among the American cities in the process of initiating bike-sharing programs. The Chicago transit agency has come under some criticism for not participating in the early stages of planning.

The Smart Growth-TOD Working Group recommends that the MTA become an active participant in the planning and implementation of New York City’s bike-sharing program and encourage its coordination with the MTA transportation to the extent possible.

Priorities

Short Term: These are priorities which the MTA should accomplish within one year.

- Adopt as an explicit goal the substantial increase of bicycle/MTA transit-linked journeys.
- Promote cycling as a transit link through a major publicity campaign, including posters on buses, subways, and trains; transit-linked cycling should be presented as a healthy, efficient, and cheap form of transportation for commuters and recreational cyclists.
- Provide information and training to conductors and other staff to facilitate the MTA’s new “cycling as a transit link” campaign.
- Provide bike racks at all MTA-owned facilities.
- Provide secure fee-based bike storage at Grand Central Terminal and 125th Street Station and other major stations with MTA-controlled parking sites.
- Improve the MTA’s website, promoting its objective to increase cycling as a transit link and providing cyclists with useful information, including recreational opportunities.
- Eliminate special permits for bicycles on railroad trains.

²⁰www.mta.info/bike: “MTA+Bike complements and supports the goals of the blue ribbon Commission on Sustainability and the MTA, which released a series of interim recommendations last month on ways the MTA can reduce its environmental impact and promote transit-oriented development.”

²¹Atlanta: <http://itsmarta.com/howto/bikes.htm>; San Francisco: <http://www.sfmta.com>; Seattle (King County): <http://transit.metrokc.gov/tops/bike/bike.html>

²²An example is the Harlem Valley rail trail, accessible from the Metro North station at Wassaia, Dutchess County. The Harlem Valley rail trail website (<http://www.hvrt.org>) provides excellent local information and additional links that are extremely useful to the cycling visitors.

²³http://en.wikipedia.org/wiki/Community_bicycle_program

²⁴See Exhibit 1, attached. Public Bike Share: Best Practices by Caroline Samponaro, Director of Bicycle Advocacy, Transportation Alternatives.

²⁵<https://www.smartbikedc.com>

²⁶<http://bike-sharing.blogspot.com>

²⁷Paris, Lyon, Marseille, Toulouse, Nantes, Besancon, le Mans, Rouen, Valenciennes, Mulhouse, and Aix en Provence.

Medium Term: These are high priorities that may take longer to achieve because they require the cooperation of other agencies.

- Work with NYC DOT and other government agencies to provide bike parking at all railroad train stations and selected bus and subway stations where the MTA does not control the adjacent parking sites.
- Work with NYC DOT and other government agencies to provide signage and safe bicycle access to and from major transit hubs.
- Work with city agencies to implement a “bike-sharing” program in New York City.

Longer Term: These are priorities that should be planned now for future implementation.

- Design on-board storage facilities for all new trains, buses, and subways.
- Provide passenger-loaded bike racks for the fronts of buses on some routes.
- Promote the use of bicycles as a transit link in TOD and Smart Growth developments throughout the MTA region.

Exhibit 1: Public Bike Share: Best Practices

Caroline Samponaro, Director of Bicycle Advocacy, Transportation Alternatives

Brief Definition:

A public Bike Share is a city-wide program of low-cost [nearly free] public-use bicycles designed to be an integral component of the city's larger public transportation network.

Summary:

Bike Share programs increase public transportation options at a relatively low cost to the city. Any registered user can “borrow” a bike from a station for a nominal fee and return it to any other station in the system. Bike Share should not be confused with free bike rental, however, because users typically pay an annual fee, borrow and return bikes to multiple locations, and ride mainly for transportation, not for recreation. While users may take the bikes for as long as they need, the usage charge for the time incrementally increases to encourage short, transit-oriented trips (the first half-hour should be free to encourage short trips and reduce barriers of entry).

Defining Features:

Public Bike Share programs hold enormous potential to transform mobility in cities by:

- expanding the reach and flexibility of the existing public transportation system
- discouraging the use of single occupancy vehicles
- freeing up space on overcrowded subways and buses
- adding a low-cost, sustainable, and healthy transportation option
- enabling a network of bicycle transit in a dense urban environment

The most successful bike share systems provide:

- 1 bike per 100-300 residents living within the chosen boundaries of a program (attention should be paid to the daytime vs. nighttime population in Manhattan)
- a dense network of stations (1/1000 feet) integrated onto the streetscape, facilitating traffic calming and the removal of car parking spaces
- 30 free minutes of cycling to encourage transportation trips
- connectivity to/from popular, transit-poor destinations
- connectivity to/from other modes of public transportation
- integration into the existing public transit system options (e.g. via MetroCard)
- strong anti-theft technology, including locks on bicycles for quick stops by users
- incentivized bike redistribution scheme to minimize use of operating vehicles

Cities well-suited to a Bike Share program have:

- the density and mixed land use necessary to generate sufficient ridership
- relatively flat terrain
- an on-street bicycle network, including lanes, bicycle boulevards, and slow streets (e.g. every 2-3 Avenues offer protected cycling routes, residential street speed limits reduced to 15 mph)

Bike Share is NOT:

- a drain on the city budget (it potentially generates revenue)
- free bike rentals (its purpose is public transportation and it integrates with other transit modes)
- a network of bicycle rental locations (the system is automated and capitalizes on low barriers to entry)
- a program only for pre-existing bicycle enthusiasts (Bike Share in Paris increased cycling by 168 percent in one year and brought bicycle mode share from less than 1 percent to almost 5 percent in the same amount of time)
- a detriment to private bike sales and traditional bike rentals (in cities like Paris it has increased both)

Impact:

By placing stations strategically – at transit hubs and other popular origins and destinations – Bike Share transforms urban mobility by adding a flexible, cost-effective and sustainable transportation option to the existing public transportation network in a city. Public bike system trips in Europe have replaced bus or subway trips by 34 to 65 percent, depending on the city, and car or motorcycle trips by 6 to 10 percent. In Paris cycling increased by 168 percent in only the first year of the bike share program and the bicycle mode share went from less than 1% to almost 5% in the same amount of time.

Bike Share holds huge potential to free-up much needed space on existing public transit modes and to favorably change urban commuter behavior as part of a larger plan to reduce carbon emissions, calm traffic to enhance street safety and improve public health.



Smart Growth/TOD - Case Studies

Metro-North Case Studies - New York

Beacon:

Bike Share programs increase public transportation options at a relatively low cost to the city. Any registered user can "borrow" a bike from a station for a nominal fee and return it to any other station in the system. Bike Share should not be confused with free bike rental, however, because users typically pay an annual fee, borrow and return bikes to multiple locations, and ride mainly for transportation, not for recreation. While users may take the bikes for as long as they need, the usage charge for the time incrementally increases to encourage short, transit-oriented trips (the first half-hour should be free to encourage short trips and reduce barriers of entry).

A policy to promote transit-oriented development (TOD) as a way of increasing ridership, supporting efficient land use, and leveraging public assets reflects the proactive role Metro-North Railroad plays in encouraging development in and around its stations. At Beacon Station, Metro-North recognized the importance of a broad-based outreach process in achieving a region-wide perspective while understanding the role of the station within the community.

In 2002 Metro-North initiated and facilitated a community planning charrette for a Station Area Master Plan that would improve station access at Beacon. The charrette engaged more than 20 key stakeholders, including the town, county, federal and state agencies, and major environmental, cultural, and local groups. This laid the groundwork for continued planning over the next two years.

A public workshop was later held to gather additional feedback on three alternatives developed from the charrette. Comments from the stakeholder groups and the public identified a preferred option and ongoing planning meetings refined the Master Plan to achieve consensus on the final version.

In 2004 a short-term improvement plan and a long-term Master Plan for the station area was finalized. The long-term Master Plan included a TOD design to improve service for current Metro-North customers and to generate economic growth in the City of Beacon. The key element of the Master Plan was a self-sustaining mixed-use TOD that would act as a gateway to the Beacon waterfront. The TOD element seeks to:

- Promote smart-growth principles including improved access to public transit, increased development density with lower parking requirements, and commercial and cultural activities.

- Integrate already existing multimodal transportation at the site.
- Support development approaches for the site that complement the local economy.
- Enhance access to and preserve key views of, the Hudson waterfront.
- Fund enhancements to the transportation facilities through a TOD/public-private partnership.
- Develop linkages to connect the station area to other local venues.

Metro-North then pursued a two-step approach to implement the Master Plan. The first step was the development of a Request For Expression of Interest (RFEI) which allowed interested developers to provide input regarding the site's potential thus assisting in establishing realistic parameters for the issuance of a formal Request For Proposal (RFP). The RFEI was issued in October 2007. Over 60 firms requested a copy of the RFEI. Based on the information received from the developer community Metro-North created a model TOD plan for the station area that best represented what was economically achievable at the levels of density and parking needed, along with the optimal mix of residential and commercial development. The model served as a basis to encourage the City of Beacon to make further zoning changes and was used to frame the creation of the TOD Request for Proposal.

With the expected release of the Request for Proposal in early 2009, the proposed TOD at the 18-acre site will take a step closer to completion. Beacon provides an excellent example of the ways in which transit can participate in the local planning process to develop TODs in suburban communities.

Yonkers:

The Yonkers transit-oriented development (TOD) project was a cooperative effort between Metro-North, New York State, the City of Yonkers, the Federal Transit Administration, and private developers. It is a clear example of the power of public and transportation development to act as an economic catalyst for a community.

The TOD project began with Metro-North's capital investments that resulted in the majestically-restored Yonkers station, which stands as the anchor and gateway for the Yonkers waterfront. Through a collaborative effort, excellent working relationships, and sound design and planning initiatives between Metro-North, the City of Yonkers, and private developers, the Yonkers waterfront is a strong testimonial to a successful transit-oriented development.

With the newly restored station completed in 2005, major infrastructure improvements by Metro-North complemented the City of Yonkers' ongoing waterfront development projects and assisted in the downtown revitalization efforts. The project created a new pedestrian access way to the Hudson River and a new park area next to the train station. Beginning in 2002, the early construction activity at the station was an enticement to other developers, with the rehabilitated Yonkers station serving as the gateway for many visitors to the waterfront and providing an excellent first impression to visitors. The Metro-North investment of renovation and related infrastructure totaled \$43 million.

The City of Yonkers constructed the waterfront esplanade to connect the train station and provide a direct waterfront entrance to the station. Through the collaborative effort of the city and Metro-North, the new entrance to the Yonkers station provides improved access for Metro-North customers residing on the waterfront. The city also provided significant investment in roadway infrastructure and an intermodal plaza at the station to enhance access. The work that Yonkers and Metro-North accomplished afforded benefits to market residential units that were being developed as part of the TOD.

A private developer working with the City of Yonkers, New York State, Scenic Hudson and Metro-North, began construction of mixed-use development at the station. The first phase included 266 residential units, 17,000 square feet of retail/restaurant space, and 28,000 square feet of office space. The second phase, completed in 2008, resulted in 294 additional units.

Metro-North Case Studies - Connecticut

Georgetown-Redding:

After 180 years of operation, a Connecticut wire mill went bankrupt but found new life from transit-oriented development. In 2002 the Town of Redding found a partner to restore and revitalize the 55-acre wire mill site centered around a new train station on the Metro-North line.

Groundbreaking occurred in 2006 with an estimated completion date in 2009. The new TOD will be guided by the principles of sustainable green development. It will include:

- Renovation of historically significant structures;
- Functional green technology, including photovoltaic's and green roofs;
- Hydroelectric dam and power plant using the existing infrastructure for power;
- New train station on the Metro-North line;
- Mixed use development with a diverse community of single-family houses, townhouses, affordable senior housing, and affordable artist work/live lofts;
- Wide assortment of retailers which reflect the needs of the residents and complement the character of the TOD; and
- Pedestrian-friendly environment with a village center, open public spaces and easy access to public transportation.

Stamford:

The pursuit of transit-oriented development is a main component of Stamford's efforts to make the city a national leader in sustainability. Stamford has pursued TOD as a strategy to:

- create an active and pedestrian-friendly environment in the city's core business center;
- increase density on the city's main street;
- build new residential neighborhoods around Stamford's train stations;
- promote the rehabilitation and redevelopment of the city's South End neighborhood including a feasibility study for a light rail line connecting the South End to the north side of downtown Stamford; and
- expand the city's walkable and lively historic center.

In June 2008 ground was broken for the development of the Metro Green Apartments, which is the first phase of Metro Green Residential. The project will include 238 mixed-income rental and for-sale residences on a mixed-use, TOD site. The Metro Green project will serve as a model for smart growth in Connecticut and beyond. In addition to the residential units, Metro Green will feature a 350,000-square-foot, 17-story, "best in class" LEED Platinum candidate office tower, as well as numerous public improvements to the streetscapes in the area, including the creation of a new public plaza.



Smart Fleets Report

The Smart Fleets Taskforce was convened to develop and evaluate sustainability strategies for energy consumption within the MTA's subway and commuter rail networks. It is composed of lead rail-car designers from New York City Transit, Long Island Rail Road, and Metro-North Railroad. To date, the committee's work has focused on improving efficiency, weight savings, and reducing total energy demand without compromising performance or passenger service. The existing vehicle equipment/systems, vehicles currently being procured – and the requirements for future fleets – were all considered with regard for the unique operating demands and regulatory environment for each agency.

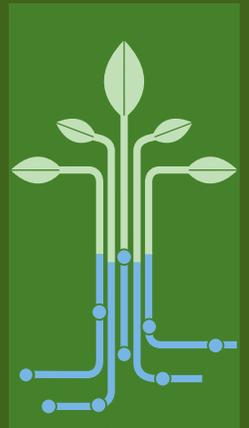
NYCT has taken the lead in analyzing a number of weight savings and energy management concepts. For the purposes of this study, these concepts can be categorized as either feasible on new vehicles or as a retrofit, or concepts with significant promise for future vehicles. This report summarizes the status of NYCT's work in these areas.

This report is available at www.mta.info/environment.



Climate Adaptation

An unabridged version of the paper informing the Climate Adaptation chapter of this report *MTA Adaptations to Climate Change - A Categorical Imperative*, prepared by Klaus Jacob (Lamont-Doherty Earth Observatory) and Cynthia Rosenzweig, Radley Horton, David Major and Vivien Gornitz (Center for Climate Systems Research, Columbia University) can be found at www.mta.info/environment.



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