

REPORT TO CONGRESS

TRANSIT GREEN BUILDING ACTION PLAN

Prepared by the

Federal Transit Administration



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Results in Brief

The explanatory statement accompanying the fiscal year 2009 Omnibus appropriation's act¹ directed the Federal Transit Administration (FTA) to submit a transit facility green building action plan to the House and Senate Committees on Appropriations.² As directed, this plan includes an analysis of green rating systems that would be suitable for transit projects; an overview of certified green building transit projects; an inventory of relevant assistance that could be provided to transit agencies; and planned FTA actions, timelines and resources to encourage green building in FTA programs.

Green buildings make efficient and effective use of resources – energy, water, raw materials, and land – and provide a healthy environment for working, learning and living. By applying green building practices to new construction and refurbishment of existing facilities, transit agencies can conserve resources through lower construction, operations, and maintenance expenditures.

Analysis of Green Building Rating Systems

The major green building rating systems applicable to transit facilities in the U.S. are identified in this Action Plan. The U.S. Green Building Council (USGBC) and Green Building Initiative both offer rating systems that assess building performance in the ability to:

- Optimize site potential
- Minimize non-renewable energy consumption
- Protect and conserve water
- Use environmentally preferable products
- Enhance indoor environmental quality
- Optimize operational and maintenance practices

The primary green building rating system used in design of new and renovated buildings is Leadership in Energy and Environmental Design or LEED[®]. It has been adopted for buildings constructed for use by the Federal Government as well as by many transit agencies as well as State and local governments. Transit agencies and state and local governments also use a simpler self-rating system that addresses energy efficiency (a key component of green construction), Energy Star[®] for Buildings and Manufacturing Plants. The Energy Star[®] system rates energy consumption of appliances developed by the U.S. Department of Energy (DOE) and U.S. Environmental Protection Agency (EPA).

Because of the similarities of transit buildings to other building structures, the LEED[®] and Energy Star[®] systems could be suitable for use in the construction of transit building. These

¹ Public Law 111-8.

² *Congressional Record*, February 23, 2009, House, Page H2473.

rating systems, however, may need further analysis and development to be applicable to other transit facilities with unique construction and operational characteristics such as subway stations, passenger shelters, commuter rail platforms, power substations, park-and-ride lots, elevated and at-grade track, overhead catenary power lines, tunnels and bridges.

Overview of Certified Green Building Transit Projects

Leaders in the transit industry have designed and built several examples of certified green buildings, some of which have earned the pre-eminent rating of LEED® Gold. Other projects planned for eventual certification have not yet reached the stage when they can be rated.

The transit industry has realized the many benefits of green building in constructing green transit facilities and rehabilitating existing building stock. For example, in April 2009, the Los Angeles County Metropolitan Transit Authority (LACMTA) unveiled a groundbreaking energy efficiency and renewable power project with the installation of the Nation's largest solar panel system at a transit facility. According to the LACMTA, the 6,720 individual solar panels at its Support Services Center in downtown Los Angeles (the agency's central maintenance facility for buses) will generate 1.2 megawatts of renewable, emission-free power. Along with other energy-efficient improvements, the project is expected to decrease the facility's annual \$1.1 million energy bill by half and reduce carbon emissions by more than 3,700 metric tons, equivalent to planting more than 550 acres of trees and removing more than 600 cars from the roads.

Other noteworthy green building transit projects are highlighted in the Action Plan, including the refurbishment of the Chicago Transit Authority (CTA) building that houses the agency's main administrative offices in Chicago, Illinois. The renovated building was completed and occupied in 2004. CTA headquarters received the Energy Star® label from 2005 to 2008. For 2008, it attained an Energy Star® rating of 92 out of a possible 100 points. In May 2007, after the building was reconditioned to meet LEED® certification standards, the building achieved a Gold LEED®-EB (Existing Building) rating. Going green for its headquarters was at CTA's own initiative and did not require any direct financial assistance from FTA. However, CTA is using Federal funds to repay the public commission bond used to underwrite the costs for the building.

The Santa Clarita Transit maintenance facility in Santa Clarita, California obtained a LEED® Gold certification. Construction of the facility was completed in 2006 after the City of Santa Clarita converted its entire bus fleet from diesel to compressed natural gas (CNG) to reduce emissions. The Santa Clarita Transit maintenance facility includes a 22,000-square-foot administration building, 25,000-square-foot maintenance building, bus wash facility, CNG fueling facility for city buses, and publicly accessible CNG fueling station. The facility has a capacity to maintain over 150 CNG buses and house 160 employees. The project was partially funded with a Section 5307 Urbanized Area Formula Program grant from FTA.

One of the most innovative green design elements of the maintenance facility is the use of straw bales with a lime plaster layer for construction on both interior and exterior structures. This construction method creates an efficient, super-insulated building perimeter to

complement the significant temperature fluctuation between night and day of the surrounding desert climate. In addition, the building was designed with on-site storm-water collection and treatment, water-efficient plumbing fixtures, and a gray water reclamation system to minimize water waste from washing buses. Santa Clarita also installed a photovoltaic array on top of the bus parking pavilion to provide shade and generate electricity for use in the facility. In addition, Santa Clarita is able to sell surplus electricity generated back to the local utility. Other green features of the maintenance facility include a well insulated “cool” roof, an under-floor heating-ventilation and air conditioning (HVAC) system, use of recycled materials, and native plant landscaping to reduce water consumption.

Federal Assistance to Transit Agencies

Several Federal Government agencies, including FTA, Federal Highway Administration (FHWA), DOE, and EPA, provide financial and technical assistance in support of greening transit facilities. The primary grant assistance programs used to fund green building projects are FTA’s formula and capital assistance grants, and the flexible funding available under the Surface Transportation Program (STP) and Congestion Mitigation and Air Quality (CMAQ) program. Research in support of green building is funded by FTA, EPA and DOE. Technical assistance is provided by FTA staff in headquarters and regional offices and in training courses offered by the National Transit Institute.

Planned FTA Actions, Timelines, and Resources

This Action Plan examines the following options:

- Encourage green building for transit facilities by recognizing building design and certification as eligible project costs;
- Encourage transit industry green building initiatives through partnerships with the American Public Transportation Association’s (APTA) sustainability commitment and other FTA training and sustainability efforts;
- Establish national and regional recognition and honorary awards for transit agencies that receive a green building certification;
- Provide incentives for green building of transit facilities through allowing higher Federal share, giving more credit/points for projects constructed with sustainable elements, or establishing new “categorical exclusion” relevant to NEPA regulations

With FTA financial support and encouragement, the transit industry and APTA have already begun implementing green transit building practices. This Action Plan details additional steps that FTA intends to take to further the implementation of green building practices.

Background

The explanatory statement accompanying the fiscal year 2009 Omnibus appropriation directed the Federal Transit Administration (FTA) to submit a transit facility green building action plan to the House and Senate Committees on Appropriations as follows:

Transit facility green building plan.--FTA should be a more active partner and proactively work with grantees to explore green building options for transit facilities. FTA is directed to submit a transit facility green building action plan to the House and Senate Committees on Appropriations within 90 days of enactment. The plan should include: an overview of certified green building transit projects; an analysis of green rating systems that would be suitable for transit projects; planned FTA actions, timelines and resources to encourage green building in FTA programs; and, an inventory of relevant assistance that could be provided to transit authorities.

This Action Plan is consistent with other Federal efforts. The stated purpose of the Energy Independence and Security Act of 2007 (EISA) signed into law on December 19, 2007 (Public Law 110-140) is “to move the United States toward greater energy independence and security, to increase the production of clean renewable fuels, to protect consumers, to increase the efficiency of products, buildings, and vehicles, to promote research on and deploy greenhouse gas capture and storage options, and to improve the energy performance of the Federal Government, and for other purposes.”

EISA provides comprehensive Congressional direction enabling Federal agencies to take leadership in promoting energy savings throughout the American economy in transportation, construction, heavy industry, homes, and consumer products. Similar provisions are included in the American Recovery and Reinvestment Act of 2009 (ARRA), Public Law 111-1, signed into law by U.S. President Barack Obama on February 17, 2009.

Public transportation is uniquely situated to support EISA. It contributes to sustainability through multiple environmental benefits and energy savings, achieved primarily through providing alternatives to travel by single-occupancy vehicle. FTA provides financial and technical assistance to the public transportation industry and works to raise awareness of new and existing solutions to sustainability problems. In addition to supporting public transportation through formula grants, FTA administers capital investment, planning, research, and technical assistance programs and awards \$10 billion annually to State and local governments and transit agencies.

Compared to transit facilities, the operation of buses and trains consumes the lion’s share of the energy used in providing public transportation service. In the 1990s, when public attention focused on pollution from diesel buses, FTA leadership and capital grant incentives enabled the transit industry to introduce new transit bus engines that met increasingly stringent emissions requirements of the Clean Air Act. More recently, FTA has funded the

purchase approximately 4,000 hybrid-electric buses that reduce fuel consumption and emissions.

Like transit rolling stock, buildings used by transit agencies for maintenance, operation, and administration also offer opportunities to reduce the carbon footprint of public transportation. Green buildings make efficient and effective use of resources – energy, water, materials, and land – and provide healthy environments for passengers and transit employees. By applying green building practices to new construction and refurbishment of existing facilities, transit agencies can save money through lower costs of construction, operation, maintenance, and utilities and help to clean the environment.

For nearly two decades, FTA regulations have required completion of an energy assessment as a prerequisite to assistance for the construction, reconstruction, or modification of buildings.³ Although this requirement has not been enforced in recent years, FTA will alert the transit industry that reducing energy consumption and greenhouse gas (GHG) emissions has become a worldwide imperative.

FTA has also taken a leadership role in encouraging green building of transit facilities by partnering with APTA to examine sustainable practices, as well as providing grants to transit agencies that support several green transit buildings.

At least 12 transit projects that meet some measure of sustainability have already been built and rated. Presently, transit agencies are seeking some level of green certification for about 50 buildings. Some transit industry leaders have recognized the benefits of being green and reducing energy costs by procuring transit vehicles that reduce their agencies' overall carbon footprint and by building more efficient transit buildings and related facilities.

Analysis of Green Building Rating Systems Suitable for Transit Projects

Green building rating systems now in use provide a systematic approach to evaluating green building practices. These systems establish criteria and methods by which buildings planned for construction and existing buildings scheduled for renovation are measured and evaluated. In order to minimize the environmental impacts of buildings, these systems include resource conservation and environmental considerations, not only in the building process but also in the operational use of the buildings.

The green building rating systems most widely used in the U.S. are suitable for transit projects that involve construction of new buildings or major renovation of existing buildings. Some systems require registration and independent assessment of documentation by qualified reviewers, while others are self-administered.

The following green rating systems are examined in this section:

³ 49 CFR 622(c).

- BREEAM
- LEED
- Green Globes
- Energy Star and
- ASHRAE

Building Research Establishment's Environmental Assessment Method

The Building Research Establishment's Environmental Assessment Method or BREEAM was the first environmental certification system. The BREEAM assessment process was created in the United Kingdom (UK) in 1990 by the Building Research Establishment (then a Government agency but now a private organization known as BRE Ltd), with the first two versions covering offices and homes. Versions are updated regularly in line with UK building regulations, and different building versions have been created to assess various building types.

In a BREEAM assessment, a qualified independent assessor awards credits for the building according to performance in a broad range of environmental impacts including:

- | | |
|-------------------------|------------------------|
| • Management | • Water |
| • Health and well-being | • Material and waste |
| • Energy | • Land use and ecology |
| • Transport | • Pollution |

A set of environmental weightings then enable the credits to be added together to produce a single overall score. The building is then rated on a scale of PASS, GOOD, VERY GOOD, EXCELLENT or OUTSTANDING.⁴ Because of the potentially long assessment period, BRE Ltd stipulates a maximum of five years from the date of registration for validating information and completing the certification process.

The two most prominent comprehensive green building performance rating systems for commercial buildings in the U.S. are the USGBC's Leadership in Energy and Environmental Design (LEED[®]) Green Building Rating System⁵ and the Green Building Initiative's Green Globes⁶ assessment program. Both rating systems require independent third-party assessments. Both systems are derived from BREEAM and, as a result, have similar goals.

Leadership in Energy and Environmental Design

Leadership in Energy and Environmental Design or LEED[®] is an internationally recognized certification system that measures how well a building or community performs across several

⁴ <http://www.breeam.org>, accessed May 13, 2009.

⁵ <http://www.usgbc.org>, accessed May 13, 2009.

⁶ <http://www.greenglobes.com>, accessed May 13, 2009.

different metrics: energy savings, water efficiency, CO₂ emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts.

The USGBC developed the LEED[®] Green Building Rating System™ as a voluntary, consensus-based national standard for developing high-performance, sustainable buildings. LEED[®] is a third-party certification program and a nationally-accepted benchmark for the design, construction, and operation of high-performance green buildings. The LEED[®] system encourages and accelerates global adoption of sustainable green building and development practices through the creation and implementation of universally understood and accepted tools and performance criteria.

LEED[®] is accessible on-line and supported by a workshop program and the LEED[®] Professional Accreditation program. LEED[®] standards are available for certification in the following areas:

- New Construction
- Existing Buildings, Operations and Maintenance
- Core and Shell
- Commercial Interiors
- Homes
- Neighborhood Development⁷

The LEED[®] system has several rating categories:

- Sustainable sites
- Water efficiency
- Energy and atmosphere
- Materials and resources
- Indoor environmental quality
- Innovation in design

LEED[®] has four rating levels: Certified, Silver, Gold, and, Platinum (highest level).

Since 2003, the General Services Administration (GSA), the Federal agency with overall responsibility for the management of technical aspects of designated major design, construction, renovation or alteration of Federal Government building projects, has required that Federal projects meet the LEED[®]-Certified level standard, with a target rating of LEED[®]-Silver.

⁷ LEED[®] for Neighborhood Development is a new rating category that is currently being piloted and is scheduled to be implemented in the summer of 2009 with a limited number of projects. It has been developed to recognize and encourage smart growth, walkable or transit-oriented neighborhood design, and green building by certifying development projects that meet specific criteria in these areas.

As a result of a 2006 evaluation for GSA of many sustainable building rating systems⁸, the GSA Administrator concluded that LEED[®] remains the most credible rating system available to meet GSA's needs for buildings owned or used by Federal Government agencies. The Energy Independence and Security Act of 2007 (EISA) requires GSA to re-evaluate the rating systems every five years.⁹

Approximately 25 states have passed or are considering legislation requiring government-funded projects to meet LEED[®] building standards. In addition, 48 cities including New York, Los Angeles, and Chicago have adopted LEED[®] standards.¹⁰

The federal government has 138 certified projects and another 1,236 pursuing certification. State governments have 216 certified projects and 1,527 pursuing certification. Local governments have 344 certified projects and 2,310 pursuing certification.¹¹

Green Globes Building Rating System

The Green Building Initiative (GBI) is another organization that has developed a comprehensive green building rating system for achieving environmentally sustainable buildings. This system is an online, web-based green building assessment system which measures building performance in a variety of areas. The system has two major categories: Green Globes for New Construction and Green Globes for Continual Improvement of Existing Buildings.

The Green Globes building rating system assesses performance in the following areas:

⁸ Fowler, K.M. and E.M. Rauch , "Sustainable Building Rating Systems Summary," Pacific Northwest National Laboratory, July 2006.

⁹ Public Law 110-40, Section 436(h), "High Performance Green Federal Buildings"

¹⁰ For a completing listing of LEED[®] initiatives of Federal, state and local governments, please refer to the USGBC website www.usgbc.org under "Government Resources, LEED[®] Initiatives in Government and Schools."

¹¹ www.usgbc.org, accessed May 13, 2009.

- Project Management/Environmental Management
- Site
- Energy
- Water
- Resources
- Emissions
- Indoor environment

The Green Globes protocol assesses environmental performance on a 1,000-point scale in multiple categories:

- Energy
- Indoor environment
- Site
- Water
- Resources
- Emissions
- Project/environmental management

After achieving a threshold of at least 350 points, new and existing commercial buildings can be certified for their environmental achievements and sustainability by pursuing Green Globes certification that assigns a rating of one to four globes.

Qualified assessors (with expertise in green building design, engineering, construction and facility operations) interface with project teams and building owners during the third-party assessment process by reviewing building documentation and conducting on-site walk-throughs.

Green Globes is currently seeking accreditation by the American National Standards Institute (ANSI). At this time, Green Globes is a partner with Energy Star[®] and is recognized by the EPA, the Department of Health and Human Services (HHS), and the Department of the Interior (DOI), and is law in 18 States.¹²

Energy Star[®] for Buildings and Manufacturing Plants

Energy Star[®] for Buildings and Manufacturing Plants is a self-rating system developed by the EPA and the U.S. Department of Energy (DOE). It is used to evaluate the energy performance of a designed building. Buildings earn the Energy Star[®] label based on meeting or exceeding energy performance standards.¹³

Energy Star[®] provides an online questionnaire and uses a statistical baseline of similar buildings in the U.S. to enable building owners and designers to rate a building's energy

¹² www.thegbi.org

¹³ http://www.energystar.gov/index.cfm?c=evaluate_performance.pt_neprs_learn, accessed May 15, 2009.

efficiency on a 100-point scale. According to this national energy performance rating system, a rating of 50 indicates average industry energy performance, while a rating over 75 indicates top performance. This designation applies to a building's energy efficiency performance only.

Based on the information entered about the building such as its size, location and number of occupants, the rating system estimates how much energy the building would use if it were the best performing, the worst performing, and every level in between. The system then compares the actual energy data entered to determine where the building ranks relative to its peers.

All of the calculations are based on source energy, which EPA considers to be the most equitable way to compare building energy performance; it also correlates best with environmental impact and energy cost.

The energy performance rating is derived from fuel consumption data of existing commercial buildings which includes the total energy use associated with the buildings. Therefore, the analysis must include all fuel sources and total estimated energy use for the building design. Gaps in energy analysis must be addressed in order for the rating to be a useful indicator of future performance.

To estimate how much energy a building would use at each level of performance, EPA conducts statistical analysis on the data gathered by the DOE's Energy Information Administration during its quadrennial Commercial Building Energy Consumption Survey.

The self-rating system uses a data checklist to provide a summary of a property's physical and operating characteristics, as well as its total energy consumption. The purpose of the checklist is to assist professional engineers in double-checking the information that the building owner or operator has entered into a portfolio manager. This document supplements a Statement of Energy Performance by providing a comprehensive review of the physical and operating characteristics that contribute to the building's performance. The data checklist must be signed by a professional engineer and sent to EPA along with the Statement of Energy Performance for a building to receive Energy Star® certification.

American Society of Heating, Refrigerating and Air-Conditioning Engineers

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) developed a rating label for buildings to be introduced in June 2009. The label was developed through collaboration with input from EPA's Energy Star® program and is designed to expand the reach of that program and to prepare the industry for the possibility of mandatory energy reporting. A June 2008 report explaining the purpose of the labeling and rating system is available online.¹⁴

¹⁴ www.ashrae.org/energylabeling, accessed April 27, 2009.

Existing Rating Systems Are Suitable for Transit Facilities

The review and analysis of green building rating systems disclosed that sustainability attributes evaluated by all three of the principal existing rating systems (LEED[®], Green Globes and Energy Star[®]) are suitable for transit projects involving design of new buildings or renovation of existing buildings. They may need additional analysis and development to be applicable to specialized transit facilities with unique functional and operational characteristics, not usually thought of as buildings. Many of the rating criteria, such as energy and water efficiency, can be applied to the design, construction and operation of subway stations, passenger shelters, commuter rail platforms, utility sheds, power substations, overhead catenary power distribution lines, park-and-ride lots, elevated and at-grade track, tunnels, bridges, and busways.

For example, park-and-ride lots, parking areas and turnout areas may be surfaced or resurfaced with porous or pervious pavement materials that would be able to absorb rainwater, reducing runoff and protecting streams, wetlands, and environmentally sensitive areas. These present an opportunity for the transit industry to initiate a self-rating process for rating or certifying non-building transit projects involving new construction or renovation.

APTA has been working with the USGBC to develop green building standards more directly applicable to transit facilities.

Overview of Certified Green Building Transit Projects

Public transportation is inherently one of the greenest forms of transportation because it provides vehicles that can be shared by many travelers, who otherwise might travel via single-occupant vehicles. Green and sustainable building and operational practices have become more prominent within the transit industry as green building standards, technologies and practices have become more commonplace.

Transit agencies are looking at ways to make buildings and facilities more sustainable because the costs associated with designing and building environmentally friendly facilities, on average, are only slightly higher than without the green features. The operational cost savings associated with going green will save money over the life cycle of the building.

Three independent studies found that buildings designed with green features can reduce energy use by as much as 50 percent compared to traditional buildings, carbon dioxide emissions by 39 percent, water consumption by 40 percent, and solid waste by an average of 70 percent. The green features do not increase net building maintenance costs. In fact, a GSA study concluded that green buildings actually reduce maintenance costs by an average of 13 percent. The data suggest that going green is not only good for the environment, it also makes financial sense.

A number of transit agencies have already incorporated green practices in the day-to-day operations when refurbishing old facilities to green standards or constructing new ones with green technologies and certifications. A survey of the USGBC's database found a dozen transit properties that have earned LEED® certifications in their maintenance facilities or administrative buildings. In addition, approximately 100 other transportation projects have been registered with USGBC, signifying intent to obtain LEED® certification.

Examples of Transit Green Building

Exhibit 1 lists some of the transit buildings and facilities that have obtained USGBC certifications ranging from LEED®-Certified to LEED®-Gold.¹⁵

¹⁵ Source: LEED® Projects & Case Studies Directory, www.usgbc.org/LEED®/Project/CertifiedProjectList.aspx, accessed May 15, 2009.

Exhibit 1. Examples of Transit Green Buildings with LEED® Certifications			
Project Name	Owner	Location	Type of Certification
East Valley Bus Administration Facility	City of Tempe	Tempe, AZ	LEED® - Gold
East Valley Bus Operation and Maintenance Facility	City of Tempe	Tempe, AZ	LEED® - Gold
MTA Transportation Building Division 9	Los Angeles County Metropolitan	El Monte, CA	LEED® - Gold
Santa Clarita Transit Maintenance Facility	City of Santa Clarita	Santa Clarita, CA	LEED® Gold
Lory Student Center Transit Center, Colorado State University	City of Fort Collins	Ft. Collins, CO	LEED® - Gold
Chicago Transit Authority Headquarters	Chicago Transit Authority	Chicago, IL	LEED® - Gold
Bay Area Transportation Authority	Bay Area Transportation Authority	Traverse City, MI	LEED® - Gold
Apgar Transit Center, Glacier National Park	National Park Service	West Glacier, MT	LEED® - Gold
Charlottesville Transit Station	Charlottesville Transit Service	Charlottesville, VA	LEED® - Gold
Interurban Transit Partnership	Interurban Transit Partnership	Grand Rapids, MI	LEED® - Certified
Wabash Station Reno	City of Columbia, Public Works	Columbia, MO	LEED® - Certified
Corona Maintenance Shop and Car Washer	New York City Transit	Queens, NY	LEED® - Certified
Salt Lake City Intermodal Passenger Hub	Utah Transit City Corporation	Salt Lake City, UT	LEED® - Certified
Pentagon Metro Entrance Facility	Pentagon Renovation Office	Arlington, VA	LEED® - Certified

Three of these transit projects, which illustrate many aspects of green building, are highlighted in the next section.

Noteworthy Transit Green Building Projects

New Construction: LACMTA Support Services Center

In April 2009, the LACMTA unveiled a groundbreaking energy efficiency and renewable power project with the installation of the nation's largest solar panel system at a transit facility. The 6,720 individual solar panels at LACMTA's Support Services Center in downtown Los Angeles (the agency's central maintenance facility for buses) will generate 1.2 megawatts of renewable, emission-free power. Along with other energy-efficient improvements, the project is expected to halve the facility's annual \$1.1 million energy bill and reduce carbon emissions by more than 3,700 metric tons, equivalent to planting more than 550 acres of trees and removing more than 600 cars from the roads.

Transit Building Refurbishment: Chicago Transit Authority Headquarters¹⁶

The Chicago Transit Authority (CTA) Headquarters Building contains 400,000 square feet and houses the main administrative offices of the CTA. The renovated building was completed and occupied in 2004. CTA Headquarters received the Energy Star[®] label in 2005, 2006, and 2007 and again in 2008, when it attained an Energy Star[®] rating of 92 out of a possible 100 points. In May 2007, after the building was reconditioned to meet LEED[®] certification standards, the building achieved a Gold LEED[®]-EB rating, the first such award in Illinois.

The building was designed and developed with leading-edge technology and high-efficiency mechanical systems. The heating, ventilation and air conditioning system has building automation system integration to coordinate and optimize the performance of various mechanical components, including chillers, boilers, cooling towers and air-handling units. The fan-powered mixing boxes have direct digital control and utilize hydronic coils, which provide high performance and economical heating.

The building's other environmental features includes a "green roof covered with plants" which covers 91 percent of its top surface. The green roof provides insulation, reduces urban heat island effects and retains storm water runoff. Windows are low-emissivity glass and are equipped with horizontal blinds to control solar heat gain. In summer, building occupants are required to keep the blinds in a lowered and tilted position to reduce solar heat gain, and building security officers check the positioning of blinds on their routine, nighttime patrols.

During the application process for LEED[®] certification, new policies, design and operation changes were implemented to increase energy efficiency, improve indoor environmental quality and increase water efficiency of the building. Lighting in private offices is controlled by occupancy sensors. Because 89 percent of office space receives natural light, building engineers disable the perimeter row of light fixtures from June through October. Under the

¹⁶ Adapted from information provided by CTA for the U.S. EPA Energy Star[®] website, <http://www.energystar.gov>, accessed May 13, 2009.

demand response plan with the local utility company, all light fixtures in general office areas are turned off, which is possible because typical workstations have task lighting and computer monitors.

During comprehensive commissioning performed for LEED® certification, the air-flow sensors in the air system were changed to more accurate and reliable electronic measuring stations to maintain the proper balance between supply and return air volumes.

Other environmental features of the building include low-flow plumbing fixtures and a bicycle storage facility with locker rooms and showers. Environmental practices include programs for comprehensive recycling, green cleaning, and low-impact pest control.

Exhibit 2: Santa Clarita Transit Maintenance Facility



New Construction: Santa Clarita Transit Maintenance Facility, California¹⁷

The Santa Clarita Transit maintenance facility, shown in Exhibit 2, in California obtained a LEED® Gold certification by the USGBC.

The construction of the facility was completed in 2006 after the City of Santa Clarita decided to convert its entire bus fleet from diesel to CNG to reduce emissions from the diesel fleet to a more environmentally-friendly alternative. The Santa Clarita Transit maintenance facility includes a 22,000 square-foot administration building, a 25,000-square-foot maintenance building, a bus wash facility, a CNG fueling facility for City buses, and a publicly-accessible CNG fueling station. The facility has a capacity to maintain over 150 CNG buses and house 160 employees. The project cost about \$20 million and was partially funded with a grant from FTA.

One of the most innovative green design elements is construction using straw bales with a lime plaster layer on both the interior and exterior. This creates an efficient, super-insulated building perimeter to complement the large day-night temperature swings caused by the

¹⁷ <http://www.santa-clarita.com/cityhall/pw/cip/tmf/> and <http://www.hoksustainabledesign.com> (example number 6 under “Featured Work”, accessed May 18, 2009).

surrounding desert climate. In addition, the building was designed with on-site storm water collection and treatment, water-efficient plumbing fixtures, and a gray water reclamation system to minimize water waste is washing buses. The facility also installed a photovoltaic array on top of the bus parking pavilion to provide shade and generate electricity for use in the facility and sell the surplus electricity back to the local utility. Other green features of the facility includes a well insulated “cool” roof, an under-floor HVAC system, use of recycled materials, and native plant landscaping to reduce the water consumption.

Noteworthy features of some additional examples of green building of transit facilities follow.

EAST VALLEY BUS OPERATIONS AND MAINTENANCE FACILITY

Valley Metro

Tempe, Arizona

Opened: October 2007

Certified: LEED®-Gold

- Contains sustainable elements that help to protect and conserve the earth’s natural resources
- http://www.valleymetro.org/valley_metro/pressroom/press_releases/residents_employers_awarded_for_cleaning_air/

THE RAPID CENTRAL STATION BUS TERMINAL

The Interurban Transit Partnership

Grand Rapids, Michigan

Opened: June 2004

LEED®-Certified

- Natural lighting, shaded from direct sun
- Recycled steel and concrete
- State of the art heating and ventilating
- <http://www.ridetherapid.org/about/environment>

LORY STUDENT CENTER TRANSIT CENTER

Colorado State University

Transfort

Fort Collins, Colorado

Opened: August 2007

Certified: LEED®-Gold

- High-performance, sustainable building
- Sustainable site development
- Water savings
- Energy efficiency
- Materials selection

- Indoor environmental quality
- <http://www.fcgov.com/transfort/transit-centers.php>

APGAR TRANSIT CENTER

Going-to-the-Sun Shuttle
 Glacier National Park
 West Glacier, Montana
 Opened: April 2009
 Certified: LEED®-Gold

- On-site storm water treatment, and native landscaping.
- Integrated day lighting and shading strategies.
- <http://home.nps.gov/glac/parknews/news09-09.htm>

DOWNTOWN TRANSIT STATION

Charlottesville Transit Service
 Charlottesville, Virginia
 Opened: March 2008
 Certified: LEED®-Gold

- Locally produced building materials
- Ultra-efficient geothermal heating and cooling system
- Recycled content materials
- Daylighting measures
- Energy and water saving features
- <http://www.charlottesville.org/Index.aspx?page=567>

CORONA MAINTENANCE SHOP

New York City Subway
 MTA/New York City Transit
 Corona (Queens), New York City
 Opened: December 2006
 LEED® Certified:

- Fuel Cell
- Photovoltaic Roof Panels
- Daylighting
- Rainwater collection
- http://www.mta.info/nyct/facts/ffenvironment.htm#green_build

The website of the USGBC contains links to other examples of other transit facilities that are either certified or registered for future certification.

Federal Assistance to Transit Agencies

This section provides specific details on selected financial and other assistance to public transit agencies available to promote green building. This support comes from a number of different Federal Government agencies including FTA, FHWA, DOE, and EPA.

FTA Research, Planning, Technical Assistance and Capital Grants

FTA provides support to transit agencies through capital grants, planning, policy, research, and technology assistance.

First, FTA helps communities support public transportation by issuing more than \$10 billion/year in grants to eligible recipients for planning, vehicle purchases, facility construction, operations, and other purposes.

Second, FTA engages in research to provide the transit industry and policy makers with the information and skills to make good business decisions about transit technology, operational practices, and capital investments; to share research results that identify best practices; and, to show a range of outcomes that help chart the course of future investments.

Third, FTA focuses on technological advances in bus and rail operations, safety features, fuel efficiencies and alternatives, intelligent transportation system applications, and information dissemination. These areas help to promote passenger safety and satisfaction and attract customers, improve capital and operating efficiencies, reduce environmental pollution, and ease dependence on fossil fuels.

All three of these functions help support green building in transit projects. In addition, direct technical assistance to grantees is provided by FTA staff in Headquarters and regional offices as well as through training courses offered by FTA and National Transit Institute which is funded through FTA Research and University Centers programs.

The functions mentioned above broadly support green building, however, the following programs specifically highlight sustainable practices and green building efforts with the transit industry.

FTA Clean Fuels Grant Program (49 U.S.C. Section 5308)

http://www.fta.dot.gov/funding/grants/grants_financing_3560.html

In FY 2008, about \$29 million was awarded by FTA to ten transit agencies for facilities and vehicles under the FTA Clean Fuels Grant Program.

The program was developed to assist non-attainment and maintenance areas in achieving or maintaining the National Ambient Air Quality Standards for ozone and carbon monoxide

(CO). The program supports emerging clean fuel and advanced propulsion technologies for transit buses and markets for those technologies.

FTA Transit Investments for Greenhouse Gas and Energy Reduction (TIGGER) (http://www.fta.dot.gov/index_9440_9326.html#TIGGER)

The American Recovery and Reinvestment Act of 2009 (ARRA) provided \$100 million through the Transit Investments for Greenhouse Gas and Energy Reduction program. These funds will be distributed as discretionary grants to public transit agencies for capital investments that will assist in reducing the energy consumption or greenhouse gas emissions of public transportation systems.

FTA Research Support of APTA Sustainability and Urban Design Standards

(<http://www.aptastandards.com/StandardsPrograms/SustainabilityandUrbanDesignStandards/tabid/244/Default.aspx>)

Since 2006, FTA has provided \$1 million per year of National Research Program funding to APTA's Standards Development program. Working groups within the standards program collaborate to develop and adopt standards on sustainability and climate change.

The use of standards in the public transportation industry has grown significantly in recent years. At APTA, more than 30 committees and 800 transit industry professionals are actively participating in five major voluntary standards development programs. These programs cut across all public transportation modes. They are focused on key elements of transit operations and maintenance including the design of bus and rail vehicles, development of operating practices, inspection and maintenance guidelines for vehicles and facilities, interoperability and interchangeability of component systems and parts as well as the adoption of definitions for data structures so that electronic components can exchange information.

FTA Environmental Management Systems Training and Assistance (http://www.fta.dot.gov/planning/environment/planning_environment_227.html)

On August 13, 2007 FTA published in the *Federal Register* an invitation to state and local transit agencies to apply for Environmental Management Systems (EMS) training and assistance. FTA-funded training and assistance will take the form of workshops, on-site technical advice, consultation and comprehensive training in the development of an International Organization for Standardization (ISO) 14001-based EMS for chosen transit facilities. An EMS is a set of operational procedures to ensure compliance with federal, state and local environmental regulations, as well as to facilitate environmental stewardship. These procedures address energy conservation, efficient water use, material recycling and waste minimization, vehicle emissions reduction, improved fueling operations and hazardous material management and substitution, among other practices. Evidence suggests that adoption of EMS results in better regulatory compliance and fine avoidance, as well as

advantages in financing, insurance, marketing, regulatory compliance, and other areas of operations.

FTA Clearinghouse of Transit Agency Sustainable Practices

(http://www.fta.dot.gov/planning/planning_environment_8524.html)

From installing solar panels to buying hybrid buses and building energy efficient facilities, transit agencies across the country are taking leadership on sustainability. The list showcases transit agencies with the efforts they are currently taking towards environmental sustainability.

FTA Transit and Environmental Sustainability Website

(<http://www.fta.dot.gov/sustainability>)

FTA's website lists activities that promote environmental sustainability and notes the contributions public transportation makes in furthering sustainability. It provides links to the following:

- Carbon Calculator
- Clearinghouse of Transit Agency Sustainable Practices
- U.S. Department of Transportation Center for Climate Change and Environment Forecasting
- Public Transportation's Role In Responding to Climate Change

Flexible Funding Programs from the Highway Trust Fund

Flexible funding, available to urbanized areas and states under the Surface Transportation Program (STP)¹⁸, may be used for transit green building projects. In 2008, over \$277 million in STP funds were transferred to FTA and used to support transit.

Congestion Mitigation and Air Quality (CMAQ) funds can be made available for transit green building projects if they serve the purpose of reducing congestion or improving air quality in areas of non-attainment of ozone or carbon monoxide air quality standards.¹⁹ In 2008, over \$617 million in CMAQ funds were transferred to FTA and used to support transit.

¹⁸ 23 U.S.C. Section 133(b)(2)

¹⁹ 223 U.S.C. §149(f)(3)

Planned FTA Actions, Timelines and Resources

Background

FTA has been actively involved in developing and deploying electric-drive buses for many years, to address the primary producer of greenhouse gas and other emissions from transit service. FTA-funded research is currently investigating more energy-efficient vehicle technologies, such as lighter weight materials and higher-performance batteries, and wayside energy storage (coupled with regenerative braking) in rail transit systems.

Although components of these programs have overlapped into the design and construction of transit facilities, FTA has not previously pursued actions specific to transit facility design and construction. As reducing or eliminating GHG emissions from the entire spectrum of transit operations has taken on greater urgency, FTA has increased its emphasis on the importance of green building and sustainability in the transit industry. This section highlights several key FTA actions currently underway or proposed as part of this Action Plan.

Current and Future Actions

As reduction of GHG has emerged as a major policy imperative worldwide, FTA's grantees have begun voluntarily adopting LEED[®] and similar green building design disciplines to the construction and reconstruction of transit facilities. FTA has supported these pioneering initiatives by recognizing the costs of green building design and certification as eligible project costs.

The ARRA of 2009 includes \$100 million in discretionary grants to public transit agencies for capital investments that will assist in reducing the energy consumption or greenhouse gas emissions of their public transportation systems. Until passage of the ARRA, there had not been specific FTA funding for green building initiatives, beyond the amounts available in formula and discretionary grant programs for the facilities, as a whole. Transit agencies awarded Transit Investment for Greenhouse Gas & Energy Reduction Program (TIGGER) grants will report and document information on performance in achieving reductions in energy use and greenhouse gas emissions. This program is expected to provide information on the green building practices of transit agencies and the results of providing Federal funding as an incentive to encourage wider adoption of green building.

Continue Transit Greenhouse Gas Emissions Management Compendium

In April 2009, FTA awarded a Cooperative Agreement to Georgia Tech Research Corporation to produce a manual for transit agencies on methods to reduce their agencies' GHG emissions and energy use. The research, in which the Metropolitan Atlanta Rapid Transit Authority (MARTA) is a sponsoring partner, will include a detailed analysis of MARTA's energy use and GHG emissions, as well as case studies of several other transit agencies. The results will be delivered in the form of a webinar for training transit managers as well as an online reference manual.

- Timeline – The compendium is scheduled for completion, along with an initial webinar, by spring 2010
- Resources – FTA allocated \$150,000 to the project, matched by \$30,000 each from Georgia Tech and MARTA for a total project cost of \$210,000.

Enhance Professional Capacity Development for Sustainability

Training FTA staff and transit agencies on the various methods by which they can incorporate sustainable design features, construction practices and operational elements in building or reconstructing transit facilities is a key approach to encouraging and implementing more green building.

Environmental Management Systems Training

From 2003 through 2007, FTA managed a contract with the Center for Organizational and Technological Advancement (COTA) and Virginia Polytechnic Institute and State University (Virginia Tech) to advance international environmental management standards (ISO 14001 – See Appendix A) in public transit agencies. This training course is titled Environmental Management Systems and focuses primarily on sustainable operational practices by the transit agency as an organization rather than on just the design and construction of transit facilities.

- Timeline – The initial training was performed in 2004. This training course could be updated in 2010 to address green building of transit facilities. FTA will work with the National Transit Institute on establishing new training courses or incorporating the subject into existing training
- Resources – Funding for the Virginia Tech and National Transit Institute work in addition to FTA staff time to manage course development

Expand Recognition and Awards

FTA will increase its use of existing authority to confer honorary awards to recognize transit agencies that receive green building certification, such as LEED[®], for their new or reconstructed transit facilities.

- Timeline – Some FTA regions began giving recognition awards in FY 2008. Initial national awards could be announced at an event such as the APTA annual meeting, and other FTA regional awards could be given beginning in FY 2010.
- Resources required would be some funding for the production of the awards and staff time for preparing and conferring the awards.

Identify Incentives for Green Building of Transit Facilities

Providing incentives to “build green” may help motivate transit agencies to go through the extra steps and possible upfront costs associated with certification requirements. It also helps to inform grantees that LEED[®] certification costs are eligible for FTA funding.

- Timeline – This incentive is already in place; however, many grantees may not be aware that LEED certification costs are an eligible capital grant expense. FTA will undertake additional efforts to educate transit agencies on the eligibility of costs related to green building.
- Resources required – Modest amounts of staff time will be needed for preparing communications and posting notices on the FTA website. Unfortunately, it is not uncommon for “green” features to be eliminated if construction costs increase after the feasibility phase and exhaust the project budget.

FTA will examine the possibility and appropriateness of including green building commitments as an evaluation factor in selecting competitive proposals for discretionary capital investment grants. A categorical exclusion for green buildings relevant to NEPA regulations may be considered on a case by case basis. More credit or points could be given to proposals for projects constructed with sustainable elements.

- Timeline – FTA could use this as an evaluation factor as part of future competitive proposals for discretionary capital assistance.
- Resources required – Changing the New Starts criteria would involve policy changes and a formal public comment and review period in addition to staff time for preparing communications, posting notices on the FTA website, and evaluating proposals. Some additional FTA oversight would be needed to ensure that the transit agencies promising sustainable elements actually carry them out as the projects are implemented.

In its deliberation of a proposal for surface transportation authorization, FTA is considering some type of incentive for the construction of facilities constructed with sustainable elements.

- Timeline – FTA is currently developing its recommendations regarding the next surface transportation authorization.
- Resources required – Modest amounts of staff time would be needed to discuss the advantages and disadvantages of this form of incentive. If enacted, some additional FTA oversight would be needed to ensure that the transit agencies promising sustainable elements actually carry them out as the projects are implemented.

Support APTA Sustainability Standards and Initiatives

FTA has been actively engaged in green building and sustainability initiatives undertaken by transit agencies through their trade association, the American Public Transportation Association (APTA).

Over the three decades, FTA has been proud to provide over \$7 million in financial assistance to the APTA Standards Program, in addition to providing leadership and technical guidance to the industry standards setting process. The FTA routinely makes recommendations on new standards and changes to existing standards based on the results of its extensive transit industry research program.

- APTA has established a Climate Change Working Group as part of its Transit Standards Development program.²⁰ Funded by FTA, this group developed a recommended practice for transit agencies to use in measuring their carbon footprints. Reducing an agency’s GHG emissions as measured by this practice (and possibly normalized by passenger miles) could be part of a green rating system for transit agencies.
- Transit Sustainability Commitment – The International Organization for Standardization (ISO) has developed standards for environmental management applicable to everything an organization does that could affect sustainability. APTA has adopted a sustainability commitment initiative designed to encourage members to implement EMS, of which green building is one aspect. APTA encourages transit agencies to commit to voluntary sustainability practices such as those required by ISO 14001²¹ and advocated by the International Union of Public Transport.

These sustainability practices, verified by periodic performance audits, apply to each transit agency. Members commit to core principles and to reduce energy use and other environmental impact measures by a certain percent per year, normalized by ridership. Like the LEED[®] system, there are different levels of compliance. Unlike the LEED[®] system, practices apply to transit agencies, rather than transit projects. More information is available at <http://www.apta.com/research/sustainability/>.

²⁰ <http://www.aptastandards.com/>, accessed May 18, 2009.

²¹ Appendix A summarizes key elements of ISO standards 14001 and 14004.

Conclusion

FTA has adopted this Transit Green Building Action Plan for immediate implementation. It will be updated as FTA gains experience with the outcomes resulting from its various elements. It has been developed with consideration of establishing a set of performance metrics to encourage continuous improvement in FTA's encouragement of transit green building and sustainability.

Acronyms

2005 EPAAct	Energy Policy Act of 2005
ANSI	American National Standards Institute
APTA	American Public Transportation Association
ARRA	American Recovery and Reinvestment Act of 2009
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BREEAM	Building Research Establishment's Environmental Assessment Method
BART	Bay Area Rapid Transit
CASBEE	Comprehensive Assessment System for Building Environmental Efficiency
CFR	Code of Federal Regulations
CMAQ	Congestion Mitigation and Air Quality Improvement Program
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO₂	Carbon Dioxide
COTA	Center for Organizational and Technological Advancement
DOE	Department of Energy
DOT	Department of Transportation
EERE	Energy Efficiency and Renewable Energy
EMS	Environmental Management Systems
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GAO	Government Accountability Office
GBI	Green Building Initiative
GHG	Greenhouse Gas
GSA	General Services Administration
HVAC	Heating Ventilation and Air Conditioning
ISO	International Standards Organization
LEED®	Leadership in Energy and Environmental Design
LEED® - EB	LEED® - Existing Building
LEED® - NC	LEED® - New Construction
LNG	Liquefied Natural Gas
LSD	Low Sulfur Diesel

MARTA	Metropolitan Atlanta Regional Transit Authority
NREL	National Renewable Energy Laboratory
NTD	National Transit Database
NTI	National Transit Institute
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (Public Law 109-59)
SEP	State Energy Program
SOV	Single-Occupancy Vehicle
STP	Surface Transportation Program
SUDS	Sustainability and Urban Design
TIGGER	Transit Investment for Greenhouse Gas & Energy Reduction Program
TRB	Transportation Research Board
TOD	Transit Oriented Development
UITP	International Union of Public Transport
USGBC	United States Green Building Council
WMATA	Washington Metropolitan Area Transit Authority
WVU	West Virginia University

References

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<http://edocket.access.gpo.gov/2009/pdf/E9-6420.pdf>
2. Report to Congress on Climate Change (currently in progress).
3. Public Transportation's Role in Responding to Climate Change
<http://www.fta.dot.gov/documents/PublicTransportationRoleInRespondingToClimateChange.pdf>
4. FTA Sustainability Website – www.fta.dot.gov/sustainability
5. APTA Standards Program Climate Change Working Group
<http://www.aptastandards.com/StandardsPrograms/SustainabilityandUrbanDesignStandards/ClimateChangeStandards/tabid/249/Default.aspx>
6. APTA Standards Program Sustainability and Urban Design (SUDS) Working Group Looking at how transit fits sustainability into the urban design and coming up with standards for how this should be done. Workplan is available at
<http://www.aptastandards.com/StandardsPrograms/SustainabilityandUrbanDesignStandards/UrbanDesignStandards/tabid/248/Default.aspx>
7. LEED[®]-ND – The “ND” stands for neighborhood design. This is a new LEED[®] standard. It was developed because the greenest building in the world does not do much for the environment if it is in the middle of nowhere and the only way to get there is through energy intensive SOV highway use. The LEED[®]-ND standard is to encourage compact, mixed-use development with high quality pedestrian and transit access.

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Appendix A

International Organization for Standardization (ISO) Environmental Management Standards ISO 14001:2004 and ISA 14004:2004

The ISO 14000 family of standards addresses various aspects of environmental management. The first two standards, ISO 14001:2004 and ISO 14004:2004 deal with environmental management systems (EMS).

- ISO 14001:2004 specifies the requirements for such an environmental management system. Fulfilling these requirements demands objective evidence that can be audited to demonstrate that the environmental management system is operating effectively in conformity to the standard.
- ISO 14004:2004 provides guidelines on the elements of an environmental management system and its implementation, and discusses principal issues involved. The underlying philosophy is that whatever the organization's activity, the requirements of an effective EMS are the same. This has the effect of establishing a common reference for communicating about environmental management issues between organizations and their customers, regulators, the public and other stakeholders.

Related ISO standards and guidelines address specific environmental aspects, including: labeling, performance evaluation, life cycle analysis, communication, and, auditing.

An EMS meeting the requirements of ISO 14001:2004 is a management tool enabling an organization to identify and control the environmental impact of its activities, improve its environmental performance continually, and implement a systematic approach to setting environmental objectives and targets, to achieving these and to demonstrating that they have been achieved.

Because ISO 14001:2004 does specify levels of environmental performance, the standard can be implemented by a wide variety of organizations, whatever their current level of environmental maturity. However, a commitment to compliance with applicable environmental legislation and regulations is required, along with a commitment to continual improvement – for which the EMS provides the framework.²²

²² http://www.iso.org/iso/catalogue_detail?csnumber=31807, accessed May 18, 2009.