New Jersey Transit:

Five Year Energy Management and Sustainability Plan

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November 18, 2011 Update

Gabel Associates was directed by NJ Transit to update the report with current SREC market values as well as the revised size of the solar project at the Meadows Maintenance Complex in Kearny, NJ. This update included the following:

- All project economics concerning the Meadows Maintenance Complex have been updated with current SREC market values.
- The ECM schedule that is funded from the revenue of the solar project has been updated to reflect revised solar project revenues (electricity savings and SREC revenues).
- All relevant Appendices to relating to the changes listed above.

All other sections of the report remain unchanged.

April 29, 2011 Update

Gabel Associates was directed by NJ Transit to update the report to reflect the revised size of the solar project at the Meadows Maintenance Complex in Kearny, NJ. This update included the following:

- The rooftop solar project at the Meadows Maintenance Complex in Kearny, NJ was changed from the originally assumed 1.1 MW to 550 kW. This reduction in size reflects a smaller than originally-anticipated ARRA grant approved by the New Jersey Board of Public Utilities, as well the unavailability of any internal funds to help finance the project. The project is now anticipated to be funded 100% by the ARRA grant; as such the project size will be limited by the grant amount; it is anticipated by NJ TRANSIT that the grant will support a project 550 kW dc in capacity.

- All project economics concerning the Meadows Maintenance Complex have been updated to accommodate the change in system size.

- The ECM schedule that is funded from the revenue of the solar project has been updated to reflect revised solar project revenues (electricity savings and SREC revenues). Revised solar project revenues reflect not only the decrease in project size and related decrease in output, but also an updated (lower) SREC market price forecast from the original report prepared in 2010.

- All relevant Appendices to relating to the changes listed above.

All other sections of the report remain unchanged.

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Acronyms

1. AC- Air Conditioning
2. ACE- Atlantic City Electric
3. APTA- American Public Transportation Authority
4. ARC- Access to the Region's Core
5. ARRA- American Recovery and Reinvestment Act
6. BGS-CIEP- Basic Generation Service – Commercial and Industrial Energy Pricing
7. BGS-FP- Basic Generation Service – Fixed Price
8. BPU- Board of Public Utilities
9. BRT- Bus Rapid Transit
10. BTU- British Thermal Unit
11. CCX- Chicago Climate Exchange
12. CESCI- Clean Energy Solutions Capital Investment
13. CHP- Combined Heat and Power
14. CIEP- Commercial and Industrial Energy Pricing
15. Committee- Energy Conservation and Sustainability Committee
16. PPA- Power Purchase Agreement
17. CO- Carbon Monoxide
18. CONEG- Coalition of Northeast Governors
19. DX - Direct Expansion
20. ECM- Energy Conservation Measures
21. EDA- Economic Development Authority
22. EMS- Environmental Management Systems
23. ERP- Energy Reduction Plan
24. ESCO- Energy Service Contract
25. FTA- Federal Transit Administration
26. GHG- Greenhouse Gas
27. GSHP- Ground Source Heat Pump
28. HBLR- Hudson-Bergen Light Rail
29. HID- High-Intensity Discharge
30. HVAC- Heating Ventilating and Air Conditioning
31. IFB- Invitation for Bids
32. IRR- Internal Rate of Return
33. IT- Information Technology
34. ITC- Investment Tax Credit
35. JCP&L- Jersey Central Power and Light
36. kW- kilowatt
37. kWh- kilowatthour
38. LEED- Leadership in Energy and Environmental Design
39. MACRS- Modified Accelerated Cost Recover System
40. mpg- miles per gallon
41. MPO- Metropolitan Planning Organization
42. MTonnes- metric tons
43. MW- megawatt
44. MWh- megawatthour
45. NJCEP- New Jersey Clean Energy Program
46. NJDOT- New Jersey Department of Transportation
47. NREL- National Renewable Energy Laboratory
48. PJM GATS- PJM Generation Attribute Tracking System
49. POC- Proof of Concept
50. PSA- Purchase Sales Agreements
51. PSE&G- Public Service Electric and Gas
52. RECO- Rockland Electric Company
53. RFP- Request for Proposals
54. RPS- Renewable Portfolio Standard
55. SACP- Solar Alternative Compliance Payment

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Executive Summary

During this difficult economic time, New Jersey Transit (NJ TRANSIT) has been continually identifying ways to cut costs and maximize efficiencies to preserve current service levels and mitigate fare hikes. Energy is a significant cost factor and rising costs can put additional pressure on NJ TRANSIT's operating budget. Over the past ten years, energy prices have seen steady increases and increased volatility due to rising energy demand and other environmental and geopolitical events. These increases and volatility in energy prices place an added stress on the operating budget of NJ TRANSIT and can necessitate fare hikes, or reduce services to offset these costs. Investments that reduce energy consumption or energy expenditures can help insulate NJ TRANSIT from volatility in the energy markets.

Investments in sustainability should also be considered by NJ TRANSIT. Sustainability investments include measures that meet existing demands without compromising the economic or environmental future. Sustainability efforts include initiatives that decrease energy consumption, and reduce impacts on the environment, including efforts to combat global climate change.

NJ TRANSIT is positioned well to play a leading role in the State's efforts to combat global climate change. NJ TRANSIT, as a public transportation entity, provides the State with a valuable tool to reduce greenhouse gas (GHG) emissions. There is significant scientific evidence suggesting that GHG emissions are contributing to global climate change, which threatens our environment, economy and our way of life. Public transportation is a more efficient form of transportation and has a lesser environmental impact than passenger vehicles. Therefore, NJ TRANSIT's efforts to increase ridership, and decrease its energy consumption, will play a valuable role in meeting the State's GHG emission reduction goals.

There are many State, federal and other resources available for entities investing in sustainability. This report includes a review of all available State, federal and other resources that can be utilized by NJ TRANSIT to offset the capital costs of these actions. This includes a list of information resources, such as Leadership in Energy and Environmental Design (LEED) and ENERGY STAR, which NJ TRANSIT staff can use as a resource when considering measures to reduce operating costs and improve sustainability. It also includes an overview of the State's Renewable Portfolio Standard (RPS) and financing alternatives for clean energy investments.

To combat the challenges of increased energy costs and impacts to the environment, NJ TRANSIT's 5 Year Sustainability Plan clearly provides a series of goals and action items to be implemented. If fully implemented, these efforts will decrease energy consumption, reduce energy costs, decrease dependence on foreign energy supplies, and minimize impacts on the environment. These goals and action items include the following:

GOAL 1: Increase Public Transportation Ridership.

Increasing public transportation ridership allows NJ TRANSIT to secure additional revenues, increase the efficiency of its operations (British thermal unit (BTU) per passenger mile), and mitigate impacts on the environment. To increase public transportation ridership, NJ TRANSIT should incorporate the following two action items:

- Action Item 1: Incorporate Sustainability into Marketing Efforts by promoting the economic and environmental benefits of public transportation.
- Action Item 2: Continue to promote Transit Friendly Development (TFD) and partner with municipalities to build additional infrastructure for public transportation. Making public transportation more accessible to the public will increase ridership.

GOAL 2: Decrease Energy Consumption in its Buildings.

Decreasing NJ TRANSIT's energy consumption is an essential aspect of sustainable development. NJ TRANSIT's energy consumption has increased nearly 20 percent since 2005 and its expenditures have increased nearly 60 percent. NJ TRANSIT has made significant efforts to monitor and decrease its energy consumption through the procurement of energy audits, which included a list of recommended energy conservation measures (ECMs), and a GHG report conducted by Science Applications International Incorporated (SAIC). There is a strong business case for implementing the recommended ECM's, as they offer an aggregate internal rate of return (IRR) of more than 50 percent. If implemented, these would pay for themselves in less than 3 years, allowing NJ TRANSIT to realize a total annual savings of more than $1.8 million. Audits of additional facilities could provide projects of similar IRR that could again decrease costs and efficiency, therefore furthering NJ TRANSITs sustainable goals.

It is recommended that NJ TRANSIT build on these efforts by implementing the following action items.

- Action Item 1: Implement the ECM recommendations in the recently-completed SAIC audits. These ECMs can be installed by financing all of the improvements up front, utilizing an alternative finance model such as an energy savings contract, or by paying for these investments over several years using solar renewable energy certificate (SREC) revenue NJ TRANSIT will be generating from its 550 kilowatt (kW) solar system.
- Action Item 2: Invest in additional energy efficiency measures in existing buildings, including building envelope improvements.
- Action Item 3: Continue and expand upon the energy procurement practices to continue receiving energy at the lowest possible price.
- Action Item 4: Incorporate energy efficiency technologies into new infrastructure by increasing building envelop efficiency, reducing lighting loads, and reducing heating ventilating and air conditioning (HVAC) loads in order to decrease energy consumption.

- Action Item 5: Implement an Employee Educational Program that will engage NJ TRANSIT employees about sustainability and energy best practices to encourage their participation in these efforts. This will promote best operational best practices that can reduce operating costs.

GOAL 3: Invest in Renewable and Alternative Energy Systems.

NJ TRANSIT should continue its investments in renewable and alternative energy systems. This will allow NJ TRANSIT to procure energy from cleaner fuels such as solar or wind, decrease its reliance on volatile and expensive fossil fuels, gain a constant stream of revenue from renewable energy certificates (RECs), and gain a good reputation as a steward to the environment. To continue its renewable energy and alternative energy investments, NJ TRANSIT should implement the following action items:

- Action Item 1: Invest in solar energy where applicable. While NJ TRANSIT has already received grant funding and issued a Request for Proposals for a 550 kW solar array, it should continue to explore locations in which it can invest in more solar. The IRR can be between 15 and 20 percent for large solar energy projects, utilizing the federal tax incentives[1] and current SREC prices.
- Action Item 2: Consider investing in wind turbines where feasible. Properties in coastal areas may have some wind energy potential, however the wind potential in the interior of New Jersey is limited. Unlike solar energy, the incentive amounts from the State are much less, and therefore, wind energy should be considered only on a case-by-case basis.
- Action Item 3: Invest in geothermal exchange or ground source heat pump (GSHP) where feasible. NJ TRANSIT should evaluate GSHP when existing HVAC and/or water heating equipment has reached the end of its useful life or in a new construction application where a lifecycle benefit analysis can be completed. However, the best applications for GSHP will be for new construction, due to the extensive drilling that is necessary.
- Action Item 4: Invest in combined heat and power (CHP) where feasible. Due to space constraints, equipment age, and site specific energy consumption patterns, NJ TRANSIT should evaluate CHP projects on a facility by facility basis.

GOAL 4: Incorporate Other Sustainability Principles in Existing and New Facilities.

To continue to develop sustainably, NJ TRANSIT should consider incorporating other sustainability principles in existing and new facilities. This can be done by implementing the following action items:

[1] Tax incentives would be relevant to improve project IRR for a project owned by a private, for-profit entity that either leased the system to Nj TRANSIT or sold power to NJ TRANSIT via a PPA.

- Action Item 1: Incorporate LEED and ENERGY STAR concepts into new and existing facilities. This will decrease energy consumption by implementing energy efficient measures and appliances and using environmentally friendly products and materials.
- Action Item 2: Use sustainable materials for construction or renovation projects. Incorporating recycled and reused building materials and maintaining a good environmental quality is important for the economic, environmental, and social needs of NJ TRANSIT's facilities.
- Action Item 3: Improve the efficiency and sustainability of NJ TRANSIT's bus operations by implementing Bus Rapid Transit (BRT) and investing in low emission bus fuels.
- Action Item 4: Improve the efficiency and sustainability of NJ TRANSIT's rail operations by investing in efficient trains for rail fleets.
- Action Item 5: Improve the efficiency and sustainability of NJ TRANSIT's light rail operations by investing in efficient trains for light rail fleets.
- Action Item 6: Improve the efficiency and sustainability of non-revenue vehicles by investing in hybrid and electric vehicles.

The action items in this report will require financial commitments from NJ TRANSIT to implement. Some investments will require high upfront capital costs, while others require operational changes with no financial commitment necessary. Therefore, this report provides NJ TRANSIT with various funding options to help pay for these measures. For example, a solar energy array could be funded outright by NJ TRANSIT, or it could be funded through a power purchase agreement (PPA) that could provide NJ TRANSIT with immediate energy savings while having no upfront capital costs.

Implementation of the above action items should be managed by an Energy Conservation and Sustainability Committee (Committee) charged with administering and implementing NJ TRANSIT's sustainability program. These action items, along with the steps NJ TRANSIT has already taken, provide NJ TRANSIT with a road map to reducing its operating costs while minimizing its impact on the environment.

1. Introduction

A reliable and efficient transportation infrastructure is a critical part of the foundation that supports our economy. Delays in the transportation system or increased fuel costs result in increased cost of goods and reduced productivity. Public transportation can provide a more efficient and less costly form of transportation. Therefore, increasing public transportation ridership can have positive economic and environmental impacts on the entire transportation system.

The transportation infrastructure also impacts our environment by contributing to GHG emissions and other environmental pollutants. While public transit infrastructure has a carbon footprint, it must be recognized in a bigger picture that the use of public transportation can have a net decrease in carbon emissions. The use of public transportation improves the reliability and efficiency of the transportation system. These improvements to reliability and efficiency reduce GHG emissions and other environmental impacts of the transportation system.

According to the U.S. Department of Transportation (USDOT), in 2007 there were nearly 250 million passenger vehicles registered in the United States.[2] This equals one passenger vehicle for every 1.2 persons in the United States. Despite the increased reliance on passenger vehicles, there have been minimal gains in fuel efficiency. In the 1990s the average fuel efficiency was 16.8 miles per gallon (mpg), and this fuel efficiency increased to an average of only 17 mpg in the 2000s.[3] Over this twenty year period, fuel efficiency increased only 1.2%. These additional passenger vehicles, and lack of efficiency improvements result in increased traffic congestion, increased dependence on fossil fuels imported from other countries, and increased impact on the environment.

GHG emissions are one of the environmental impacts that result from our current transportation infrastructure. There is broad scientific evidence supporting the conclusion that GHG emissions, such as CO_2, from human activity are impacting the earth's climate. These emissions primarily come from the burning of fossil fuels to generate electricity, fuel our cars and heat our homes. Recent studies suggest that temperatures are expected to rise up to 4 degrees in the winter, and 3 in the summer, in the next few decades.[4] This potential impact on the climate threatens our environment, economy, public health and our way of life. In New Jersey, these impacts could be particularly severe. The melting of ice caps caused by increased temperatures could cause rises in sea level threatening the state's shoreline and ecology as well as low-lying infrastructure.

The transportation sector is a significant contributor to GHG emissions. According to an analysis done by the New Jersey Department of Environmental Protection (DEP), the

[2] http://www.bts.gov/publications/national_transportation_statistics/html/table_01_11.html
[3] http://www.bts.gov/publications/national_transportation_statistics/html/table_04_09.html
[4] http://nj.gov/globalwarming/about/

transportation sector is the largest and fastest growing sector of New Jersey's GHG emissions.[5] The DEP estimates that 35% of New Jersey's GHG emissions come from transportation uses. This growth in GHG emissions in the private sector can be attributed to an increase in vehicle miles traveled (VMT), and the increased use of less efficient forms of transportation, such as sport utility vehicles. However, public transportation can help to curb the growth in GHG emissions from the transportation sector by reducing reliance on motor vehicles and improving the efficiency of the transportation infrastructure.

In New Jersey's "Global Warming and Response Act Recommendations Report", the State has made the public transportation system a critical component to reducing New Jersey's contributions to GHG emissions. Specifically, the report states that to decrease the VMT from automobiles, the State must "make increasing transit and green commuting programs a cornerstone of its efforts to achieve the statewide GHG limits."[6] The State's GHG reduction strategy includes a goal of more than doubling its transit ridership by 2050.

New Jersey's public transportation system is one of the most used and extensive in the country. At 10.4 percent, New Jersey has the third highest percentage of residents that use public transportation to commute to work, behind only the District of Columbia and New York.[7] This high commuter rate is supported by an expansive NJ TRANSIT infrastructure that consists of 247 bus routes, 11 commuter train lines serving 164 stations, and three light rail lines serving 60 stations. This expansive infrastructure results in nearly 75 percent of New Jersey's population being located within half a mile of a rail station or bus line. However, this also provides a foundation to further increase ridership in New Jersey, to improve its sustainability, and to reduce the environmental impacts from our transportation infrastructure.

Public transportation offers a valuable opportunity to reduce our dependence on foreign oil, reduce traffic congestion, save consumers money, and mitigate our impacts on climate change. Traveling by public transportation uses less energy, emits fewer GHG emissions, and produces fewer pollutants than travel in private vehicles. It is estimated that GHG emissions are reduced by 37 million metric tons (MTonnes) annually by the use of public transportation in the United States. While driving a private vehicle can account up to 55% of a single person's household carbon footprint; taking public transportation can decrease that footprint by 30%. It can also be more expensive, as an average two-worker household can save $6,251 by taking public transportation in lieu of a car.[8]

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[5] "Meeting New Jersey's 2020 Greenhouse Gas Limit: New Jersey's Global Warming Response Act Recommendations Report", by the NJ DEP. For more information go to: www.nj.gov/dep/oce/njgrwa_final_report_dec2009.pdf.

[6] "Meeting New Jersey's 2020 Greenhouse Gas Limit: New Jersey's Global Warming Response Act Recommendations Report", by the NJ DEP. For more information go to: www.nj.gov/dep/oce/njgrwa_final_report_dec2009.pdf.

[7] 2007 American Community Survey data.

[8] http://www.publictransportation.org/reports/documents/greenhouse_brochure.pdf

NJ TRANSIT has shown a commitment to further improving the environmental and energy footprint of public transportation in New Jersey. Recently, NJ TRANSIT initiated a plan of action to improve the sustainability and energy efficiency of its operations. These efforts include implementing energy efficiency measures in buildings, recycling batteries and tires, and using cleaner fuel sources. This report builds on these accomplishments by reviewing additional sustainability and energy efficiency options available to NJ TRANSIT and recommending next steps in its mission to become a model of transit sustainability.

2. Transit Sustainability

Public transportation is a more sustainable form of transportation than single occupancy vehicles. It offers a valuable way to reduce GHG emissions and air pollution, by decreasing the VMT of single occupancy vehicles. The UN Bruntland Commission defines sustainable development as, "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."[9] Specifically, for an entity to be sustainable, it must meet environmental, economic, and social needs of the present in a way that will not adversely impact future development, growth, or prosperity. Transit sustainability, therefore, is a means of building infrastructure and expanding mobility in a responsible way that recognizes the environmental, economic, and social consequences of development.

There are many ways in which NJ TRANSIT should continue to develop more sustainable practices and programs that will decrease energy consumption and mitigate impacts on the environment. In 2009, the American Public Transportation Authority (APTA) released a draft report entitled, "Transit Sustainability Practice Compendium." This document suggests the following six "sustainability practices" be adopted by public transportation entities to improve the sustainability of its operations:

1. Improve mobility via improved and enjoyable transit services.
2. Reduce per capita automobile vehicle mile traveled.
3. Reduce passenger transportation-generated CO_2 and GHG.
4. Create livable communities through facilitating more environmental friendly forms of mobility such as walking, biking, and public transit. Increase the number of routine destinations that are accessible safely and comfortably by walking, biking and public transit.
5. Reduce passenger transportation-caused ambient hazards such as noise, particles in the air, vibration, physical threats, and mental stress to the public in general and particularly to pedestrians.
6. Reduce stress, loss of productivity, and traffic deaths and injuries and related health care costs caused by automobile travel.

[9] Julie Hoover, *Winning with Sustainability*. American Public Transportation Authority, January 10, 2009.

The APTA report also outlines five "sustainability aspects" that need to be considered when implementing the "sustainable practices". These aspects include:

- **System Planning, Land Use & Site Design:** Includes land use impacts, such as opportunities that result from transit operations.
- **Materials:** Includes material selection, design, construction, and fabrication of all physical elements. Include material selections used in operations, such as cleaning products and chemicals.
- **Energy:** Includes electricity and fuel consumption, renewable energy resources, and energy efficiency and optimization (excludes emissions).
- **Ambient Environmental & Health:** Includes rider experience, system cleanliness, place making, and accessibility.
- **Emissions & Pollution Reduction:** Includes all emissions, fuel, chemical use, water, and other sources of pollution.[10]

NJ TRANSIT should continue to participate in improving sustainability for transit as a whole by incorporating the above objectives wherever possible. This report incorporates these aspects throughout its sections in order to develop a five year sustainability plan for NJ TRANSIT.

2.1 Sustainability Resources

There are a number of different green rating systems including Building Research Establishment's Environmental Assessment Method, U.S. Green Building Councils (USGBC), LEED, Green Globes, ENERGY STAR, and American Society of Heating, Refrigeration and Air-conditioning Engineers. The primary green building rating system is LEED Certified Buildings. Energy Star is also a way in which NJ TRANSIT can address energy efficiency. These two programs are discussed further below.[11]

The Federal Transit Administration (FTA) and APTA also encourage the development of green building for transit facilities, provide incentives for green buildings and establish national and regional recognition and awards for transit agencies that receive green building certification.[12] These incentives and guides provide a valuable resource to NJ TRANSIT as it incorporates sustainable design into its infrastructure.

2.1.1 Leadership in Energy and Environmental Design

Developed by the USGBC, LEED is a third party green building certification system aimed at increasing all forms of sustainability through smart building and building operation and maintenance practices. LEED standards promote minimizing the environmental footprint for

[10] Tian Feng, *Transit Sustainability Practice Compendium* 2009.
[11] FTA, 10.
[12] Federal Transit Administration. *Report to Congress, Transit Green Building Action Plan*. July 2009. 5.

new and existing infrastructure by establishing eight standards, by which projects are judged, including:

- Location and Planning
- Sustainable Sites
- Water Efficiency
- Energy and Atmosphere
- Materials and Resources
- Indoor Environmental Quality
- Innovation and Design Process
- Regional Priority

LEED certification can be applied to both new buildings and existing ones. LEED uses a comprehensive checklist and awards points in order to rank a facilities' level of sustainability using the eight criteria listed above. Depending on the points obtained from the process, projects can receive a LEED certified, silver, gold or platinum rating level. [13] LEED certification is available for new construction, existing buildings, operations and maintenance, core and shell, commercial interiors, homes and neighborhood development.

To certify a project, the property owner must hire a third party evaluator to complete and certify the check list and point total for the project. While this additional step adds cost to the project, it also ensures that the technologies installed are correctly adjusted and that the maximum benefit is being achieved. Therefore, despite the added cost, the improvements made from this step can provide far more benefit to the end user. However, often times, public entities skip this step to save money and instead deem its project to be LEED Silver equivalent.

2.1.2 ENERGY STAR

ENERGY STAR is a joint program developed by the U.S. Environmental Protection Agency (USEPA) and the U.S. Department of Environmental Protection (USDEP). Its goal is to use sustainable products and practices to reduce environmental impacts from conventional energy generation and save consumers money. Products yielding the ENERGY STAR label use less energy, thereby saving money, and protecting the environment. Buildings can also don the ENERGY STAR emblem. This means they have been awarded a national mark of excellence in energy performance. That includes sustainable management, building design, energy efficiency and an effective energy strategy for the future.

Through ENERGY STAR's Portfolio Manager, ENERGY STAR provides an on-line questionnaire that includes information on building size, location, number of occupants, and energy consumption and uses a statistical baseline of similar buildings in the U.S. in order for building owners and developers to rate their building's energy efficiency. This is rated on a 100-

[13] FTA, 11.

point scale in which a score of 50 indicates average industry energy performance and over 75 indicates top performance. Once the questionnaire is filled out, the system estimates how much energy the building would use if it were running at peak efficiency versus its energy consumption at the worst efficiency. The system then compares the actual energy data to other buildings in the United States to see how it ranks.[14]

The EPA recognizes buildings that use 40 percent less energy than average buildings, without compromising comfort or services.[15] For example, buildings that score 75 or over are eligible to receive the ENERGY STAR Label.

2.2 The Business Case for Sustainability

The environmental and economic public benefit of public transportation can only be realized if public transportation offers a more efficient, easy to access and less costly form of transportation. However, recently, NJ TRANSIT has had to consider fare hikes and possible reductions in service to fund its operations. The agency is looking for ways to decrease its operational costs, and improve the efficiencies of its operations. Investments in sustainability concepts can play a central role in reducing costs to avoid large fare hikes or reductions in service.

Decreasing energy consumption, investing in renewable energy, and reducing emissions can lower operating costs, decrease future regulatory risks, enhance products or services and build stronger stakeholder relationships. These benefits make a strong business case for NJ TRANSIT to incorporate sustainability concepts into its operations. These efforts also result in positive impacts in the work environment. Some companies that have implemented these efforts have noticed an increase in internal productivity as a result of their clean energy and sustainable practices.

Renewable energy projects are an example of a sustainability initiative that provides both economic and environmental benefits. In most cases, renewable energy projects qualify for significant state and federal incentives. These incentives can reduce the high upfront capital costs of installing a renewable energy system such as solar energy. These projects provide property owners with reduced long term energy costs and a hedge against volatile and escalating energy prices. Reducing emissions also allows facilities to prepare for eventual GHG or other air emission regulations that may emerge in the near future.

The first step in pursuing clean energy and sustainability practices is to create a base-line analysis showing each facility's energy consumption and environmental impact. This analysis can also identify the cost savings and financial benefit of these opportunities. The next section discusses how NJ TRANSIT has established a base-line for energy use by commissioning energy

[14] FTA, 14.
[15] ENERGY STAR Commercial and Industrial Program. 2010. www.energystar.gov.

audits and reports. The section also discusses what NJ TRANSIT has accomplished since in an effort to strengthen its leadership role in the environmental movement.

However, not all sustainability initiatives make economic sense. For instance, some renewable energy projects with lesser state incentives than solar, such as wind energy, may not offer a reasonable return on investment. Therefore, before installing any type of renewable, alternative, or efficient resource, NJ TRANSIT should conduct sensitivity analyses and forecasts that measure the economic benefits, impacts to the environment, and costs of each project.

Developing and implementing efficiency and renewable technology into transit infrastructure creates products that are cleaner and healthier. Investing in buses and trains that run on more efficient fuel or that use regenerative braking creates a product that is less harmful to the environment. Implementation of these practices can strengthen relationships with stakeholders, customers, employees and local communities.

3. NJ TRANSIT Energy Consumption

Over the past decade, energy prices have experienced increased volatility and increased costs to consumers. Since 2000, electricity prices have increased by approximately 40 percent for commercial and industrial customers in New Jersey, while diesel prices have more than doubled during this time period. However, environmental and geopolitical events have also resulted in increased price volatility. In the July of 2008 diesel prices soared to $4.70 per gallon, which is a 64 percent increase from the price of diesel in July 2007.[16] These price increases and volatility place additional stresses on energy budgets for entities like NJ TRANSIT.

Over the past five years, NJ TRANSIT has spent more than $750 million on its energy usage, and in 2009 alone it spent more than $170 million. This energy consumption is overwhelmingly used by its transportation operations, by nearly a four-to-one ratio. In 2009, about 83 percent of its energy consumption and approximately 80 percent of its energy expenditures were used for its transportation vehicles (see Figures 3-1 and 3-2 below).

[16] Source: http://tonto.eia.doe.gov/dnav/pet/pet_pri_gnd_dcus_nus_w.htm

Figure 3-1: Consumption Breakup

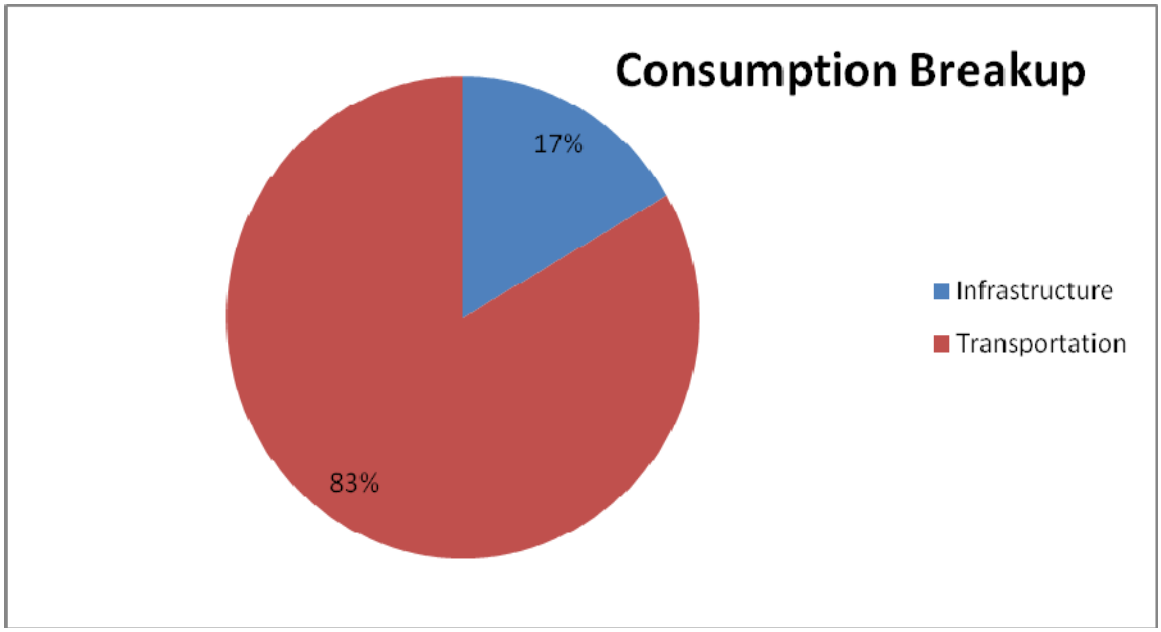
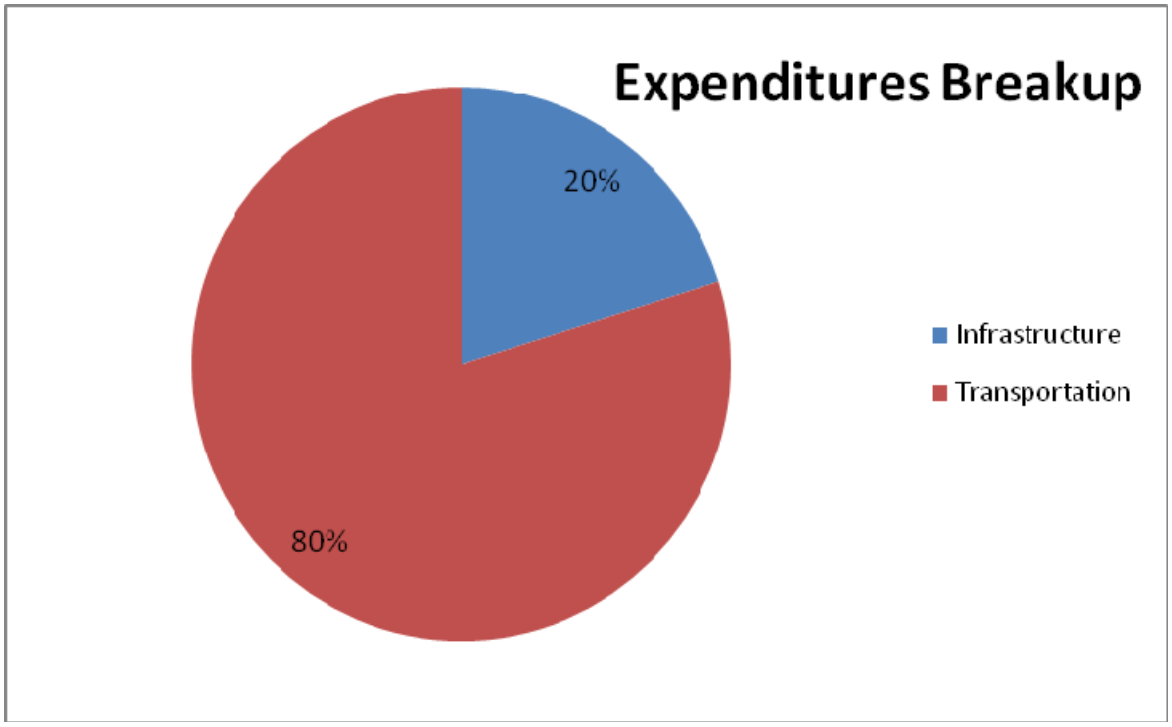


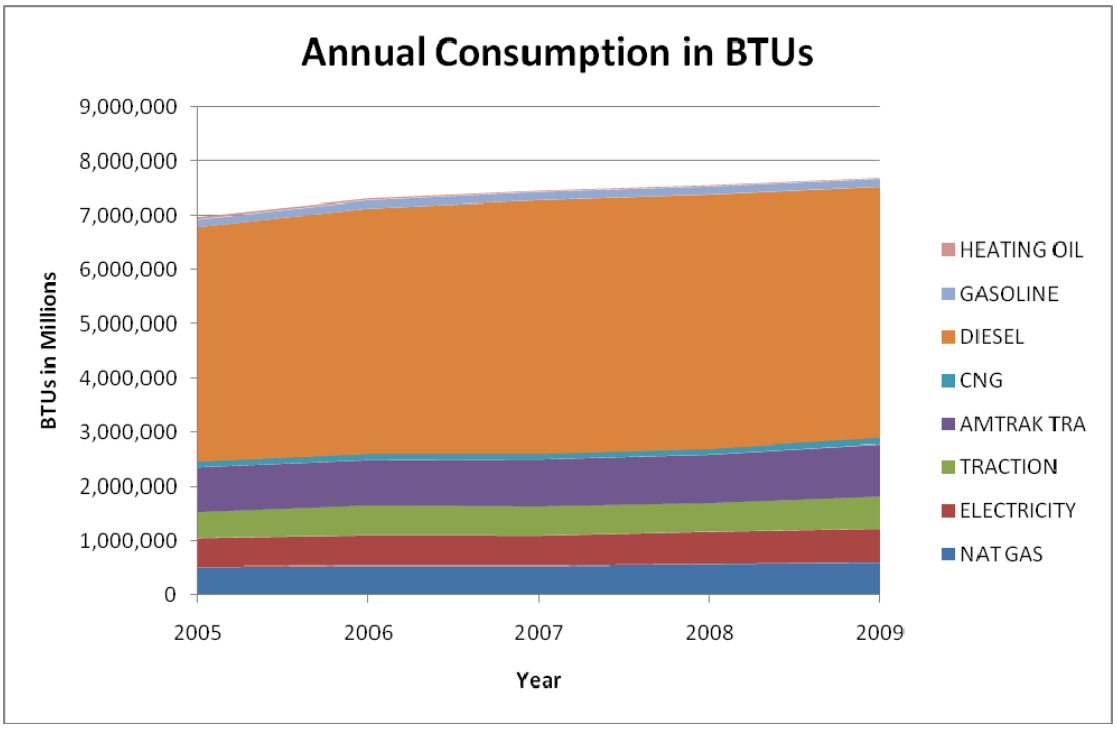
Figure 3-2: Expenditures Breakup



Accordingly, while reducing energy consumption in buildings and other infrastructure as outlined in a recently-completed energy audit will provide valuable savings, such buildings and infrastructure improvements will not make a major impact on operating costs compared to energy expenditures for transportation vehicles.

As shown in Figure 3-3, since 2005 NJ TRANSIT's has seen its energy consumption and energy expenditures steadily increase. During this time, energy consumption increased about 10 percent.

Figure 3-3: Annual Energy Consumption



A majority of the increases are due to increased consumption in rail and, particularly, light rail operations. Since 2005, energy consumption has increased nearly 15 percent for rail and more than 125 percent for light rail operations. These increases are largely due to expansion of service.

While energy consumption has gradually increased over the past 5 years (by about 10 percent between 2005 and 2009 and stated above), energy expenditures increased nearly 60 percent. This is due to the large increases in diesel prices (about 65 percent increase since 2005) and to a somewhat lesser degree electricity prices (about 40 percent increase since 2005 for New Jersey grid-sourced electricity and traction power and about 14 percent increase for Amtrak-sourced traction power)

The gradual growth in energy consumption (about 10% overall) during the past five years is due in large part to rail and light rail operations, with rail electricity (traction and non-traction combined) increasing about 17% between 2005 and 2009, and light rail electricity consumption (traction and non-traction combined) increasing nearly *four-fold* since 2005. Bus operation energy consumption, as well as rail diesel energy consumption, has remained relatively flat.

The following two figures show the NJ TRANSIT's energy expenditures and energy consumption by fuel source in 2009.

Figure 3-4: Expenditures by Commodity

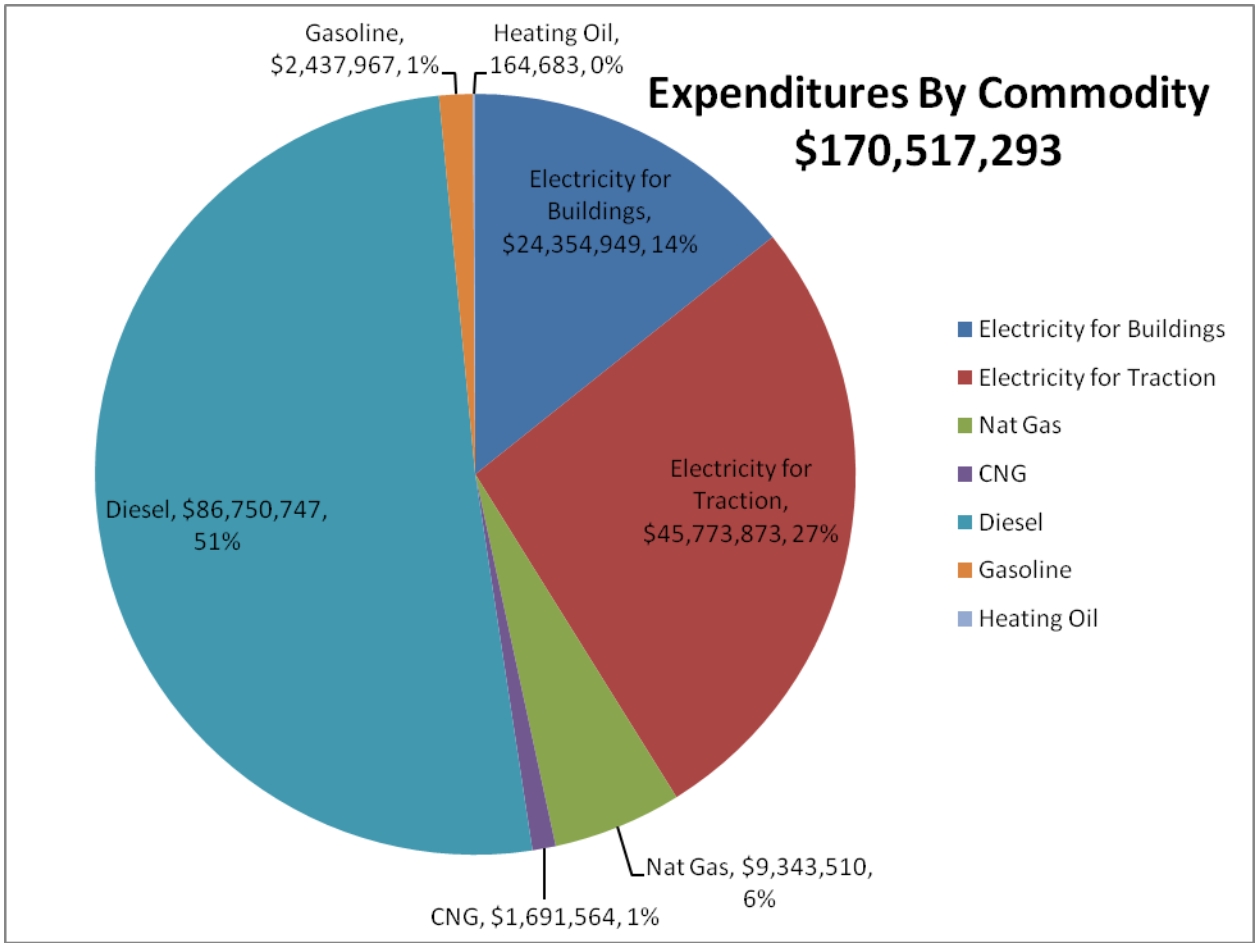
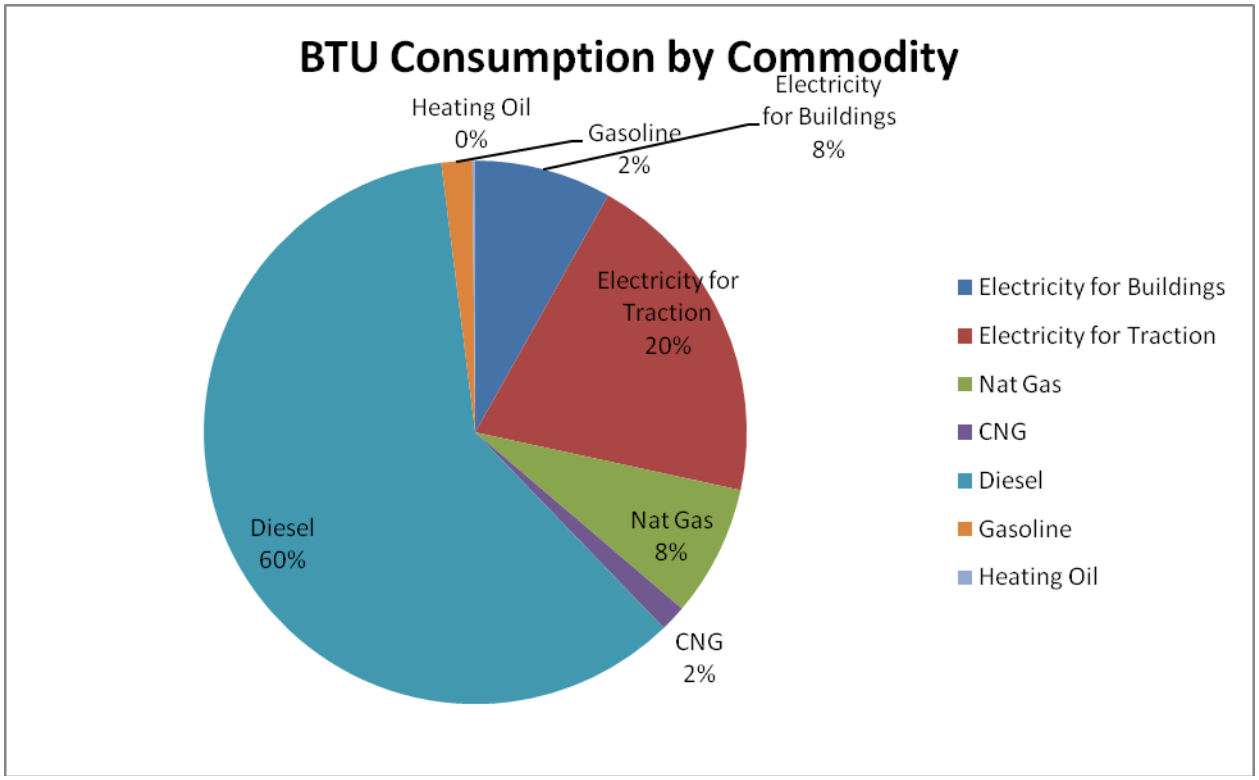


Figure 3-5: Consumption by Commodity



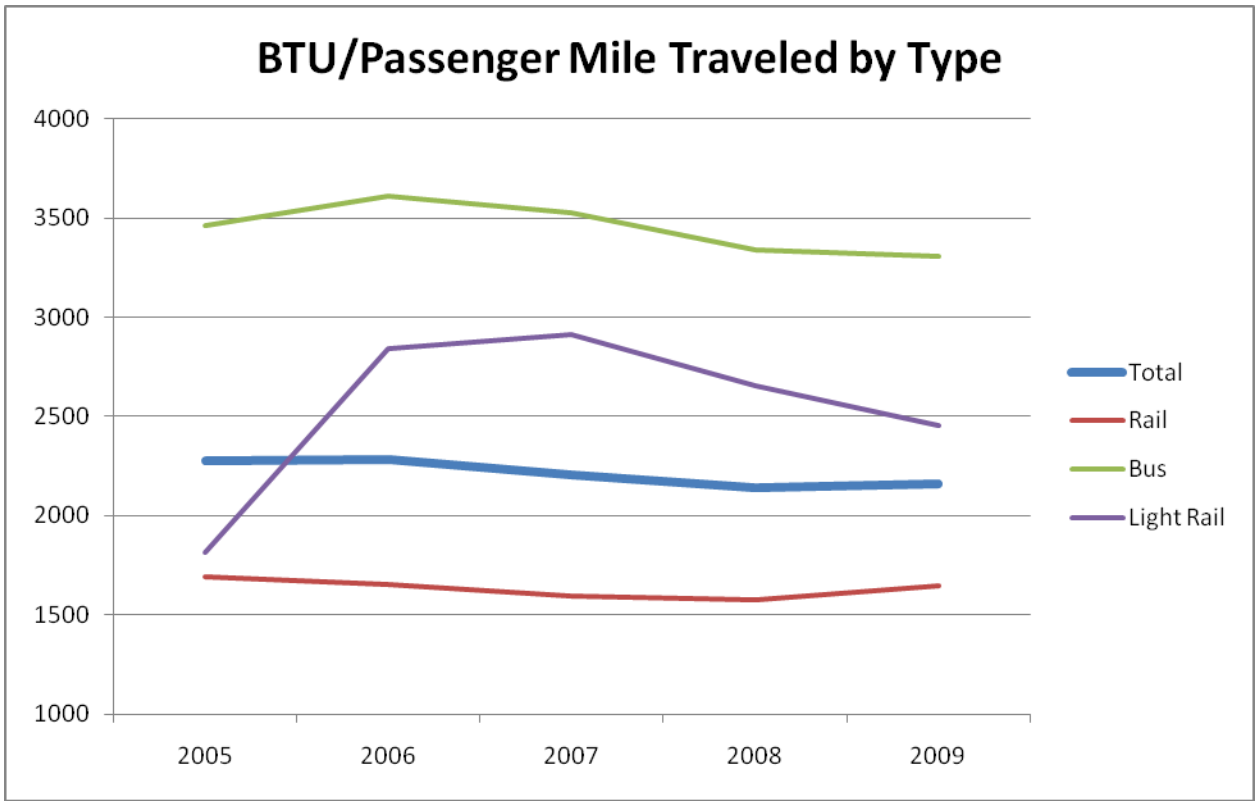
Diesel consumption consisted of 60 percent of the total energy consumption (expressed in BTU equivalent) while it represented only 51 percent of total expenditures. Conversely, electricity for traction made up 20 percent of total energy (BTU equivalent) consumption while accounting for 27 percent of total expenditures. Therefore despite the relative rise in diesel prices it is still somewhat more cost-effective on a $/BTU basis than the other major energy source used by NJ TRANSIT, electricity. As such, managing electricity prices and maximizing the efficiency of traction power operations continues to be a priority.

Improving the efficiency of its transportation infrastructure, by reducing energy consumption and energy expenditures per passenger mile traveled should be NJ TRANSIT's primary focus. One way to measure this progress is by examining the BTU and energy expenditures per passenger mile traveled. This metric is important because passenger miles traveled via mass transportation is presumed to displace passenger miles traveled via cars, SUVs and trucks. The more efficiently in terms of energy consumption per passenger mile that NJ TRANSIT can move

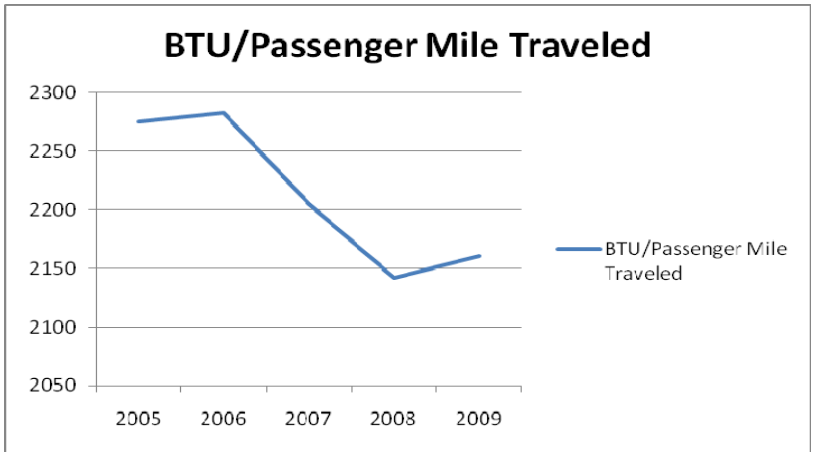
passengers, the more cost-effective its operations become and, perhaps just as important, the more net energy consumption and GHG emissions savings can be achieved for the State.

Graph 3-1-1 shows the BTU per passenger mile traveled over the past five years both in total and broken down by for NJ TRANSIT bus, rail and light rail operations, while Graph 3-1-2 focuses on just the Total BTU per passenger mile traveled over the past five years for NJ TRANSIT.

Graph 3-1-1: BTU per Passenger Mile Traveled by Type



Graph 3-1-2: BTU per Passanger Mile Traveled, Total



Graph 3-1-1 shows that NJ TRANSIT's most efficient form of transportation over the past five years has far and away been their rail use, averaging just over 1,600 BTU's per passenger mile traveled. On the other end of the spectrum are NJ TRANSIT's buses, averaging nearly 3,500 BTU's per passenger mile traveled, and peaking at 3609 BTU's per passenger mile traveled. There was a modest rise in total BTU per Passenger Mile Traveled from 2005 to 2006, which appears to have been driven by a slow-down in the rate of growth in light rail ridership[17] and a downturn in bus ridership[18]; however this was followed by a strong decline of over 100 BTU's per passenger mile between 2006 and 2008. This trend between 2006 and 2008 reflects an increase in ridership and attendant average occupancy of NJ TRANSIT's mass transportation vehicles over the two year period, leading to improved overall operational, energy and cost efficiency.

However Graph 3-1-2 also shows a turnaround and an increase in BTU/passenger mile between 2008 and 2009. This hopefully temporary reversal in overall efficiency appears to have been caused by a decrease in vehicle occupancy rates resulting from economic downturn, which manifested particularly in an increase in BTU per passenger mile traveled by rail (see Graph 3-1-1). This conclusion is based on the fact that the total energy consumption (BTU) in 2009 followed the same roughly 2 percent growth rate as had occurred during the prior years, while the passenger miles traveled growth rate in 2009 was less than 1 percent, as compared to the average growth rate of about 5 percent during the prior few years. These figures suggest that while service was expanded modestly in 2009 (reflected by the 1.8% growth in total energy consumption), ridership did not follow at the same pace (total combined passenger miles traveled by rail, light rail and bus rose only 0.3%, and passenger miles traveled by rail alone was flat).

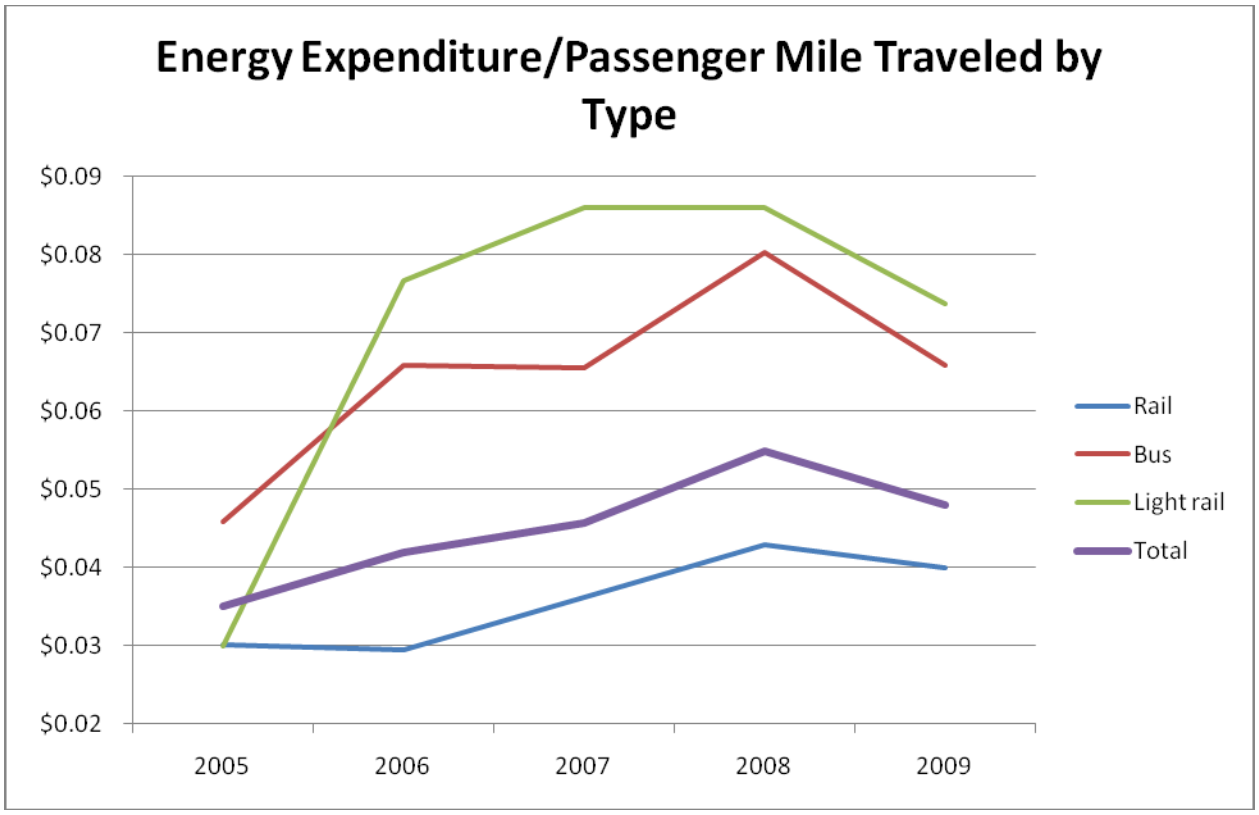
[17] Light rail passenger miles traveled still rose by a healthy 16% rate in 2006; however this was a substantial drop-off from the 39% and 75% growth rate in 2004 and 2005, respectively.

[18] Bus passenger miles traveled decreased in 2006 by 2.2% from the previous year.

This apparent modest increase in BTU of energy consumed per passenger mile traveled is likely a function of the poor economy in 2009, and this trend is expected to reverse and that the BTU/passenger mile trend will again turn downward as the economy improves. However, this trend bears close attention.

In addition to the BTU/passenger mile metric, it is obviously also important from a cost-effectiveness standpoint to examine energy expenditures per passenger mile. Graph 3-2 shows the energy expenditures per passenger mile traveled by type of transit since 2005.

Graph 3-2: Energy Expenditures per Passenger Mile Traveled



Graph 3-2 shows a positive trend in terms of the energy cost per passenger mile traveled; however, this one-year reversal is driven primarily by the sharp decrease in diesel prices during 2009[19], which could reverse itself if and when economic growth returns. NJ TRANSIT should continue monitoring these metrics to track the progress of its work on improving cost efficiency, particularly when normalized to account for uncontrollable movements in market energy prices.

[19] NJ TRANSIT's procurement strategy for large traction accounts which introduced a block-and-index pricing product, discussed in more detail in Section 5.2 of this report, enabled it to take advantage of reductions in spot electric energy prices in 2009, which also contributed to the reduction in energy expenditures/passenger mile in 2009.

The efforts outlined in this plan will help reduce both the energy expenditures and energy consumption per passenger mile traveled.

4. NJ TRANSIT Energy Conservation Projects and Initiatives

NJ TRANSIT has initiated several successful efforts that reduce operating costs and mitigate impacts on the environment. In 1994, NJ TRANSIT began implementation of an effective ongoing energy conservation program that has mitigated facility energy consumption increases while adding facilities and services. To accomplish this, NJ TRANSIT commissioned reports, energy audits, and utility bill analyses, to track energy and water consumption as well as measure its carbon footprint and track its development.

NJ TRANSIT continued these efforts in 2009 by conducting 21 energy audits to further reduce its energy consumption. Each audit examined various facilities including maintenance garages, train stations, bus depots and office buildings and suggested ECMs that could be incorporated into the infrastructure of the building in order to decrease energy consumption. The reports also tracked the 2006 and 2007 electric, natural gas, and in some cases, water, sewage, and oil consumption and used these values to benchmark the amount of savings that could be reduced once the ECMs were implemented. The reports also include a "Savings and Cost Summary" for each ECM that outlines the following:

- useful life of each ECM,
- cost of each ECM,
- annual electric savings,
- peak demand reduction,
- annual gas savings,
- one-time incentive amounts, and
- simple payback in years.

The reports conclude by outlining additional energy savings opportunities.

NJ TRANSIT also commissioned a series of efforts to reduce its impact on the environment. In 2008, NJ TRANSIT commissioned a report entitled, "Assessment of NJ TRANSIT's Carbon Footprint" which determined that NJ TRANSIT was a net GHG emission reducer in 2006. In reaching this conclusion, the report took into consideration NJ TRANSIT's energy footprint and environmental benefits of public transportation over passenger vehicle transportation. The report examined how NJ TRANSIT can monetize, cap, and trade its GHG emission reductions. It also projected the amount of energy NJ TRANSIT would consume and the amount of GHG emissions, specifically CO_2 emissions, it would emit for 2007 through 2010. This information can be used for future planning efforts to reduce its impact on the environment.

The New Jersey's Global Warming Response Act Recommendations Report, which was completed by the New Jersey DEP, included the participation of NJ DOT, NJ TRANSIT and

other State entities and stakeholder groups. This report provides the state as a whole with a roadmap for reducing GHG emissions to 1990 levels by 2020 and 80 percent below 2005 levels by 2050.

NJ TRANSIT has also made a commitment to the 2009 Pilot phase and continuation of participation in the full launch of the APTA Sustainability Commitment. NJ TRANSIT has utilized matrix management in which NJ TRANSIT employees with similar skills are pooled together for work assignments in order to integrate sustainability programs into departments. This is a management tool that improves the effectiveness and efficiency of implementing sustainability programs. It has held awareness meetings with rail, bus and corporate facility operations managers and procurement staff about various NJ State energy reduction incentive programs and the results of the above mentioned energy audits.

Base-line measurements and criteria were also established by NJ TRANSIT to monitor energy consumption and emissions production at its facilities. This base-line measures water and energy usage on a monthly basis by location, and tracks the amount of carbon emissions and other pollutants that are emitted. Air and water pollutants are measured and managed by NJ TRANSIT's Environmental Services for strict compliance based on State of New Jersey permits. This information will provide a valuable metric to measure the need for efficiency or conservation efforts at NJ TRANSIT's facilities.

4.1. NJ TRANSIT's Carbon Footprint Report

NJ TRANSIT is committed to decreasing its production of GHG emissions which are associated with global climate change. In its core business of public transportation, NJ TRANSIT is a significant contributor to reducing GHG emissions. The use of public transportation over passenger vehicles reduces VMT and provides quantitative benefits to the environment.

As of 2006, NJ TRANSIT has and continues to implement the following to reduce GHG emissions and other impacts on the environment:

- Use of ultra low sulfur fuel in all diesel engine buses;
- Use of recycled paper products and have recycled batteries, oil, ballasts;
- Incorporate life cycle cost of energy in procurement decisions and will pay up to a 15% preference price premium for more energy efficient equipment and materials;
- Purchase of ENERGY STAR compliant products where available;
- Use of low volatile organic compound (VOC) products;
- Filter and reuse of bus wash water;
- Use of facility preventive maintenance procedures to keep equipment running optimally and keep thermostats between 68 and 72 degrees depending on the season;
- Installed fast opening and closing doors at bus garages;

- Maintains an environmental services unit to manage underground storage tanks, hazardous materials and site remediation; and,
- Participates in a Goodyear and Firestone program in which it leases and recycles bus tires.

In July, 2008, NJ TRANSIT conducted an assessment of its carbon footprint using the services of SAIC to improve the sustainability of its operations. The report focused on reducing GHG emissions, specifically CO_2e[20] emissions. The report estimated the NJ TRANSIT GHG emission footprint for the time period of 2000 to 2006 using historical information. The report compared NJ TRANSIT's carbon footprint with the amount of CO_2e emissions avoided due to fewer VMT and reduced traffic congestion. Based on this comparison, the report concludes that NJ TRANSIT is a net carbon reducer. In 2006, the report estimates that NJ TRANSIT was a net carbon reducer by 589,000 MTonnes.

SAIC also conducted a 2030 GHG emission reduction scenario, which provides a valuable metric for NJ TRANSIT to quantify the environmental impacts of its sustainability efforts. The report provides NJ TRANSIT with the information necessary to implement initiatives that decrease its contributions to GHG emissions and provides an analysis of the financial benefits of monetizing these efforts through a cap and trade system.

4.2. Energy Consumption

Over the past five years, NJ TRANSIT's energy expenditures total nearly $750 million. Therefore, efforts to reduce energy expenditures can play a critical role in reducing operating costs and reducing the need for fare hikes at NJ TRANSIT. As of 2006, NJ TRANSIT has implemented demand side management changes to reduce its energy consumption and improve the sustainability of its operations. It has incorporated energy efficient operating practices, purchased energy efficient bus and rail vehicles, purchased energy efficient appliances and implemented energy efficient design of facilities. Specifically, NJ TRANSIT has implemented the following demand side management practices:

- installed 22,000 energy efficient lighting fixtures at 27 of their largest facilities (i.e. Newark Penn Station, Meadows Maintenance Complex, Orange Bus Garage) that have resulted in reduced energy consumption of 11 million kilowatthours (kWh) resulting in annual savings of $950,000;
- installed building automation systems which control electricity and natural gas usage at Washington Township Garage, Newark Bus Complex, Meadowlands Bus Garage, Hilton Garage, Orange Garage and Newark Penn Station resulting in annual savings of 4.2 million kWh or $400,000;

[20] CO_2e refers to metric tons of carbon dioxide and other GHGs that are expressed their equivalent carbon dioxide metric ton impact.

- completed a fuel switch from electricity to natural gas for the chiller plant at Newark Penn Station resulting in reduced energy consumption of 1 million kWh, resulting in annual savings of $130,000;
- increased the efficiency of three large air compressor systems at Hamilton Township Garage, Newark Bus Complex, and Meadows Maintenance Complex resulting in annual savings of 1.2 million kWh and an annual savings of $82,000; and,
- increased the purchase of hybrid sedans and SUV vehicles.

In 2009, to continue tracking and improving the sustainability of rail and bus facilities, NJ TRANSIT commissioned energy audits performed by SAIC for its administration buildings, garages and train stations.

Table 4.2-1 summarizes the result of these audits for each of these facilities. In total, the examined facilities consumed on average 96,181,318 kWh of electricity, 4,107,584 therms of natural gas, 173,893 gallons of oil, 5,508,580 gallons of water, and 7,671,222 gallons of sewage for 2006 and 2007. On average, each NJ TRANSIT facility was responsible for 0.017 MTonnes of CO_2 per square foot in 2006 and 0.019 MTonnes of CO_2 per square foot in 2007. Between 2006 and 2007, GHG emissions increased nearly 12% per square foot.

In addition to establishing a baseline energy usage for each of the audited facilities, the SAIC audits identified recommended ECMs to be undertaken at each of the audited facilities to reduce energy consumption. These ECMs are discussed in more detail in Section 5.2 of this Report.

Table 4.2-1: NJ TRANSIT Energy Audit Facility Summary

Facility	Size (sf)	2006/2007 Avg. Electric Usage (kWh)	2006/2007 Avg. Natural Gas Usage (therms)	2006/2007 Avg. Oil Usage (gals)	2006/2007 Avg.Water Usage (gals)	2006/2007 Avg. Sewer Usage (gals)	Mtonnes CO2/sf 2006	Mtonnes CO2/sf 2007
Big Tree	51,000	898,397	71,148		12,947	1,343	0.0155	0.0238
Egg Harbor	100,000	2,574,150	257,270		3,415,500	3,020,000	0.0266	0.0264
Fairview	43,000	833,691	110,745		1,299,387	1,365,474	0.0237	0.023
Secaucus	312,500	8,101,624	29,386		2,295,485	1,128,514	0.013	0.0145
Greenville	64,000	1,809,200	216,353		1,159,400	1,278,777	0.0323	0.0318
Hamilton	140,000	2,724,190	2,521		13,634,412	19,567,680	0.0174	0.0181
Hilton	212,000	6,972,586	359,625		3,088,524	173,170	0.0262	0.0319
Hoboken	500,000	1,377,117	89,533		36,585,245	39,483,860	0.0023	0.0024
Howell	262,000	3,769,200	251,571		3,088,524	39,133,500	0.0118	0.014
Maplewood	125,000	6,972,586	9,623		2,059,015	115,446	0.0286	0.028
Market St.	102,000	901,323	189,645		1,912,005	1,912,005	0.0132	0.0244
Meadowlands	267,000	1,716,243	145,435		4,941,217	10,791,442	0.0079	0.006
Meadows	600,000	16,643,107	562,176		61,862,555	61,862,555	0.0173	0.0233
Headquarters	300,000	9,115,480	42,337		*	*	0.0157	0.0162
Newark Bus Complex	701,400	10,167,008	609,322		11,099,602	11,099,002	0.0131	0.0166
Penn Station	283,200	8,550,000	86,655	173,893	20,402,356	20,308,112	0.0217	0.0235
Newton	185,125	3,302,611	237,816		898,512	898,722	0.0158	0.0157
Oradell	83,000	1,435,219	117,557		2,170,054	2,170,054	0.016	0.0226
Orange	167,000	2,124,000	205,700		3,664,214	3,664,214	0.0121	0.0137
Washington	223,000	3,373,847	291,583		3,404,000	3,357,000	0.0148	0.0139
Wayne	210,000	2,819,744	221,588		3,449,449	3,449,449	0.0123	0.0172
Totals	4,931,225	96,181,319	4,107,584	173,893	180,442,403	224,780,319		
Average	234,820						0.017014	0.019381

*Green text de-notes NJ TRANSIT-supplied data; all other data direct from SAIC audits.

NJ TRANSIT has implemented numerous measures to decrease its energy consumption prior to this latest effort to undertake energy audits of some its major facilities. These completed efforts include installing or implementing the following measures:

- fast operating garage doors on bus maintenance facilities;
- building automation systems in bus and rail maintenance facilities;
- energy efficient lighting in bus, rail and corporate facilities;
- photo-cells installed in parking and platform lighting;
- motion detectors to control lighting;
- energy efficient air compressor systems at bus facilities; and
- efficient spray painting process facilities that reduce the amount of paint used and prevent the release of VOC

In 2009, NJ TRANSIT was also awarded federal funding from the Transit Investments Greenhouse Gas and Energy Reductions (TIGGER) program. The funding, in the amount of $250,000, is being used to upgrade four air compressor systems to energy efficient systems at the Meadows Maintenance Complex in Kearny NJ, the Meadowlands Garage in North Bergen, the Greenville Garage in Jersey City, and the Newark Central Maintenance Facility and Ironbound.

NJ TRANSIT has also implemented water conservation initiatives. Through a utility bill analysis and reporting system, NJ TRANSIT is able to quickly identify leaks and correct them. Auto on/off faucets, low flow shower heads, toilets and urinals are all standard equipment for any new or retrofit construction. In addition, all train and bus wash facilities have water reclamation equipment that cleans and reuses water.

4.3 NJ TRANSIT Renewable Energy Initiatives

NJ TRANSIT is also committed to adopting renewable energy applications where financially feasible. NJ TRANSIT is currently developing a 550 kW solar energy array on the roof of its Meadows Maintenance Complex in Kearny, NJ. It has received $3.16 million in support from the NJ State Energy Grant Program for this project. The State Energy Grant Program is funded from the American Recovery and Reinvestment Act (ARRA) and is expected to create jobs. The 550 kW solar project will be producing approximately 600 megawatt-hours (MWh) per year, resulting in SREC revenue averaging approximately $212,952 per year for the first ten years and estimated annual energy savings of $87,810 in its first year using a conservative 10.5 cents per kWh price estimate.

NJ TRANSIT has also partnered with parking deck operators in Trenton to install two solar photovoltaic systems on parking decks. These systems will reduce operating costs and include charging stations for electric vehicles to promote zero emission electric vehicles.

Renewable energy investments offer a valuable opportunity for NJ TRANSIT to reduce its impact on the environment and insulate itself from rising and volatile electricity prices.

Therefore, renewable energy investments should continue to be a NJ TRANSIT priority. Section 5.3 analyzes NJ TRANSIT's additional options for incorporating solar energy and other renewable and alternative energy systems into its operations.

4.4 NJ TRANSIT Vehicle Efficiency Initiatives

NJ TRANSIT has invested in higher efficiency transportation infrastructure to help offset GHG emissions and reduce energy consumption. In many cases, diversifying the fuel mix can be very effective at reducing transportation costs and mitigating impacts on the environment. For instance, electricity can be generated without emitting any GHG emissions (such as generation from nuclear power, solar arrays or wind turbines) or other air pollutants. It offers a valuable transportation alternative to traditional fossil fuel based transportation, and is being incorporated into NJ TRANSIT's transportation fuel portfolio.

The following section outlines the transportation upgrades that NJ TRANSIT has made by transportation operating unit.

Bus

NJ TRANSIT operates a fleet of 77 compressed natural gas buses. The remaining bus fleet is clean diesel fueled with ultra low sulfur diesel (ULSD). NJ TRANSIT has tested both bus and rail fleets on various blends of biodiesel fuels, and has found the use of certain biodiesel blends to be operationally feasible. Due to existing fuel contracts and price, NJ TRANSIT has determined that the commercial use of biodiesel blends is not currently cost-effective; however it is NJ TRANSIT's intent to implement this type of fueling when cost effective. NJ TRANSIT is also testing seven hybrid buses that run on smaller diesel engines and batteries for about a 20% reduction in fuel consumption. It also purchased ten ten-passenger hybrid cut-away buses with wheelchair lifts for use in county rural programs. Through these initiatives, NJ TRANSIT has used ULSD in bus fleet in advance of federal mandates. Currently, NJ TRANSIT has 1,100 buses on order that have new transmission technology with clean burn diesel engines that will decrease diesel consumption by an estimated ten to fifteen percent.

Rail

NJ TRANSIT is currently using ULSD in rail fleet in advance of federal mandates. It has also added rail seating capacity through purchase of multi-level coaches, thus decreasing the number of trains that need to operate to carry the same number of passengers. Currently, NJ TRANSIT has 26 hybrid locomotives on order. The hybrid locomotives will run on diesel, biodiesel blends up to B20 and electricity. The locomotives will enable one seat rides for routes that traverse on both electrified and non electrified tracks. As additional funding is made available, NJ TRANSIT plans to purchase more of these trains.

NJ TRANSIT's Alp 46 locomotives are equipped with regenerative braking which reduces energy consumption and costs. These trains make up 30% of NJ TRANSITs electric-powered rail locomotives. In addition, all electric-powered light rail vehicles are equipped with regenerative braking which reduces energy consumption and costs.

NJ TRANSIT has also installed compressed air and electricity plugs in rail yards enabling locomotives to be shut down which reduces idling, diesel consumption, GHG emissions, air pollutants and noise. Rail operations have taken a proactive approach of shutting down the diesel engines one hour after the scheduled arrival of trains into its maintenance facilities. This was accomplished by installing Kim Hot Start systems that keep the main engine water at an acceptable level to protect the engine during cold weather season. This reduces consumption of fuel and GHG emissions.

4.5 NJ TRANSIT's Transit Friendly Planning Program – Then and Now

NJ TRANSIT can also improve the sustainability of its operations by supporting land use planning efforts such as transit-oriented development (TOD). TOD is defined as development strategically located near mass transit infrastructure to encourage increased transit usage. For example, TOD can consist of, "compact, mixed-used development within an easy walking distance of transit (typically within one-half mile of the transit station) that accommodates safe multi-modal access."[21]

To be successful in New Jersey, TOD requires active land use planning participation by local municipalities. NJ TRANSIT has commuter rail and light rail stations in about 130 of the state's 566 municipalities. Many of these towns are small and have minimal resources to dedicate to local planning efforts. The State tries to support these efforts through its Office of Smart Growth, but ultimately the final decisions and much of the planning gets done by the local municipality. Due to the lack of resources, municipal master plans and zoning are intermittently updated, and in most communities, they were developed with little consideration for transit and TOD. The result is municipal land use regulations and a planning environment makes it difficult for TOD to be implemented. Despite these difficulties, interest in TOD has increased in New Jersey. Many communities have worked with developers and supported the implementation of TOD infill projects.

Since the creation of NJ TRANSIT in 1979,[22] the agency has been investing billions of dollars to repair, rehabilitate, expand and connect the state's public transit network. As a result, over the last 25 years, ridership has doubled. With the addition of the Hudson-Bergen Light Rail (HBLR) Line, River Line in South Jersey, the Newark Light Rail Line and Secaucus Junction station, NJ TRANSIT has created a rail network with more than 200 stations serving the majority of state residents. Complementary investments in various multi-modal "hub" locations (i.e., Trenton Transit Center, Wayne Transit Center, Mount Arlington Transit Center) and intra/inter-state bus service (newly created and branded "GO BUS" skip-stop express services between Irvington Bus Terminal Newark and Penn Station and Bloomfield Township, and Newark Liberty International Airport, "bus only" express lanes on US Route 9 to midtown Manhattan, etc.) have enhanced NJ

[21] APTA Standards Development Urban Design Group. "Recommended Practice for Transit Agency, Community and Business Partnerships to Promote Transit-Oriented Development and Joint Development." 4 August 2009. APTA.

[22] NJ TRANSIT is an instrumentality of the State of New Jersey.

TRANSIT's ability to connect New Jersey residents to jobs, housing, recreation and each other. Transportation planning in New Jersey today is about increasing multi-modalism, enhancing levels of service, rehabilitating and maintaining station facilities, improving access (pedestrian and vehicular), balanced commuter parking and making transfers at hubs as convenient as possible. Encouraging sustainable, mixed-use growth around stations, terminals and transit hubs which increase ridership, encourage mobility choice and foster connectivity is key to successful transportation planning in a state that is a national leader in rail, bus and light rail facilities.

To encourage the efficient use of its infrastructure investments, NJ TRANSIT has promoted collaborative planning with host communities, engaging state agencies, developers, municipal officials, planning and zoning boards, and citizens in discussions about the benefits of coordinated land use and transportation. In 1994, the agency, with a grant from the FTA under the ISTEA legislation[23], produced a publication entitled: *Planning for Transit-Friendly Land Use*, A Handbook for New Jersey Communities. This easy to understand guide was designed to "[help] communities that wish to consider the implementation of 'transit-friendly' land use plans around their transit stations, along their major transit corridors, and for proposed new areas of development." The text features discussions of land use and development patterns, pedestrian and bicycle access and circulation, parking location and design, station area qualities, implementation tools, and a sample master plan for the transit-oriented development district (TOD). Pictures and diagrams augmented the explanations and a robust set of appendices featured sample zoning ordinance language, resources available from state, federal and transit sources, bibliography, and a glossary of selected transit and land use terminology. More than fifteen years later, this handbook is still relevant and used by professionals and lay persons alike.[24]

In 1999, upon receiving a competitive grant from the Transportation and Community and System Preservation Pilot Program (TSCP)[25], part of the federal transportation legislation of 1997 known as TEA-21,[26] NJ TRANSIT launched the "Transit-Friendly Communities for New Jersey" program. Working with a consortium of nonprofit organizations, the New Jersey Office of Smart Growth, and local public and private sector partners, the pilot planning project provided educational workshops and technical assistance to a wide range of rail station communities throughout the state. From 1999–2002, eleven selected communities[27] were shown how to leverage transit investments to achieve stronger downtowns, improve their station area environment, expand transit ridership and make their stations the focus of the community's life. The Alan M. Voorhees Transportation Center (VTC) was a program partner with NJ TRANSIT

[23] Intermodal Surface Transportation Efficiency Act of 1991.
[24] The Handbook is available on CD-ROM from NJ TRANSIT.
[25] NJ TRANSIT received $535,000 which was supplemented with a local match from the agency and the New Jersey Department of Community Affairs for a total of $845,000.
[26] Transportation Efficiency Act for the 21st Century
[27] Bayonne, Hackensack, Hillsdale, Hoboken, Matawan, Palmyra, Plainfield, Red Bank, Riverton, Rutherford and Trenton.

(along with the New Jersey Office of Smart Growth and key New Jersey-supportive non-governmental organizations such as Downtown New Jersey, Inc., New Jersey Future, Project for Public Spaces, Inc., and the Regional Plan Association). The results of this program were compiled in *Building a Transit-Friendly Community*, published in 2003.[28]

In 2004, NJ TRANSIT continued these efforts when it partnered with Rutgers' University VTC to create a newsletter that would enrich the TOD conversation in New Jersey's diverse communities by providing information about best practices, model programs, legislation, and the key issues that affect TOD's acceptance at the local level. In May 2005, VTC launched *Transit-Friendly Development Newsletter*, an electronic publication that is emailed to over 6,000 transportation professionals, planners, developers, municipal officials, and interested citizens across the country. All issues are archived and available on the VTC website.[29] Current topics of interest, such as visualization, form-based code, consensus building, eminent domain, brownfield redevelopment, shared parking and the recent market downturn have all been featured, along with spotlights on new TOD projects in the state, region and nation. Towns with thoughtful planning efforts and successful implementation are profiled to inspire other municipalities. There is also a section on recommended reading for publications on TOD and there is always an opinion questionnaire where readers can comment. We are informed that feedback has been extremely positive and that the publication reaches a wide audience because of its electronic form. This newsletter can be found at: http://policy.rutgers.edu/vtc/tod/newsletter.php.

Building upon the success of the pilot Transit-Friendly Communities program, NJ TRANSIT was able to establish a permanent "Transit Friendly Planning Program" (TFP) which has continued to provide strategic planning, visioning and development assistance to interested communities (nearly 50 to date) through on-call consultants with expertise in transportation planning, shared parking, urban design, market analysis, economic development, downtown revitalization and community outreach. Key components of this program are collaboration, partnership, and diversity. The goals of this program are to:

- Encourage land use patterns near transit that (1) improve access to transit, (2) increase access to jobs, (3) revitalize traditional downtowns, urban centers and suburban neighborhoods, and (4) strengthen local and regional economies.
- Unleash the economic development opportunities and improved quality of life that communities have available to them by integrating public transit planning with local land use planning and redevelopment.
- Improve public transit's competitive edge as the mode of choice for New Jerseyans.
- Increase NJ TRANSIT's farebox and non-farebox revenues.

[28] Available on CD-ROM from NJ TRANSIT
[29] See http://policy.rutgers.edu/vtc/tod/tod_projects.html[29]

- Establish the TFP Program as a national model for promoting and implementing center-based, transit-oriented development and redevelopment.

NJ TRANSIT seeks to partner with communities, counties, state agencies, NGOs, private developers, property owners and citizens at large to create consensus-based, transit supportive land use plans that stakeholders can use to guide development and redevelopment at and surrounding existing or proposed transit facilities. By creating local "transit-friendly plans," NJ TRANSIT has successfully demonstrated how statewide transportation investments can enhance the environment, create strong community centers, encourage private reinvestment in the local economy and improve the quality of life of New Jersey residents. At its core, NJ TRANSIT's Transit-Friendly Planning Program has enabled staff and on-call consultants to work with willing communities to help rationalize their land-use decisions so that people are connected with the goods, services and destinations they need or desire and the existing transit network is used to its fullest potential, resulting in more ridership and more robust, livable communities.

For the last 15 years, as interest in TOD has expanded, communities have requested NJ TRANSIT to assist them in defining vision plans for their station areas. Some of the organizing elements in these studies included:

- **Agency role:** The goal of NJ TRANSIT's planning work with municipalities is to facilitate the preparation of a community-based vision plan. Community leaders, residents, business owners and elected officials have engaged with NJ TRANSIT to prepare plans that meet community needs and that can be incorporated into the local master plan and adopted as "TOD" zoning. To do this, NJ TRANSIT oversees the hiring and work of the consultant, but the consultant interfaces with and establishes a rapport directly with the local community.

- **Consulting Assistance:** A consultant with expertise and experience with TOD is selected to work with the community. To expedite hiring consultants, NJ TRANSIT has a process under which task order consultants are pre-selected for a variety of disciplines, including transit-friendly planning. This approach has been used several times and allows work to be initiated quickly.

- **Steering Committee:** At the outset of the project, the municipality's leadership is asked to select the members of a steering committee, which meets at milestone points to guide and comment on the planning effort. This committee is asked to liaison with residents and business owners who will be concerned with the station area. Applying this approach, NJ TRANSIT has assisted a number of municipalities in developing vision plans. In recent years, two municipalities, Netcong and Somerville, have used this process and then defined and adopted redevelopment plans (land use zoning) under New Jersey redevelopment law. Both Netcong and Somerville worked with NJ TRANSIT to solicit developer proposals.

However, even with the Handbook, the newsletter, the *Transit-Friendly Communities* model and continued transit-friendly planning assistance, community acceptance of transit oriented development (TOD) in New Jersey is less than ideal. NJ TRANSIT works with communities across the state on a variety of issues, but has reported that local opposition can detract and often defeat TOD objectives. Opponents have been reported to use terms like density, traffic congestion, and parking issues to frighten and confuse. Citizens, accustomed to sprawl development, are skeptical of mixing uses in denser, clustered settings and buildings**.** It is clear that a more effective mechanism is needed to reach and engage a more diverse spectrum of communities so that the components and benefits of good center-based, transit-focused land use planning, the role of the transit agency, the importance of participating in the discussion and the creation of real change in New Jersey's communities can be demonstrated and implemented.

The Next Generation of Transit Friendly Planning at NJ TRANSIT

Since the adoption of the State Development and Redevelopment plan in 1986, New Jersey has attempted to fully integrate local land use activities with sound transportation planning and investment. Looking ahead, we believe NJ TRANSIT – through a targeted, proactive, re-energized Transit Friendly Planning Program - could assume a stronger, lead role in enabling and supporting local, state and regional economic growth objectives. For NJ TRANSIT, this is not "social engineering;" it is a common sense approach that will lead to a more sustainable, economically viable state.

Certainly, at the National level, there has been a recent, strong push for program integration between USDOT, USEPA and U.S. Department of Housing and Urban Development (USHUD), with the specific goal of creating "livable communities" where land use and transit work together in a sustainable, environmentally friendly manner. We have the opportunity to position NJ TRANSIT to take full advantage of this national agenda so that we end up with a world class transit system that supports world class communities. To that end, NJ TRANSIT is partnering with a consortium of state agencies, the North Jersey Transportation Planning Authority (which is one of three Metropolitan Planning Organizations (MPO) in New Jersey), various non-governmental organizations and community development corporations to prepare and submit a "sustainable New Jersey" application to the USHUD under the newly created Livable Communities Initiative. The *NJ Sustainable Communities Partnership* is seeking grant funds to help the State realize the potential economic benefit related to this significant regional investment.

In particular, the Access to the Region's Core (ARC) tunnel project presents an enormous opportunity to coordinate and consolidate this work into a regional and sustainable TOD strategy for New Jersey. Moreover, complementary transit system investments within New Jersey present both the opportunity and the need for comprehensive coordinated land use planning along the rail, bus and light rail corridors within the ARC region of influence. The 'next generation' of NJ TRANSIT's Transit Friendly Planning Program (TFP) can – and should – be

use to provide direct support to those communities committed to creating land use entitlements that foster sustainable, implementable and equitable transit-oriented development in New Jersey.

Areas of focus for NJTRANSIT's "new" TFP Program include:

1. Technical Assistance to Communities
2. Creation of a TOD Database/Performance Measurement Tool
3. Community Engagement & Public Education, and
4. Proactive Program Management & Development.

Technical Assistance Program

NJ TRANSIT's TFP Program involvement in initiating and underwriting Vision and Redevelopment plans has been invaluable in the process of redeveloping underutilized areas around transportation facilities throughout the state. The Program builds on NJ TRANSIT's established role in partnering with local municipalities in initiating and building consensus around new visions for the areas around their facilities. At the same time, it envisions taking a more strategic approach in deploying its team of Task Order Consultants to provide technical assistance in areas around NJ TRANSIT's stations. This implies engaging station areas beyond NJ TRANSIT- controlled properties where increased development or more complementary land use will result in significant potential for increased ridership and/or statewide development and redevelopment objectives.

This approach will be implemented in three levels:

1. ***On a Corridor Level:*** The program recommends taking into consideration different station areas' regional access characteristics, their relative strength in the market, and the potential role they might play in the NJ TRANSIT system. This approach could help NJ TRANSIT focus more significant parking resources at locations that have superior access for commuters, while simultaneously lessening the parking load in downtown settings where increased parking might be prohibitively expensive, and be detrimental to getting development started.

2. ***On a Local Level:*** The program will look at innovative approaches, such as seeking out strategic partnerships with local municipalities to develop parking facilities that provide for parking needs of both the downtown and commuters, free-up scattered sites for infill development allow and advance downtown development.

3. ***Lead to Implementation:*** Within the technical assistance projects, the program should take a more strategic approach. NJ TRANSIT TFP Technical assistance has been focused primarily on visioning. This emphasis has filled the need on the part of local municipalities in the immediate past period to understand the possibilities that existed in the land around their stations. In the past several years however, as the

development community has caught on to the potential of TOD and as state programs such as the TFP program has extended its reach, the more prevalent challenges have been less about vision and more about entitlement and devising ways to get these projects started. The program recommends that all Technical Assistance programs include development of strategies for implementation in addition to the typical focus on issues like land use, circulation and urban design.

The Screening Process

In order to identify the most effective locations for the TFP to deploy its resources, the team devised a multi-step process to comprehensively screen potential opportunities for TFP attention. This process was developed to allow for a high-level screening to be completed in a relatively brief amount of time. The goal of this process is to arrive at a more focused pool of potential opportunities that could be developed into technical assistance and/or public education program activities in the 2009-2012 TFP Program cycle.

Screening Level 1: Station areas with TOD Potential

The team started with NJ TRANSIT's entire system of over 160 rail stations and nearly 250 bus lines. Station areas impacted by NJ TRANSIT's major capital projects, those with significant NJ TRANSIT-owned land, and those that enjoyed the system's highest value service (i.e. a one-seat ride and within 75 minutes of Penn Station) formed the genesis of the first round of station areas to be considered. To complete this initial pool of candidates, the team reached out to stakeholders comprising over 35 state agencies, MPOS, advocacy groups, trade organizations and academic think tanks. In addition, the team solicited input in meetings with nine other NJ TRANSIT units and departments with allied interests, and drew on the collective intelligence of the consultant team. Through this process, a list of over 100 "Station Locations with TOD Potential" emerged.

Screening Level 2: Station areas with <u>strong</u> TOD Potential

TOD is ultimately about harnessing the private sector and public sector resources beyond NJ TRANSIT's control. As such, the team looked primarily to evidence of market interest and public sector support:

Market Activity and Interest

The team applied a high-level screen to each candidate location identifying whether, since 2004, any significant development has been completed or proposed which would demonstrate a level of favorable market conditions. Those locations deemed favorable suggest likelier success for a TOD project at that location.

Public Financing

At this point, the team identified those locations with Public Financing potential, based upon existing State Programs (including the Urban Transit Hub Tax Credit, Economic Redevelopment Growth Grant, NJ Urban Enterprise Zone, and NJ Redevelopment Authority programs). The criteria is not used as a factor to eliminate candidate locations, but rather to potentially elevate opportunities where public financing might prove a determining factor in combination with other criteria already in place.

NJ TRANSIT- controlled property

While the presence of significant NJ TRANSIT controlled property was not treated as a prerequisite for TFP technical assistance, it was a favorable indicator as it offered the opportunities for early stage implementation and for NJTRANSIT to realize non-farebox revenue.

From the application of the above filters, the team generated a list of approximately 50 "Station areas with Strong TOD Potential"

Screening Level 3: Station areas recommended for TFP Program Activity

The final screen involved evaluations by the team for conditions that promote development. This filter was advanced through "windshield survey" level tours of every station area in Group 2, and through extensive discussion drawing upon the collective intelligence of the team and the NJ TRANSIT TFP unit.

The team site assessments addressed the physical conditions surrounding identified locations, taking particular account of available developable parcels, existing urban fabric, vehicular access to stations from regional and interstate highways, pedestrian access to the station; intermodal connections, and neighboring uses.

The team also took into account additional factors such as

- Clarity of direction at the local level;
- Ongoing development process(es) in progress – municipalities that have been the beneficiary of recent interventions but have failed to move plans forward for reasons beyond the areas NJ TRANSIT has the ability to influence (such as political consensus, the market, etc) were not considered to be able to justify the risk of further investment at this time;
- Current ridership levels – high levels of current ridership indicated that the strength of the station could be built upon; and
- Projected population growth – high levels of projected population growth indicated a growing market.

As part of the TOD planning process NJ TRANSIT has also examined ways it can improve the sustainability of its operations by decreasing its energy footprint and reusing old infrastructure when possible. This includes incorporating responsible energy applications, such as state of the art energy efficiency technologies, in its new buildings and facilities. NJ TRANSIT also looks to re-use, repair and rehabilitate existing rail stations and infrastructure rather than demolish and rebuild. When new facilities are needed to be built, NJ TRANSIT works with architects and engineers to incorporate energy efficiency and sustainability designs into the building. This includes incorporation of natural sky lighting, cool white roofs and parking surfaces that reduce run-off. All buildings over 15,000 square feet are designed to LEED Silver equivalent status. This is discussed further in Section 5.4.1.

4.5.1 Transit Village Initiative

The New Jersey Department of Transportation (NJDOT) and NJ TRANSIT spearhead a multi-agency Smart Growth partnership known as the Transit Village Initiative. The Transit Village Initiative creates incentives for municipalities to redevelop or revitalize the areas around transit stations using design standards of transit-oriented development (TOD). TOD helps municipalities create attractive, vibrant, pedestrian-friendly neighborhoods where people can live, shop, work and play without relying on automobiles. Municipalities that are committed to TOD may be eligible for NJDOT Transit Village designation.

The Transit Village Initiative is an excellent model for Smart Growth because it encourages growth in areas where infrastructure and public transit already exist. Municipalities must meet the Transit Village Criteria and complete a Transit Village Application in order to be designated a Transit Village

In addition to community revitalization, the Transit Village Initiative seeks to reduce traffic congestion and improve air quality by increasing transit ridership. Studies have shown that adding residential housing options within walking distance of a transit facility; typically a one-half mile radius, increases transit ridership more than any other type of development. Therefore, one of the goals of the Transit Village Initiative is to bring more housing, businesses and people into the neighborhoods around transit stations.

A recent example of a mixed-use, TOD project being advanced in a designated Transit Village is the $15 million Gateway Transit Village project in New Brunswick, NJ. In 2009, construction began on the Gateway Transit Village project. This project includes housing, business and office space, and a 657 space parking garage across from the Northeast Corridor rail line and adjacent to Rutgers University. The project is expected to provide 3,000 construction jobs and is expected to be completed by 2012.[30]

[30] Hester, Tom. "New Brunswick breaks ground for $150 million transit village." *Newsroom Jersey*. 10 June 2009. http://www.newjerseynewsroom.com/state/new-brunswick-breaks-ground-for-150-million-transit-village.

4.6 NJ TRANSIT Information Technology Program

Energy consumption by information technology (IT) equipment is also a major concern for NJ TRANSIT. Over the past two decades, energy consumption for IT equipment has increased substantially. During this time, equipment such as servers has become a critical component to support databases, internet services and other IT demands. A standard computer server can consume up to 8,600 kWh annually. This means that computer servers could use more than 700 kWh of electricity each month or more than 20 kWh a day.[31] The total power demand for servers, including cooling and auxiliary equipment, accounted for 1.2% of the U.S. electricity consumption in 2005. This electricity demand cost approximately $3 billion in 2005.[32] It is estimated that if all servers in the United States meet ENERGY STAR specifications, "energy cost savings would approach $800 million per year and prevent GHG emissions equivalent to those from over one million vehicles."[33]

In addition, new equipment is needed to be purchased on a regular basis to meet these IT demands. The NJ TRANSIT Technology Services groups supports approximately 400 servers. Each one of these servers has a five to six year replacement cycle, which costs approximately $8,600 per server to replace. Additionally, 30 new servers are added each year at a cost of $258,000 per year.

The hardware costs and energy costs to support these servers is significant. NJ TRANSIT has undertaken an effort to consolidate its server infrastructure and reduce energy consumption in its IT Program. NJ TRANSIT is utilizing the latest technology called "server virtualization," which will allow them to run many "virtual servers" on a few physical servers. This helps to reduce the need for server hardware, thereby reducing the need to purchase additional servers and reducing energy consumption. NJ TRANSIT's goal is to utilize "server virtualization" technologies until it has a ratio of 30 virtual servers per one physical server. Initially, NJ TRANSIT will target test systems. Next, it will target its oldest servers that are in need of replacement. NJ TRANSIT has already successfully implemented a Proof of Concept (POC) VMware ESX virtual server environment. This has been running for about six months and supports 20 test servers hosting a variety of applications. Use of this virtual server application has verified that the technology works well on the current computer hardware. The technology also integrates well with NJ TRANSIT server operating systems (Windows/Linux) and applications (Web/Sharepoint/SQL/Terminal Services). During this POC NJ TRANSIT was able to successfully migrate physical servers directly to virtual servers by utilizing the VMware converter utility.

[31] Energy Star website: http://www.energystar.gov/index.cfm?c=ent_servers.enterprise_servers
[32] *Estimating Total Power Consumption by Servers in the U.S. and the World* by Jonathan G. Koomey, Ph.D.
[33] Energy Star website: http://www.energystar.gov/index.cfm?c=ent_servers.enterprise_servers

The estimated benefits of a virtual server environment at NJ TRANSIT include:

- Elimination of the need to purchase 30 servers per year (approximately $258,000 per year and $1,290,000 over five years);
- Reduction in the amount of electricity used by 611,606 kWh per year (approximately $58,000 per year and $290,000 over five years);
- Reduction in the amount of heat produced and cooling required. Industry standard ratio of cooling cost to power usage is 1.5:1 (approximately $87,000 per year and $435,000 over five years);
- Reduction in the Data Center footprint required for 14 racks to hold 200 physical servers;
- Reduction in the amount of manpower required for hardware maintenance on 200 physical servers; and,
- Reduction in the cost of maintenance for servers older than five years (approximately $64,000 per year).

Implementation of a virtual server environment will achieve significant cost savings that are estimated at approximately $467,000 per year or $2,335,000 over five years. NJ TRANSIT should continue to invest in "virtualization" technologies that reduce their need for hardware and energy consumption in their IT department.

4.7 Sustainable and Environmental Management Projects

NJ TRANSIT has also implemented policies that decrease its impacts on the environment. These efforts include marketing programs that encourage the use of public transportation and efforts that decrease the environmental impacts of the NJ TRANSIT infrastructure, such as implementation of an effective underground storage tank program.

NJ TRANSIT has implemented a number of programs that promote sustainability by encouraging bus and rail passengers to participate in public transportation. "My Transit" is a free e-mail alert system that sends out advisory notices to cell phones, hand held wireless devices or computers during on peak period delays, major service disruptions, schedule changes and construction advisories. These efforts work to promote the use of public transportation to reduce GHG emissions and other air pollutants such as ozone.

In addition, NJ TRANSIT has implemented and continues to implement the following environmental management initiatives;

- Established a corporate environmental compliance policy;
- Created an effective underground storage tank program that includes spill prevention, leak detection and real time monitoring;
- Installed anti-idling signage at all rail and bus stations;
- Conducted groundwater remediation at facilities, including the Meadows Maintenance Complex;

- Commissions semi-annual environmental audits of maintenance and service facilities;
- Conducted an employee environmental awareness program;
- Implemented a comprehensive recycling programs that includes; waste oil, batteries, tires, metal, plastic, newspapers, oil filters, construction debris, fluorescent lights, and light ballasts;
- Conducts proper management of all hazardous waste;
- Used and continues to use recycled office paper and printing is double sides whenever possible;
- Re-uses contaminated soil for screening and landfill cover;
- Re-uses and recycles of old infrastructure for new projects, such as using old track ballast when installing new track for the Lackawanna project.
- Established a corporate policy to use green products at all facilities when available and reasonably priced.

Air pollutants from transportation infrastructure are also a major concern for NJ TRANSIT and local communities, particularly urban communities. Studies have shown that these air pollutants can lead to increased cases of asthma and other respiratory ailments. While public transportation can help improve air quality in these communities by decreasing traffic congestion and vehicle travel, NJ TRANSIT is further committed to promoting public low emission transportation in all of its 130 communities.

In addition to its Ozone Pass Program where participants can use special $3.00 round trip tickets during air quality action days designated by the NJ DEP, the following air quality initiatives have been implemented by NJ TRANSIT and are organized by three types of NJ TRANSIT transportation vehicles .

Bus

Through the BRT Go Bus Service, NJ TRANSIT has improved the flow and speed of bus traffic and has upgraded bus shelters. These efforts include promoting signal priority at places such as Bloomfield Avenue that have resulted in decreased travel times. It also includes dedicating bus lanes at places such as the Newark Penn Station exit to Raymond Blvd, Routes 1 & 9, Route 3, Route 46, I-78 corridor, the greater New Brunswick area, and the city of Newark. In addition, dedicated bus lanes are being considered for the Elizabeth area and Northwest NJ area.

All South New Jersey transit and suburban buses, which include 241 buses, are equipped with bicycle racks to promote zero emission traveling. Bikes can be stored in luggage areas on cruiser buses. There are currently about a 1,000 new buses on order that will have racks on them when delivered.

Rail

NJ TRANSIT has expanded its rail services to make public transportation available to more people. It has implemented new services at the Lackawanna Connection, the Meadowlands Sports Complex and expanded the light rail service. NJ TRANSIT has also developed light rail line extensions on the Pennsauken River line extension and the 8th Street HBLR. The expansions will generate new ridership that reduces VMT.

Non-Revenue Vehicles

NJ TRANSIT supports vanpooling programs to provide additional access to public transportation infrastructure. Bicycle racks are installed at NJ TRANSIT stations across the state to further promote zero emission traveling. Currently, there is capacity for over 2,000 bicycles at 166 locations.

Conclusion

NJ TRANSIT should continue to implement programs that promote environmental and economic benefits of public transportation. Efforts such as vanpools and bicycle racks offer a more environmentally responsible transportation alternative for people commuting to and from NJ TRANSIT stations. These efforts are reducing GHG emissions and other environmental pollutants that negatively impact local communities. To expand these efforts, NJ TRANSIT should create an education and awareness program to inform its employees as well as the public about the availability and benefits of its programs. Reducing its impact on the environment should continue to be a central focus of NJ TRANSIT.

5. NJ TRANSIT's Five-Year Management Plan for Continued Energy Conservation and Sustainable Development

NJ TRANSIT has demonstrated a commitment to implementing energy conservation and sustainability measures. Further implementation of these measures will reduce operating costs by reducing energy consumption and assist New Jersey in meeting its commitment to decrease GHG emissions. This Five-Year Management Plan for Continued Energy Conservation and Sustainable Development provides NJ TRANSIT with a roadmap to achieve reductions in energy expenditures while minimizing its impact on the environment.

To accomplish this objective, it is recommended that the following four goals to be achieved:

1. Increase Public Transportation Ridership
2. Decrease Energy Consumption
3. Invest in Renewable and Alternative Energy Systems
4. Incorporate Other Sustainability Principles in Existing and New Facilities

These efforts will enable NJ TRANSIT to mitigate the need for fare hikes or limit public transportation services. Fare hikes or service limitations are counter to NJ TRANSIT's mission, and limit the accessibility and ridership of public transportation services, resulting in increased:

- Vehicle traffic;
- Transportation costs; and,
- GHG emissions.

Due to the economic and environmental benefits of public transportation, NJ TRANSIT should make increasing public transportation ridership its top objective. While the other action items, including energy efficiency are beneficial, the benefits to the operating costs and environment of increasing ridership far exceed any of the benefits from the other goals and action items listed in this report.

To oversee, the implementation of this plan, and ensure achievement of the above four goals, it is recommended that NJ TRANSIT develop an Energy Conservation and Sustainability Committee (Committee). To administer and organize sustainability initiatives, businesses are reaching out to third parties and searching internally for experts in the environmental and energy field. Planning sustainable projects can be a complex task and a steering committee can be an essential part in centralizing and monitoring the agency's progress.

The Committee should be made up of NJ TRANSIT employees across disciplines to centralize NJ TRANSIT's energy conservation and sustainability efforts. As described herein, many individual elements within NJ TRANSIT have proactively undertaken initiatives to promote sustainability. Centralizing these efforts in a committee allows these efforts to be mainstreamed and administered from the heads of each department. Engineers, accountants, lawyers, facility managers, and representatives from the marketing division should all be part of the Committee. These representatives should have the ability to identify challenges, influence agency policy, and actively work with other State and federal entities on the implementation of this document.

It is recommended that this Committee is formally adopted by the NJ TRANSIT Board of Directors (Board) to provide it with the organizational support necessary to implement the action items in this plan. It would also be helpful to have representatives from the public or sustainability professionals in an advisory role to this Committee to provide support and input into the process. These public or sustainability professionals can provide valuable input on NJ TRANSIT impacts on local communities and new incentives or technologies that should be utilized.

It is recommended that this Committee be responsible for the following tasks:

- Develop and submit an annual budget to the Board for approval.
- Conduct an annual review to be submitted to the Board, outlining the progress that is being made on implementing the action items in this plan.
- Identify incentives or financial structures that can be used to implement this plan.
- Work with State and federal representatives to advocate on behalf of NJ TRANSIT's sustainability efforts.
- Update this sustainability report every three years and submit it to the Board for approval. This provides the Committee with the ability to provide their input on the plan as technologies, and available incentives available are constantly changing.
- Market the plan and implementation efforts to NJ TRANSIT employees and the public. This will promote sustainability practices and the use of public transportation.
- Ensure that all of the goals and action items of the plan are being achieved and that energy challenges, or threats to the environment, are resolved in a timely and comprehensive manner.
- Develop a NJ TRANSIT "Climate Action Plan".
- Monitor opportunities to participate in climate registration and CO_2 trading programs.

As part of these efforts, the Committee should take a leadership role on the federal and state levels in shaping energy policy. The Committee should focus on methods of offsetting negative fiscal impact associated with environmentally-friendly initiatives available to NJ TRANSIT. In representing NJ TRANSIT, the Committee should engage APTA and the Coalition of Northeast Governors (CONEG) to shape federal energy legislation; propose tax credits and incentives to providers of alternative fuels and public transportation with pass-through savings to users; and seek federal grants to offset costs of initiatives. The Committee should also support APTA programs and guidelines and implement such programs where appropriate.

It is also of critical importance that the Committee is aware of all federal and State incentives that are available to support implementation of this plan. State departments and agencies, such as the New Jersey's Board of Public Utilities (BPU) and the Economic Development Authority (EDA), have been tasked with designing incentives to meet the State's clean energy and sustainability goals. Often times, these State departments and agencies are also tasked with administering federal funds that are received by the State, such as the ARRA funds. Therefore, it is critical to actively monitor these programs to identify grants, rebates or other assistance that will help fund clean energy or sustainability applications.

Locally, the Committee should work with regional transportation planners, municipalities and communities to educate them about NJ TRANSIT's goals and initiatives and work with them on developing programs that promote sustainable development. This process should include local municipality and community involvement in implementation of the plan and drafting of future plans. This will give them an opportunity to provide useful input on NJ TRANSIT's sustainability efforts and foster a strong and valuable relationship with its Committee.

5.1 Goal: Increase Public Transportation Ridership

NJ TRANSIT's central mission of increasing public transportation ridership is an effort that will significantly improve the sustainability and environment in New Jersey. Out of all of the goals and action items in this report, the environmental benefits of public transportation offer the best hope of reducing air and GHG emissions. Increased ridership also spreads fixed costs over more revenues, which can help to mitigate the need for fare increases or decreased services. Therefore, it is recommended that NJ TRANSIT implement the following two action items to increase public transportation ridership in New Jersey:

1. Incorporate its sustainability efforts into its marketing campaign to increase public transportation ridership, and promote sustainability.
2. Continue supporting land use and zoning policies that encourage the use of public transportation, such as Transit Friendly Planning.

5.1.1 Action Item 1: Incorporate Sustainability into Marketing Efforts

Educating the public about sustainability and energy best practices can be an invaluable resource for an organization. Making the public aware of the sustainable efforts of a company is good for marketing and sales purposes, but also promotes sustainability and smart energy practices. Therefore, NJ TRANSIT should also develop a public relations campaign to promote its sustainability goals and projects. These efforts may help to increase ridership by promoting the environmental and economic benefits of public transportation.

As part of this advertising campaign, NJ TRANSIT's marketing department should design a program slogan that compliments the NJ TRANSIT logo. For example, a slogan could be "NJ TRANSIT, The Way to Go *Green*." This slogan and logo would be the public face of NJ TRANSIT's sustainability efforts.

As part of the campaign, NJ TRANSIT should also educate the community on the economic and environmental benefits of public transportation. The advertising campaign should also be organized by transportation unit so that people become educated about the public transportation vehicles they are riding. Not only will this allow people to be better informed about current environmental issues, it will also publicize NJ TRANSIT as an industry going green and attract more passengers.

Together, these internal and external marketing campaigns will provide NJ TRANSIT with the foundation necessary to achieve the sustainability goals outlined in this document. These efforts will increase ridership and provide the buy-in necessary to achieve the systematic change that improves the operational efficiencies of the agency.

5.1.2 Action Item 2: Continue to Promote Transit Friendly Planning

Continuation of the TOD process is an essential aspect of sustainable development. Municipalities should be engaged in brainstorming efforts to discuss additional TOD projects. Informational sessions could be held with State, County, local municipal officials, and community stakeholders to get their input and buy-in in TOD. These venues can also be used to inform community members about NJ TRANSIT's dedication to sustainability efforts and the importance and benefits of TOD. NJ TRANSIT should continue its pledge of developing TOD partnerships with five municipalities per year.

NJ TRANSIT's Transit Friendly Planning (TFP) Program spurs economic growth by leveraging the benefits of transit for all New Jerseyans. The TFP Program is dedicated to strengthening the link between transportation and land use, promoting more environmentally and economically sustainable patterns of housing and employment in the State, and seeks to forge partnerships at all levels in support of NJ TRANSIT's larger mission of providing safe, reliable, convenient and cost effective transit service.

To further the efforts of TFP, NJ TRANSIT should implement the following strategies:

- Help NJ TRANSIT leverage its capital investments and resource allocations with other aligned federal, state, county and local resources to increase development opportunities in areas served by transit.
- Strengthen and expand partnerships with local, state, regional and federal government entities, the private sector, non-governmental organizations (NGOs) and other like-minded institutions to promote sustainable land-use and foster livable communities across the state.
- Educate communities about the benefits and challenges of TOD, provide expertise to facilitate it and create and adopt performance metrics to evaluate success.
- Establish the NJ TRANSIT TFP Program as a premium "brand" (i.e., the nation's leading statewide program that fosters and creates center-based, TOD).

Discerning where and to what degree technical assistance and community engagement/public education dollars will be spent will be determined through the application of a "screening process" that will take into account a variety of 'conditions' about any given place to assist staff and on-call consultants with determining how best to align limited NJTRANSIT planning resources with community goals – and to attract project partners (i.e., state agencies, NGOs, private developers) to create and implement the most sustainable projects possible.

5.2. Goal 2: Decrease Energy Consumption

Recently, NJ TRANSIT has shown a strong commitment to decreasing its energy consumption to reduce energy expenditures and minimize the impact on the environment. Reducing energy consumption through conservation and energy efficiency is the most cost-effective way of reducing energy costs and environmental impacts. Implementation of the following action items can effectively decrease energy consumption and reduce NJ TRANSIT's energy expenditures:

1. Implement the ECM Recommendations in the Completed Audits
2. Invest in Additional Energy Efficiency Measures
3. Continue and Expand Upon the Existing Energy Procurement Practices
4. Incorporate Energy Efficiency Technologies into New Infrastructure
5. Implement an Employee Educational Program
6. Purchase Energy Efficient Vehicles

NJ TRANSIT has completed energy audits for 21 of its largest facilities. These audits provide the information necessary to improve energy efficiency in these facilities. These audits propose various ECMs that will reduce energy consumption, but will require budgeting, capital investment, and the staff resources necessary to implement.

5.2.1 Action Item 1: Implement the ECM Recommendations in the Completed Audits

Ideally, NJ TRANSIT should finance all of the ECMs recommended by SAIC as one large investment, as these ECMs together, are estimated to produce an IRR of nearly 50 percent, meaning an aggregate simple payback of just over two years.

In calculating the IRR, all data pertaining to investment, annual consumption savings, average demand reduction, and one time incentive amounts was taken directly from SAIC's energy audits. However, in reviewing the estimated dollar savings from the report it was determined that these savings estimates should be updated. We therefore undertook to develop a long-term electric price forecast to apply to the ECMs over their expected useful lives to refine the dollar savings estimates, and to develop IRRs and estimated simple paybacks for each investment. Based on this data, costs and benefits including net cashflow, cumulative cashflow, net present value, and IRR were determined for each ECM (Appendix A.3 to Appendix A.27) as well as the total project if all ECMs are financed at the same time (Appendix A.2).

Electric Rate Forecast:

For the electric price forecast used to value the energy savings produced by the ECMs, we adjusted the starting average avoided price for delivered electricity down to $0.12/kwh. This conservative estimate is about 6% lower than the 2009 actual average price of (non-traction) paid by NJ TRANSIT, reflecting an approximate 25% reduction in the price NJ TRANSIT pays for power supply for its smaller basic generation service – fixed price (BGS-FP) accounts as the result of a recent invitation for bids (IFB) implemented in April 2010, and an assumed new power supply contract obtained as part of the NJCESP procurement program at a price similar to the actual cost of power for its larger basic generation service – commercial industrial energy pricing (BGS-CIEP) non-traction electric accounts. Moreover, we assume that these price levels will be maintained for three years as the result of three-year, fixed price supply contracts.

For each of the top three utilities Public Service Electric and Gas (PSE&G) Jersey Central Power and Light (JCP&L) and Atlantic City Electric (ACE), Gabel Associates prepared an electricity forecast which "unbundled" the utility rate into commodity, local utility charges, interstate transmission charges and other surcharges; forecast each component (by season and time of day when applicable); and re-bundled the components to build a rate forecast. The commodity cost forecast also took into account forward market data as well as the likely emergence of a federal cap-and-trade program. To determine New Jersey-wide average annual escalation rates for electricity prices, the price forecasts for the top three utilities were combined into a load-weighted average based on the percent of load each utility serves.

For the longer-term forecast of commodity prices, Gabel Associates has analyzed current forward electric markets as well as long-term assumptions from the U.S. Energy Information Administration (EIA) to develop the wholesale electric price forecast.

The first five years of the wholesale price forecast are based on recent forward electric markets which can change significantly over a short period of time. However, the $0.053/kWh 2010 value is below the most recent 10-year average. Further, the long-term forecast does not exceed the recent peak annual average price of $0.091/kWh until 2025.

The mounting social and political pressure to reduce GHG emissions could be expected to put upward pressure on electric rates. This program will mostly impact lower cost coal-based generation, which currently sets the wholesale price for electricity more than 75% of the time in PJM.

Based on these considerations, a 3.7% long term escalation rate for wholesale prices is utilized, which we believe to still be conservative, particularly in light of the relatively low start prices we are utilizing.

ECM Benefits and Opportunities:

As such, as described above we have re-run the savings estimates for the ECMS originally presented in the SAIC audits, and added an IRR and simple payback calculation, using what we believe to be conservative 'avoided cost' estimates. Nonetheless, the aggregate opportunities identified in the SAIC audits still produce a projected IRR of 52.5%.

These ECMs make a strong business case to be implemented immediately, which will reduce energy expenditures and improve the sustainability of their operations. These financial schedules and complete list of ECMs are provided in Appendix A, and provide the Committee and NJ TRANSIT with the information necessary to plan for the budgeting and capital investment necessary to fully implement these ECMs.

To finance these projects, it was assumed that NJ TRANSIT would borrow and/or use the revenue it will receive from SREC sales it will obtain from its 550 kW solar system. Appendix B

provides a financing model for the total projects assuming that ECMs are implemented all at once and a 15 year lease payment is procured at a 4.5 percent interest rate. This model also assumes current SREC market values, which include an average of approximately $200 per MWh for the first four years, approximately $300 per MWh for the next six years and approximately $250 for the remaining five years. The financing model demonstrates that the benefits of installing ECMs greatly outweigh the costs creating a total net cashflow for NJ TRANSIT over 20 years of $46,109,925 or a net present value of $29,351,145.

An alternative is for NJ TRANSIT to enter into a performance-based PPA type contract that is privately financed. The advantage of this type of financing is that there is no capital outlay and the private entity can take advantage of the 30 percent federal investment tax credit (ITC). However, the disadvantage to this model is that the financial benefits of the system, including SREC revenues, are split between the private entity and NJ TRANSIT.

There are also many low-cost or no-cost "habits", beyond installing the ECMs, which will allow NJ TRANSIT to reduce energy consumption. These include:

- unplug seldom-used appliances such as refrigerators;
- set computers to sleep and hibernate when not in use;
- turn down the thermostat in the winter time after work hours,
- turn out lights in unused rooms; and,
- set the thermostat on water heaters between 120 and 130 degrees.

These no cost energy management efforts will provide immediate energy savings and should be immediately implemented throughout the NJ TRANSIT footprint.

NJ TRANSIT has obtained TIGGER funding in the amount of $250,000 to begin implementing some of the ECMs. These funds are being used to upgrade four air compressor systems to energy efficient systems at the following facilities:

- Meadows Maintenance Complex in Kearny
- Meadowlands Garage in North Bergen
- Greenville Garage in Jersey City
- Newark Central Maintenance Facility and Ironbound

Table 5.2.1-1 on the following three pages summarizes the costs and benefits of all the recommended ECMs and ranking them by IRR. The table includes:

- useful life in years of each ECM;
- capital investment required;

- annual electric savings in kWh and dollars;
- average demand reduction in kilowatt (kW);
- annual gas savings in therms and dollars;
- annual fuel savings in gallons and dollars;
- annualized net change in O&M in dollars;
- total annual savings in dollars;
- onetime incentive amount; and,
- simple payback in years.

The ECMs were taken from the individual SAIC facility energy audits. The simple payback for these ECMs was calculated based on the investment, one-time incentive, and estimated annual energy savings for each investment.

Table 5.2.1-1: Recommended ECMs Project Economics Summary and Ranking

Rank	IRR	ECM	Investment (2008 $)	Annual Savings ($)	One Time Incentive	Simple Payback (years)	Life Span of Equip.	Locations
1	560.70%	Repair Compressed Air Leaks	$3,500	$21,351	$0	0.16	20	Hilton Garage, Market St. Garage
2	495.56%	Duct OA to Compressor Intake	$1,160	$6,268	$0	0.19	20	Hilton Garage, Market St. Garage
3	400.68%	Install Natural Gas Line on Duel-Fuel Boilers	$15,000	$46,584	$0	0.32	20	General Office Building
4	341.2%	Reset Boiler Water Supply Temperature	$8,351	$40,322	$0	0.21	10	Greenville, Howell Garage, Newton, Washington Township Garage
5	324.4%	Reduce Water Tower Boiler Water Temperature	$899	$4,127	$0	0.22	10	Howell Garage
6	133.56%	Lighting Controls	$113,408	$131,510	$14,490	0.75	10	Big Tree Garage, Newark Penn Station, Egg Harbor, Fairview Garage, Greenville, Hamilton, Hilton Garage, Howell Garage, Market Street Garage, Meadowlands Maintanance Garage, Meadowlands Maintanance Complex, Newark Bus Maintanance Center Ironbound Garage, Newton, Pradell Buss Maintanance Garage, Orange Garage, Rail Facility Hoboken, Washington Township Garage, Wayne Garage
7	92.99%	Domestic Hot Water Renovation	$10,400	$6,220	$200	1.64	10	Newark Penn Station

Rank	IRR	ECM	Investment (2008 $)	Annual Savings ($)	One Time Incentive	Simple Payback (years)	Life Span of Equip.	Locations
8	87.3%	VFDs for Heating-Only AHUs	$17,171	$10,437	$5,365	1.13	15	Newark Penn Station
9	85.2%	Utility Data Monitering	$24,000	$21,912	$0	1.10	10	Secaucus Transfer Station
10	82.44%	Install Variable Frequincy Drives (VFDs)	$25,062	$15,523	$7,800	1.11	15	Hamilton, Howell Garage, Newton, Washington Township Garage
11	68.67%	Control Bay A and Bay B Exhaust Fan	$118,560	$96,090	$0	1.23	10	Greenville
12	67.97%	Lighting Retrofits	$2,278,003	$1,177,424	$480,153	1.53	10	Big Tree Garage, Newark Penn Station, Egg Harbor, Fairview Garage, Greenville, Hamilton, Hilton Garage, Howell Garage, Market Street Garage, Meadowlands Maintanance Garage, Meadowlands Maintanance Complex, Newark Bus Maintanance Center Ironbound Garage, Newton, Pradell Buss Maintanance Garage, Orange Garage, Rail Favility Hoboken, Washington Township Garage, Wayne Garage
13	52.51%	Computer Auto-Shutdown	$24,000	$13,298	$0	1.80	10	General Office Building, Headquarters Building
14	36.04%	Install Escalator Controls	$93,000	$35,846	$700	2.57	10	Secaucus Transfer Station
15	24.5%	BAS Revisions	$101,800	$26,236	$0	3.88	15	Newark Penn Station, Secaucus Transfer Station

Rank	IRR	ECM	Investment (2008 $)	Annual Savings ($)	One Time Incentive	Simple Payback (years)	Life Span of Equip.	Locations
16	22.28%	Heat Recovery from Bays A,B and C	$291,551	$78,487	$0	3.71	15	Greenville
17	21.55%	Exhaust Air Heat Recovery	$44,500	$11,018	$0	4.04	20	Headquarters Building
18	19.20%	Replace PTAC Units	$5,394	$862	$195	6.03	20	Greenville
19	10.15%	Replace Reciprocating Chillers	$110,000	$11,843	$2,860	9.05	20	Newton
20	9.03%	Premium Efficiency Motors	$266,520	$29,661	$16,873	8.42	15	Newark Penn Station, Egg Harbor, Greenville Hamilton, Howell Garage, Meadowlands Maintanance Garage, Newton, Washington Township Garage
21	8.57%	Reduce Boiler Water Supply Temperature	$1,384	$229	$0	6.04	10	Egg Harbor
22	5.42%	Replace Constant Volume AC Unit	$26,450	$2,330	$1,748	10.60	15	Newton, Washington Township Garage
23	3.74%	Replace Packaged Units	$58,050	$3,629	$2,963	15.18	15	Newark Bus Maintanance Center Ironbound Garage
24	-2.88%	Replace Packaged Rooftop AC Units	$135,866	$5,729	$5,951	22.68	15	Greenville, Howell Garage
25	-13.41%	Install Heat Recovery Units in Locomotive Shop	$1,918,800	$79,098	$0	24.26	10	Meadowlands Maintanance Complex
Total	50.4%		$5,692,829	$1,876,034	$539,298	2.75		

While all ECMs could be financed and installed at the same time due to the high aggregate IRR, we understand that NJ TRANSIT has a policy to not undertake any capital projects with simple payback exceeding 10 years. This would place in question the last four ECMs identified in Table 5.2.1-1, specifically measures ranked 22 through 25. Moreover, NJ TRANSIT personnel have indicated that ranked ECM project #7, Domestic Hot Water Renovation at Newark Penn Station, is not technically feasible.

It is recommended that in the next five years, NJ TRANSIT should implement all of the above ECMs. To support this effort, NJ TRANSIT should create a funding and accomplishment schedule as part of the 5 year sustainability plan.

5.2.1.1 ECM Implementation

The ECMs in this report highlight positive financial benefits with an excellent IRR. These energy efficiency investment opportunities provide NJ TRANSIT with the potential to achieve an estimated aggregate IRR of approximately 50 percent, and therefore make a strong business case to be implemented immediately on an aggregated basis. For a public entity this would typically be accomplished through an aggregated procurement and long-term, low-interest financing of the project cost. However, we understand that NJ TRANSIT's internal mission statement and policy is to avoid securing any debt obligations and, instead, to fund all capital improvements from the current operating budget. This necessitates an evaluation of alternative and creative financing strategies. The initial source of funding explored to enable the implementation of the ECM projects was a Net Revenue for Energy Efficiency (EE) projects model. The Net Revenue for EE projects model represents the initial amount of yearly funding NJ TRANSIT has available to initiate ECM implementation projects, and is potentially comprised of solar project-related revenues. It is not the total amount of available resources currently available or in the existing capital budget, however, as each ECM is implemented, the ECM begins to generate savings to be used as revenue to pay for additional measures. These savings can be treated as funding for future ECM projects. In essence, the ECMs would become self-funding.

This report includes a scenario in which NJ TRANSIT can proceed with the implementation of ECM projects. As shown in more detail below this Base Case scenario creates a limited amount of funds in the early years, thereby necessitating a delay in implementation of a number of larger, yet extremely cost-effective and beneficial projects.

For purposes of this scenario, the ECMs were bundled by measure across all sites. In other words, for certain measures (ex. lighting retrofits) opportunities were identified in multiple sites. It would be much more cost-effective in the procurement process to procure a single lighting vendor to implement all lighting retrofits as the different sites simultaneously as part of one project, rather than implementing lighting retrofits on a piecemeal, site-by-site basis. As such, a

specific measure (ex. lighting retrofit) is not implemented until there are sufficient funds to pay for the entire project at all sites. All figures shown in the scenario below are estimates, and further evaluation is required to determine purchase and construction costs across sites. Additional due diligence is also required to determine the logistical viability of implementation across multiple sites.

This implementation scenario will receive first year net revenue for EE projects, which is created from solar related benefits, of $119,803 Net revenue for solar is made up of utility revenues from avoided electricity costs and from revenue generated from SREC sales minus insurance and operations and maintenance costs. Under this scenario, NJ TRANSIT would be able to fund all ECM projects by year 7 of the project plan. This presents financial metrics of average yearly earnings of $1,050,173 and total earnings of $21,003,454 over a 20 year period. The goal of this scenario is to implement as many ECMs as possible in year one, in order to maximize the savings of each ECM. This along with the large windfall from receiving all SREC revenues allows NJ Transit to build up the necessary capital to implement the largest of the ECM projects.

Below is presented the implementation schedule of ECMs along with a table summarizing the financial metrics of this scenario.

Year	ECM	Cost
1	Lighting Controls	$113,408
	Duct OA to Compressor Intake	$1,160
	Reduce Water Tower Boiler Water Temperature	$899
	Repair Compressed Air Leaks	$3,500
	Delamp NJT Offices	$0
	Reduce Compressed Air Line Pressure	$0
	Shut Down Escalators	$0
2	Reset Boiler Water Supply Temperature	$8,351
	Replace PTAC Units	$5,394
	Reduce Boiler Water Supply Temperature	$1,384
	Install Natural Gas Line on Duel-Fuel Boilers	$15,000
	Control Bay A and Bay B Exhaust Fan	$118,560
	Utility Data Monitering	$24,000
	Install Variable Frequincy Drives (VFDs)	$25,062
	VFDs for Heating-Only AHUs	$17,171
	Domestic Hot Water Renovation	$10,400
	Computer Auto-Shutdown	$24,000
	Replace Constant Volume AC Unit	$26,450
	Install Escalator Controls	$93,000
3	Heat Recovery from Bays A,B and C	$291,551
	BAS Revisions	$101,800
	Exhaust Air Heat Recovery	$44,500
	Replace Reciprocating Chillers	$110,000
4	Premium Efficiency Motors	$266,520
5		
6	Lighting Retrofits	$2,278,003
7	Replace Packaged Units	$58,050
	Replace Packaged Rooftop AC Units	$135,866
	Install Heat Recovery Units in Locomotive Shop	$1,918,800

	Net Revenue from Solar	Savings from ECMs	Investment in ECMs	Net Available Revenues
Year 1	191,803	246,560	118,967	836
Total	4,705,372	21,811,613	5,692,829	21,003,454
Average	235,269	1,147,980	813,261	1,000,164

Summary

Substantial benefits are possible, if NJ TRANSIT is able to identify and allocate a modest amount of its operating budget to implement ECMs as part of its Sustainability Plan. While we have not ascribed a specific 'time value of money' (i.e. the allocated funds are re-paid over time

without interest), the actual opportunity cost to NJ TRANSIT of these allocations is deferred capital investments of a similar magnitude in other areas. As such, there is a net cost to NJ TRANSIT only if capital projects that might be deferred would generate an IRR greater than the aggregate 52.5% IRR projected for the ECMS.

It is noted that in the scenario above we have included all of the ECMs identified in the SAIC study. It is recognized that several of these projects may have payback periods of over ten years, which we understand is NJ TRANSIT's internal cut-off for funded projects. Essentially, the savings generated by the most cost-effective ECMs create sufficient revenues to carry those ECMs that have longer paybacks. *Moreover, it is noted that the payback analysis does not take into account any 'avoided capital' savings associated with the replacement of older equipment that at some point will have to be replaced in any event.* This observation is particularly noteworthy for such longer payback ECMS as replacement of chillers, motors, and packaged rooftop AC units.

5.2.2 Action Item 2: Invest in Additional Energy Efficiency Measures

The ECMs listed above are the efforts that provide a strong business case for NJ TRANSIT to implement immediately. However, there are additional energy efficiency improvements that may help to substantially decrease the energy consumption and energy expenditures for NJ TRANSIT. These efforts include:

- Conducting a thermal imaging scan to identify saturation and hot and cold pockets in a building.
- Upgrading single paned windows to double and triple pane low-e argon film.
- Replacing existing doors with insulated doors.
- Weather stripping around doors and windows to keep air from leaking out or in.
- Replace old and leaking roofs with Energy Star rated insulated white reflective roofs.

These efforts cannot be modeled for their IRR, since the economic benefits will vary depending on the characteristics of the building.

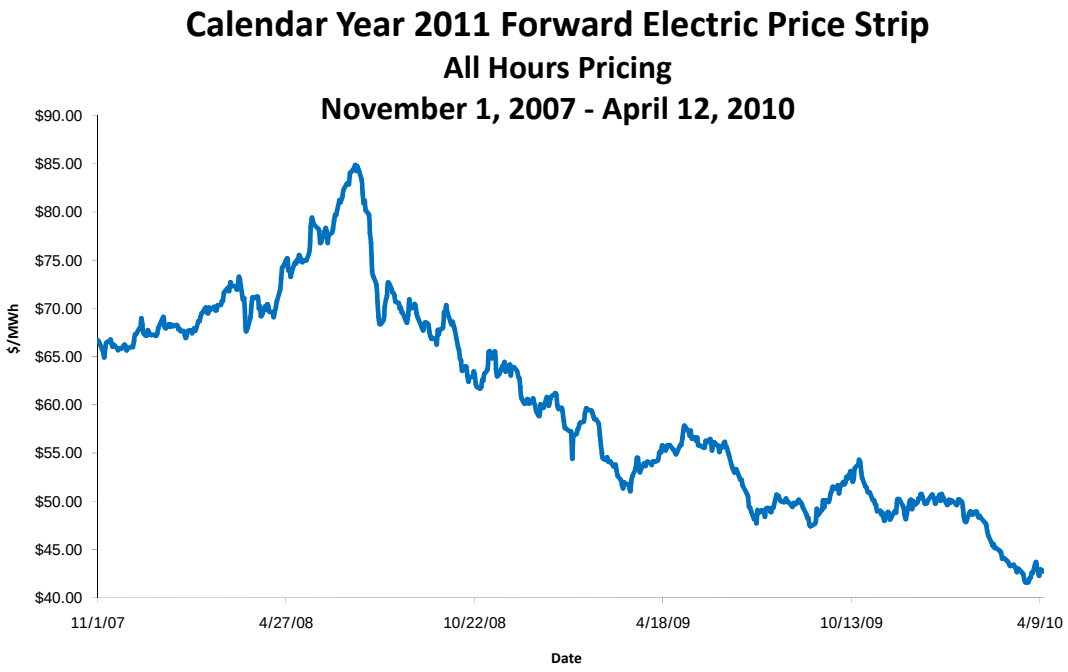
It is recommended that, subject to funding, NJ TRANSIT conduct a comprehensive energy analysis of existing facilities to provide additional energy savings opportunities in the building envelope.

5.2.3 Action Item 3: Energy Procurement Review and Analysis

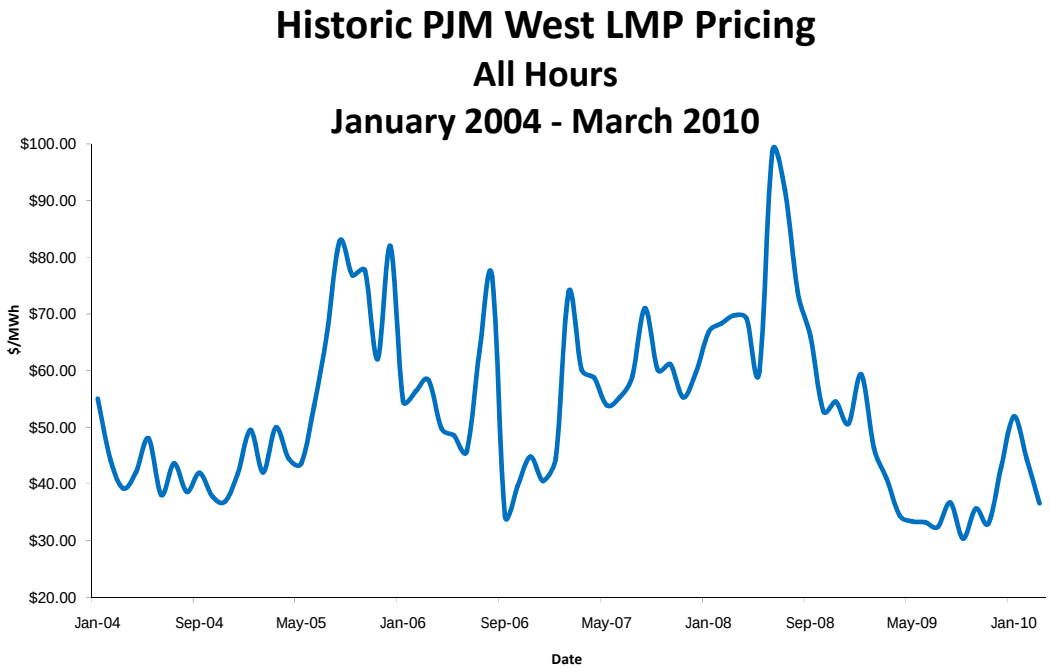
The commodity market for electricity has historically exhibited a large degree of volatility, and that volatility has become even more pronounced over the past decade. In addition to mid-to-long term market supply and demand fundamentals, which have become more global in energy markets, weather conditions and geopolitical events contribute to short-term volatility. Events such as Hurricane Katrina resulted in tremendous increases in energy prices, while recent events

such as the current economic recession has resulted in reduced energy prices. The volatility in electric power markets is portrayed in Graph 5.2.3-1 and Graph 5.2.3-2. Graph 5.2.3-1 demonstrates the price spikes caused in the aftermath of natural gas supply disruptions brought about in late Summer 2005 by Hurricanes Katrina and Rita, the run-up in market prices in 2008 brought about by a combination of supply/demand factors as well as price speculation, and the sharp decline in prices through the latter part of 2008 and into 2009 as the economy went into recession and financial and other markets were in distress.

Graph 5.2.3-1: Calendar Year 2011 Forward Electric Price Strip



Graph 5.2.3-2: Historic PJM West LMP Pricing



In light of this volatility, it is important for large energy consumers such as NJ TRANSIT to be proactive in developing strategies that decrease their vulnerability to energy price spikes due to factors outside of their control and, where possible, reduce energy expenditures.

To decrease its vulnerability to energy price spikes, NJ TRANSIT has, since 2003, been proactively participating in an aggregated electric power procurement program administered under the auspices of the New Jersey Department of Treasury and more recently the State Office of Energy Savings, referred to as the New Jersey Consolidated Energy Savings Program (NJCESP). The aim of the NJCESP program is to undertake a bulk purchase of supply for a number of State agencies, authorities, and universities, and thereby drive down prices through purchasing in volume. For its high voltage electric accounts served through the delivery grids of New Jersey electric utilities, PSE&G, JCP&L and ACE, NJ TRANSIT had entered into fixed price electric power supply contracts to hedge against price volatility. In 2007, NJ TRANSIT again participated in the NJCESP procurement program. However for its largest, traction power accounts, NJ TRANSIT created a separate bid group that awarded contracts for a 3-year Block and Index product. This product is structured to provide a portfolio approach, where a base block of energy is hedged at a fixed price, and residual load (delta between the total usage and the base block in any hour) is settled in the spot market. This pricing product served NJ TRANSIT well by providing a degree of price stability through a partial hedge, but also allowing NJ TRANSIT to benefit from the sharp drop in spot market prices beginning in August 2008. As a result, NJ TRANSIT's unit cost of energy for its traction accounts served through New Jersey electric utilities dropped in 2009. That supply contract expires in June 2010, and NJ TRANSIT

is currently, through the NJCESP program, seeking bids for a new supply contract. The goal in the current contract is to lock-in fixed prices at the currently depressed market levels.

NJ TRANSIT has demonstrated resourcefulness and flexibility in developing electric power supply procurement strategies that adapt to market conditions, and attempt to achieve the dual goals of achieving price stability and minimizing costs. It should remain vigilant in this regard, and continue to explore improvements in its procurement strategies, not only for electric power supply but also for diesel and natural gas.

It is also noted that Amtrak power is that power purchased through Amtrak, and is sourced by Amtrak in part from Philadelphia Electric Company (PECO). PECO has been operating for many years under price caps that were instituted by the State of Pennsylvania when it first introduced deregulation at the retail level. Those price caps expired in 2010, and there is a threat of price spikes for Amtrak power. NJ TRANSIT has a representative that sits on a Committee with Amtrak that meets quarterly to explore and discuss energy procurement strategies and opportunities. NJ TRANSIT should continue its participation on this Committee, which is more important now than ever given that price caps have expired in Pennsylvania, thus creating the potential for increases in the cost of Amtrak power.

5.2.4 Action Item 4: Incorporate Energy Efficiency Technologies into New Infrastructure

In addition to its existing infrastructure, NJ TRANSIT should incorporate best available sustainability technologies into its new buildings. While this includes more than energy efficiency improvements, reducing energy consumption should still be the main priority. Increasing building envelop efficiency, reducing lighting loads, and reducing HVAC loads, are good ways in which NJ TRANSIT can develop more efficient buildings.

LEED and ENERGY STAR standards outlined in this report can serve as a valuable resource to evaluate the best available technologies. NJ TRANSIT should also evaluate the incentive amounts available from the NJ Clean Energy Program to implement these measures.

5.2.5 Action Item 5: Implement an Employee Educational Program

Employee participation and buy-in is a critical component to improving the sustainability of an organization's operations. There are many behavioral changes, such as turning off unused lights, provide financial and environmental benefits. For instance, Kimberly-Clark is a global company, whose products include Kleenex, which implemented a sustainability program. A major component of this sustainability program was employee engagement. They saw tremendous benefits by including their employees in the program:

> Kimberly-Clark works with employees to set up specific sustainability programs through communities of practice (COPs), and to educate employees about the companies' environmental actions and impacts. This year the company implemented a new program, "Small Steps," to spur

sustainability actions among employees, and to emphasize the impact of committing to one small action, personally. Nearly 2,000 people have signed up since the "Small Steps" program was launched in June 2009; the company goal was to have 10,000 employees involved in the program by the end of 2010. By taking a viral approach, the company believes that the cumulative business benefits of small employee actions (such as turning off computers at the end of each day) will be significant over time.[34]

NJ TRANSIT should make employee outreach and involvement a major component of the organization's sustainability plan. Internal and external education programs are a vital first step to developing a sustainable firm and community.

In collaboration with facility managers, the Committee should hold training sessions for NJ TRANSIT staff to educate them about the five-year sustainability efforts. Staff members should be educated on the following;

- The Committee and this plan;
- Previous efforts to support energy conservation and sustainability;
- Best operational practices to decrease energy consumption in facilities;
- Financial schedule for installing ECMs at each facility;
- Incentive programs for energy efficiency improvements; and
- Current and future projects.

The Committee should begin by introducing the agency's sustainability goals and action items and provide its implementation plans. The Committee should also organize training on best operational practices for facility workers to continue to decrease energy consumption. These efforts will increase the success rate of operational improvements, and assist NJ TRANSIT in meeting its sustainability goals.

The Committee should also work with facility management to establish an incentive program for employees who identify energy efficiency improvements. Finally, the Committee should discuss current projects and get input from employees on future sustainability commitments, goals and improvements.

5.3. Goal 3: Invest in Renewable and Alternative Energy Systems

Renewable energy and other alternative energy technologies offer a valuable opportunity to reduce energy costs and minimize impacts on the environment. These technologies provide electricity while emitting zero emissions and have significant state and federal incentives to make them financially feasible.

[34] *The Business Case for Environmental Sustainability Employee Education*, by the National Environmental Education Foundation, February 2010.

NJ TRANSIT has already identified renewable energy investment opportunities. Through its ARRA grant award of $3.16 million, NJ TRANSIT is in the beginning stages of implementing a 550 kW solar project on the roof of the Meadows Maintenance Complex in Kearny, NJ. NJ TRANSIT also installed two solar systems connect to electric vehicle charging stations on parking decks in Trenton, NJ.

Still, there are many NJ TRANSIT-owned land and facilities where it may be feasible to install renewable or alternative energy systems to decrease energy consumption, cost and impacts on the environment. Solar, wind, and other forms of renewable energy should be considered where feasible.

Therefore it is recommended that NJ TRANSIT implement the following action items where feasible:

1. Invest in Solar Energy
2. Invest in Wind Turbines
3. Invest in Geothermal Exchange or GSHP
4. Invest in CHP Technologies

5.3.1 Action Item 1: Invest in Solar Energy

Solar energy systems use the most abundant source of energy on earth, converting the power of sunlight directly into electricity. Solar energy equipment has no moving parts and requires minimal maintenance. It generates solar electricity without producing emissions of GHG or other pollutants, and its operation is virtually silent. The most obvious direct benefit of solar energy systems is that they generate electricity on-site and result in reduced utility purchases. Enhancing this value is the fact that solar energy generation is highest during on-peak and summer hours, when electricity prices are at their highest. The value of reduced utility purchases will vary among the suppliers and by project. To accurately determine the investment quality of a solar project, the size, installation cost, location, and electric usage pattern of the host site are all considered.

However, solar energy is not without its drawbacks. It provides an intermittent supply of electricity. While it is an excellent renewable source of energy, it is not a dependable source of energy. Solar energy systems generate no power during nighttime hours, and reduced power on cloudy days. Perhaps more importantly, solar energy is very expensive to install. A solar energy system can cost five to ten times as much as a natural gas fueled power plant of equal size.

Partially offsetting this cost disadvantage is the fact that solar energy has no fuel cost associated with generating electricity. Combining this with current federal tax incentives and New Jersey's solar energy incentives can make solar energy a cost-competitive source of electric generation.

New Jersey has strong solar energy incentives and as of October 31, 2011 approximately 498 MW of solar capacity has been installed in the state. To date, New Jersey is second to only California in terms of the amount of solar capacity currently installed. Solar projects in New Jersey are supported by the following economic benefits:

1) Generating electricity and thereby reducing purchases from the local utility;
2) Favorable net metering regulations;
3) Revenue from the sale of SRECs;
4) 30% Federal ITC; and
5) Federal tax advantages associated with accelerated depreciation of capital investment.

NJ TRANSIT has the potential to incorporate a large amount of solar power to reduce its electricity consumption and take advantage of the State's strong solar incentives. Solar energy systems can be installed on NJ TRANSIT buildings, vacant land properties (i.e. along the side of tracks), and even as carport canopy systems on parking lots owned by NJ TRANSIT.

As a public entity NJ TRANSIT will need to partner with a private company to fully realize the benefits of the federal tax incentives. This may include entering into a PPA, which will allow for NJ TRANSIT to purchase the power from the solar energy system at reduced rate. A private company would take advantage of the federal tax credits, and trading the SRECs. However, this is not the only model, and the Committee should explore various financial arrangements to maximize the return on the system. This may also include a public-private partnership that allows both parties to share in the revenue of the system and provides NJ TRANSIT with an entity to monetize the federal tax credits and flow a portion of those benefits back to NJ TRANSIT in the form of improved pricing.

Given the current incentives for solar energy in New Jersey, NJ TRANSIT should consider expanding its solar investment by establishing a working team as part of the Committee that would be able to advance multiple projects. The team should be made up of NJ TRANSIT engineers; facility managers from corporate, bus, and rail facilities; lawyers; and consultants who can advise on risk management and procurement processes. The team should develop a process that would stream line solar development and installation across multiple NJ TRANSIT facilities. The team would develop a list of potential sites and establish criteria for participation in the solar project. It would also determine whether sites should be grouped into tranches or submitted as a single solar procurement. Finally, the team would manage the funding and bidding process internally or by using an outside consultant and engineering firm.

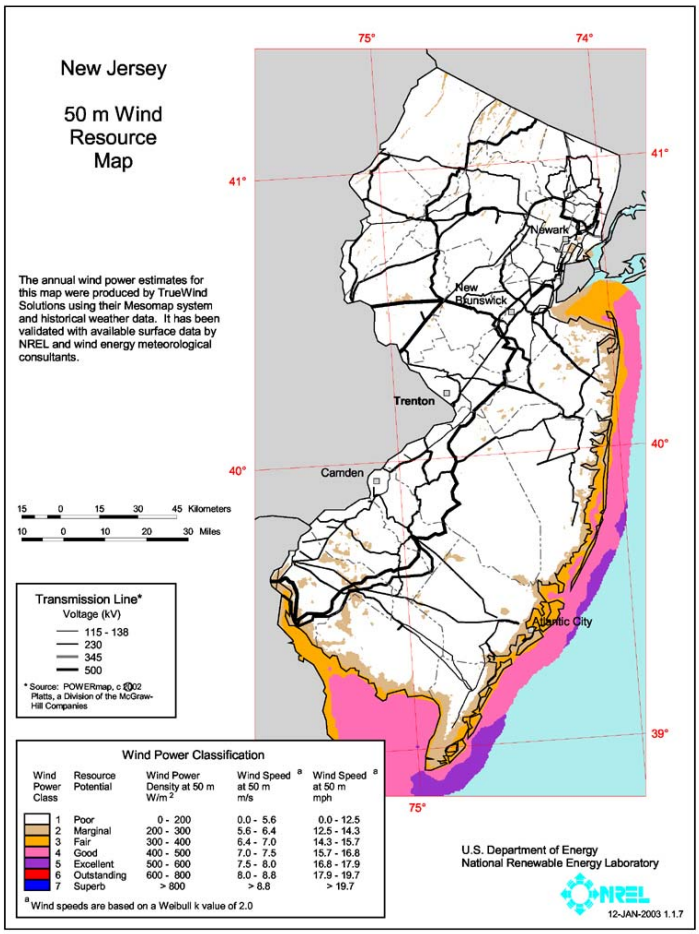
5.3.2 Action Item 2: Invest in Wind Turbines where Feasible

Wind turbines convert wind energy into electricity. They can be large, ground-mounted installations or small, building-mounted installations. In New Jersey, wind resources are restricted primarily to the coastal regions of the State. Figure 3.4.2-1, shows New Jersey's wind energy resources, as evaluated by the National Renewable Energy Laboratory (NREL).

Combining current federal tax-based and state rebate incentives for private sector ownership, wind turbine payback periods in most locations exceed 10 years, and can be twice as long as solar energy projects. For public sector projects, payback is much longer, since they cannot take advantage of strong federal tax credits. Wind turbine energy opportunities can be reevaluated when either state and/or federal programs provide increased benefits to assist in improving overall economics for public entities.

If NJ TRANSIT has properties in coastal areas, there may be limited wind energy potential, and should be evaluated on a case by case basis.

Figure 5.3.2-1 Wind Energy Map of New Jersey



5.3.3 Action Item: Incorporate Geothermal Exchange or GSHP where Feasible

Geothermal exchange systems take advantage of the earth's underground temperature, which remains relatively constant at 55 degrees Fahrenheit year round. Through drilling holes and

installing a heat-pump system, an installation site can realize reduced heating and cooling costs. Complexities in geotechnical variables and total system design make new construction sites the best locations for geothermal applications.

The incremental costs of integrating a GSHP implementation into existing equipment, has a significant, negative impact to the project economics. As a result, GSHP should be evaluated when existing HVAC and/or water heating equipment has reached the end of its useful life or in a new construction application where and a lifecycle benefit analysis can be completed.

5.3.4 Action Item: Incorporate CHP

CHP systems simultaneously generate steam and electricity, resulting in much greater energy efficiency than electric-only generators. However, to achieve this efficiency and optimize economies, the installation site must have a large and consistent thermal load. A good example would be an industrial laundry service, which requires constant hot water and hot air.

Several CHP incentive programs have recently been implemented at the state and federal level that will enhance the cost-effectiveness of CHP investments. The federal government provides a federal ITC for 10% of the project.

In addition, State incentives for CHP are currently being considered and could be announced when the revisions to the State Energy Master Plan are completed. Therefore, NJ TRANSIT should continue to monitor this process to identify potential availability and eligibility.

In addition, gas utility companies, such as South Jersey Gas offer additional CHP incentives, including rebates and reduced tariffs. Together these incentives can make a CHP project financially advantageous for an end user.

Space constraints, equipment age, and site specific energy consumption patterns can all impact the feasibility of a CHP project. Therefore CHP projects should be evaluated on a facility by facility basis.

5.4. Goal 4: Incorporate Other Sustainability Concepts into New and Existing Facilities

NJ TRANSIT should incorporate sustainability concepts and applications into its new and existing facilities where possible. This includes evaluating and improving the fuel sources and efficiencies for its transportation fleet. Therefore, it is recommended that NJ TRANSIT implement the following five action items:

1. Incorporate LEED and ENERGY STAR Concepts into New and Existing Facilities
2. Use Sustainable Materials for Construction or Renovation Projects
3. Improve the Efficiency and Sustainability of its Bus Operations
4. Improve the Efficiency and Sustainability of Rail Operations

5. Improve the Efficiency and Sustainability of Light Rail Operations
6. Improve the Efficiency and Sustainability of Non Revenue Vehicles

5.4.1 Action Item 1: Incorporate LEED and ENERGY STAR Concepts into New and Existing Facilities

NJ TRANSIT has shown strong commitments to incorporating renewable energy, energy conservation, and low emission technologies when designing new buildings. However, sustainable development also includes the issues such as;

- Optimization of location in a way that uses natural sunlight;
- Inclusion of the already existing environment as part of its design;
- Reduction of storm-water run-off; and,
- Reduction of thermal gradient differences.

Water conservation should also be considered in the design of a building. Conserving water minimizes the amount of waste water that a building produces and discharges into the sewage system. Programs such as LEED provide NJ TRANSIT with a valuable roadmap to incorporate these other environmental considerations.

In participating in the LEED or ENERGY STAR programs, it is important for NJ TRANSIT facilities to manage rehabilitation or new construction efforts to preserve bio-diversity and minimize harmful effects on surrounding areas. This includes increasing the desirability of a site for certain flora and fauna and keeping in consideration the already existing environment at the site. This also includes minimizing harmful effects, including removal of development related impacts that negatively affect the surrounding physical environment.

5.4.2 Action item 2: Use Sustainable Materials for Construction or Renovation Projects

When construction or renovation projects commence, NJ TRANSIT should also consider the use of sustainable materials and resources. Reusing or recycling materials is more environmentally friendly than using virgin materials. Also to be considered is the amount of waste that is produced during construction. Therefore, NJ TRANSIT should use materials that are rapidly-renewable resources such as wood or other plant-based resources that are replaceable and conserve the environment as well as materials with benign impact on the environment and materials that can easily be cleaned with non-toxic or bio-degradable agents. NJ TRANSIT should avoid using ozone-depleting substances such as CFCs and HCFCs and avoid using insulation materials that utilize chlorine-based gases in their production.

In developing sustainable and green buildings, environmental quality is also important for the economic, environmental, as well as social needs of the facility. Improving air quality in stations

and enhancing daylight in indoor spaces is not only environmentally friendly, but it also creates better and healthier environments for facility employees, thus increasing productivity.

Once a building is renovated or newly constructed, sustainable practices should continue throughout the operation and maintenance of the buildings. Facility operators should monitor mechanical and electrical systems performance and ensure the building is maintained with materials that do not adversely affect the environment. Placing lighting replacements on a schedule is also a good way to decrease energy consumption in a cost effective manner. [35]

Over the past fifteen years, ridership in public transportation has increased by 30% while the infrastructure has struggled to keep up. The capacity of ridership has been reached and exceeded, and major overhaul is required in many of America's largest cities in order to accommodate the millions of people seeking to be more sustainable by taking public transit. NJ TRANSIT is no different, and will be required to invest in its infrastructure to support its current system and support additional public transportation ridership.

Sustainability principles should be included in these infrastructure investments. Smart planning efforts, and new fuel technologies could offer NJ TRANSIT with a valuable opportunity to dramatically improve the sustainability of their operations. These efforts should include:

- Conducting feasibility and technology reviews to determine the economic and environmental benefits of alternative fuel supplies;
- Improving the efficiency of the public transportation system by decreasing travel time; and
- Increase ridership through expansion of service territory, including expansions to the light rail infrastructure;

Together, these efforts will help NJ TRANSIT to strategically invest in its future while maximizing the environmental and economic benefits of these investments.

5.4.3 Action Item 3: Improve the Efficiency and Sustainability of its Bus Operations

NJ TRANSIT determines when it purchases new buses based on a mileage life cycle. Typically buses are overhauled at 1 million miles, and then are retired after the second million miles. However this is a general guideline, and in actuality the buses are retired and replaced in large batches, resulting in large batch orders of replacement buses. These periodic bulk orders of new buses provide an opportunity to incorporate technologies and planning that is more beneficial for the environment and can reduce NJ TRANSIT's operating costs. The efforts should be included in NJ TRANSIT's procurement and planning processes. These investments include cleaner fuel sources, and development of BRT that will improve the efficiency of the overall system.

[35] 2005 Guidelines and Standards Manual.

NJ TRANSIT should continue to explore alternative fuel sources that can reduce its impact on the environment, and reduce its energy expenditures. Biodiesel fuel is one type of fuel that should be actively considered. The use of biodiesel fuels reduces GHG emissions but it is more expensive than diesel. NJ TRANSIT has tested B 20 diesel in buses and have found it to be a successful transportation fuel. However, NJ TRANSIT has also determined that using B 20 system-wide is not currently cost effective. While ultra-low sulfur fuels may not be as beneficial to the environment as biodiesel, it is more environmentally responsible than the current fuel mix, and more cost effective than biodiesel. Therefore, while NJ TRANSIT uses ultra-low sulfur fuel in all buses and light rail, it should continue to explore the use and feasibility of biodiesel vehicles and monitor the relative market prices of diesel and biodiesel fuels. Fuel technologies will continue to evolve, and it is important that the agency continue reviewing and evaluating new fuel sources that offer environmental and economic benefit potential.

BRT also offers an opportunity for NJ TRANSIT to reduce its impact on the environment and reduce its energy expenditures. Incorporating BRT applications into its planning efforts can significantly improve the efficiency of the entire transit system by reducing idling time, decreasing travel time and increasing overall reliability of the system. BRT can be defined as, "a flexible, rubber-tired form of rapid transit that combines stations, vehicles, services, running ways and intelligent transportation system elements into a fully integrated system with a strong image and identity."[36] BRT elements include:

- Creating exclusive rights of way such as dedicated lanes for buses;
- Enhancing bus shelters and stations;
- Investing in new buses with a BRT brand that distinguish it from older models;
- Increasing frequency and service plans;
- Simplifying route structure for better efficiency;
- Using fare prepayment to reduce queuing time at stops; and
- Using intelligent transport systems that include real-time passenger information, computerized dispatch, and signal priority.[37]

Incorporating BRT into the planning and infrastructure of the transit system allows for more efficiency for the public transportation infrastructure. Increasing the efficiency of the transit system will make the public transportation system more appealing to the public, and will help to increase ridership.

[36] Herbert Levinson et. Al., "Bus Rapid Transit. Volume 1: Case Studies in Bus Rapid Transit," Transit Cooperative Research Program Report 90, Transportation Research Board, 2003.
[37] Adam Millard-Ball. "Bus Rapid Transit and Carbon Offsets," California Climate Action Registry, November 2008.

5.4.4 Action Item 4: Improve the Efficiency and Sustainability of Rail Operations

NJ TRANSIT commits approximately 50 percent of its transportation fuel consumption to its rail vehicles, and should explore ways to decrease this consumption, and find fuel sources that are better for the environment. It should also look for ways to increase access to its rail infrastructure, particularly regarding its light rail infrastructure, which is more easily accessible and has lower capital costs.

NJ TRANSIT should evaluate its rail fleet and research the best available fuel technologies that can be used to decrease impacts on the environment and reduce energy expenditures. In 2007, the Department of Energy Protection (DEP) approved funding for NJ TRANSIT to test using B 20 in diesel locomotives. This effort should be continued for B 20 and other alternative fuels that offer potential. Since fuel technology and fuel market pricing is constantly changing, this should be an ongoing effort at NJ TRANSIT. NJ TRANSIT should also explore an increase in the percentage of electric powered locomotives capable of regenerative braking as well as maximize the regenerative braking systems on the electric powered locomotives that already have installed such features.

5.4.5 Action Item 5: Improve the Efficiency and Sustainability of Light Rail Operations

NJ TRANSIT should also continue its investments in light rail transit to connect stations. Light rail trains are smaller and lighter than heavy rail and therefore are less costly to construct and operate. This smaller and lighter infrastructure also makes it easier to incorporate this infrastructure into urban environments. Expansion of the light rail infrastructure can be used to provide additional access and interconnectivity of the public transportation system in New Jersey. Specifically, light rail infrastructure should be developed to connect the public transportation system with communities that have sporting arenas, theaters and popular shopping areas. This will decrease car emissions by attracting more passengers who would otherwise drive because they do not have access to bus or train stations.

5.4.6 Action Item 6: Improve the Efficiency and Sustainability of Non Revenue Vehicles

It is also important that NJ TRANSIT improve the sustainability of its own vehicle fleet. NJ TRANSIT has invested in hybrid and electric vehicles. In addition, NJ TRANSIT should continue to evaluate, and if possible implement policies to decrease the size of its non-revenue fleet. It should also establish minimum standards when purchasing fuel efficient vehicles. Fuel efficient vehicles such as hybrid and electric cars can offer superior energy savings to traditional vehicles. However, these savings are often offset by higher upfront capital costs. Therefore, NJ TRANSIT should incorporate this consideration when evaluating new vehicle purchases.

6. Funding Sources

There are numerous funding sources available to NJ TRANSIT to implement this sustainability plan. These sources present the opportunity to achieve sustainability in many different aspects, and can help NJ TRANSIT achieve their efficiency goals in both ECM and solar projects despite challenging funding and economic circumstances. The following sections explore public and private funding for energy efficiency, renewable energy, and alternative energy projects.

6.1. Funding for Energy Audit Recommended ECMs and other Energy Efficiency Improvements

Energy Service Contracts: Energy Service Contracts (ESCOs) offer clients the ability to realize ECMs without having to finance the projects. An energy service company will agree to pay for the upgraded energy measures, and will be repaid through the savings realized by these measures. This model requires no upfront capital costs to fund the energy efficiency improvements. However, the energy savings of the energy efficiency upgrades are shared between the Energy Service Contractor and the property owner. NJ TRANSIT should evaluate an ESCO model on a case by case basis, based on the upfront capital they are able to commit to a project.

FTA Environmental Management Systems Training and Assistance: This program offers Environmental Management Systems (EMS) training and assistance to chosen transit agencies. 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. 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 (IOS) 14001 – based EMS for chosen transit facilities. 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.

Application Process: The FTA believes that organizational commitment to environmental protection and sustainability are the most important elements of the program and that regular and meaningful senior management participation is crucial to successful EMS implementation. With that in mind, FTA's main selection criteria were:

- Organizational commitment by transit agency leadership to EMS implementation:
- Geographical diversity;
- Previous environmental experiences; and
- Environmental challenges from operations and/or pending capital projects.

Funding has recently been approved to move forward with another round of training and assistance. FTA looks favorable upon agencies that haven't undergone prior training making NJ TRANSIT an ideal candidate to participate in a future training and assistance program.

New Jersey Clean Energy Program Pay for Performance: New Jersey Clean Energy Program (NJCEP) Pay for Performance offers energy efficiency improvement to applicants who have an annual average peak electricity demand of 200 kW or larger. Pay for Performance relies on a network of Program Partners who become contracted to NJ TRANSIT to provide direct technical services for energy efficiency improvement, new construction, and CHP projects. This partner acts as an Energy Expert and will develop an Energy Reduction Plan (ERP) that is made up of whole-building technical component energy audit, a financial plan for funding energy efficient measures, and a construction schedule for installation. Pay for Performance takes advantage of the ENERGY STAR Program with Portfolio Manager, EPA's interactive tool that allows facility managers to track and evaluate energy and water consumption across all of their buildings. This program allows NJ TRANSIT to assess the energy management goals over time, identify strategic opportunities for savings, and receive EPA recognition for superior energy performance.

Upon completion of an approved ERP within six months that provides for a minimum source energy reduction of 15 percent, participants will receive their first of three incentives. The incentive amount equals $0.10/square foot of the project with a minimum of $5,000, capped at 50 percent of the building's annual energy cost.

Upon installation of measures identified in the approved ERP, participants will receive the second incentive equal to a minimum of $0.11 and a maximum of $0.13 per projected kWh saved of electricity and a minimum of $1.10 and a maximum of $1.45 per projected Therm saved of gas.

Upon verification of realized energy savings as a result of the installed measures, participants will receive the third incentive equal to a minimum of $0.07 and a maximum of $0.09 per projected kWh saved of electricity and a minimum of $0.70 and a maximum of $1.05 per projected Therm saved of gas.

New construction projects, 50,000 sq. ft. or more that are located in a Smart Growth area, are also eligible for incentives under Pay for Performance.

Application Process: NJ TRANSIT can select a program partner from the list of approved partners. A Program Partner is a pre-approved business who has experience conducting energy audits and has knowledge of comprehensive opportunities involving energy efficiency measures for this program. They will then work with the program partner to submit an application and participation agreement to New Jersey's Clean Energy Program c/o TRC Energy Services. Once the Application Package is approved, a Notice to Proceed will be sent and a Case Manager will be assigned to the project. NJ TRANSIT and Partner will work together to develop goals and

create an ERP to achieve no less than 15% energy savings. Along with the ERP, Partner will submit a complete Benchmarking Report, the Partner-Participant Contracts, and a request for Incentive 1, which will be received upon approval. Eventually, NJ TRANSIT will submit forms for Incentives 2 and 3 upon completion of specific stages.

If NJ TRANSIT is building new construction, it should determine if the new construction is located in a Smart Growth area. If the location is not in a Smart Growth area then NJ TRANSIT will not qualify for funds for new construction at that site.

NJCEP SmartStart Buildings: This program provides financial incentives, design support, and technical assistance for energy efficient measures. Financial incentives are provided for qualifying equipment including but not limited to high-efficiency lighting and lighting controls, heating and cooling equipment, water heating, motors and variable frequency drives. These incentives were developed to help applicants offset some of the added cost to purchase qualifying energy-efficient equipment, which provides significant long-term energy savings. A wide range of incentives is available for qualifying equipment (depending on type, size and efficiency).

Of the ECM prescribed for NJ TRANSIT, two upgrades are covered under this program, lighting upgrades and HVAC upgrades. For lighting upgrades, the prescriptive lighting and lighting controls are covered under the program. For prescriptive lighting, depending on the type of lighting installed, incentives can vary from $10 per fixture for T-5 or T-8 lamps with electronic ballast in existing facilities to $284 per fixture for T-5 or T-8 High Bay Fixtures. Lighting control incentives can vary from $20 for wall mounted controlled occupancy sensors to $75 per high-intensity discharge (HID) or Fluorescent Hi-Bay daylight dimming controlled fixture. Depending on the type of HVAC installed, incentives vary from $40 per ton for Central Direct Expansion (DX) Air Conditioning (AC) Systems to $250 for Dual Enthalpy Economizer Controls.

The program is also available to address new construction and renovation needs for large and small projects. For new construction or renovation needs, annual financial incentives include; design support for projects in and beyond the conceptual stage, technical assistance for projects past the design and bidding stages, support for customized energy-efficiency measures, and equipment rebates. Combined awarded incentives are limited to a maximum of $500,000 per customer utility account and are available as funding permits.

Application Process: For details on equipment requirements and full listings of incentives, refer to the online application forms at www.njcleanenergy.com. Please note that almost all equipment incentives require pre-approval before equipment is installed. To start the pre-approval process, NJ TRANSIT must submit an Equipment Application and appropriate Equipment Worksheets for the type or types of equipment planned for installation along with

equipment specification sheets and current utility bill(s). To be eligible to receive financial incentives under this Program, Applicants must receive electric and/or gas service from one of the regulated electric and/or gas utilities in the State of New Jersey. These include: ACE, JCP&L, Rockland Electric Company (RECO), New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

Incentives for new construction are available only for projects in areas designated for growth in the NJ State Development and Redevelopment Plan. NJ TRANSIT must determine if location for new construction is in a designated growth area by referring to the Smart Growth Locator available from http://sgl.state.nj.us. NJ TRANSIT will send in an application and appropriate forms to the NJ SmartStart Buildings Program Commercial/Industrial Market Manager who will review and approve the project if all forms have been filled out correctly and all eligibility requirements have been met. To receive an incentive, NJ TRANSIT must not install the proposed new equipment or disconnect the existing equipment before receiving the Letter of Approval from the Market Manager. This pre-approval requirement may be waived by the Market Manager for HVAC equipment, motors, and water heaters that have failed.

6.2 Funding for Renewable Energy Systems

6.2.1 Solar Energy Projects

Power Purchase Agreement: Under a PPA model, a solar developer would finance, own, design, install, commission, operate and maintain the solar facility. The client will realize economic value from the project through reduced power costs from the solar developer. The solar developer would sell the output of the solar facility to the client on a long term basis. The PPA would also contain operational and financial protections.

A request for proposals (RFP) process is developed and administered to select a qualified vendor to provide a PPA proposal to own, design, install and maintain the solar system. This approach is a competitive process that allows solar vendors to use their capabilities and creativity to design a project and propose a project design and PPA. This model provides NJ TRANSIT the opportunity to take advantage of reduce electricity prices, while not needing to pay for the upfront capital costs, and enables the value of the federal tax credits to be obtained by a private entity.

However, this model also limits the benefits of a solar energy array. NJ TRANSIT is currently funding a 550 kW at its Meadows Maintenance Complex in Kearny. This project utilizes $3.16 million in ARRA funds to pay for part of the project. NJ TRANSIT could continue to seek State or Federal dollars to fund additional renewable energy projects, or enter into a public-private partnership that enables them to share in the cost and benefits of the renewable energy system.

NJ SREC Registration Program: In New Jersey, SREC revenues are a significant contributor to project financing. SRECs represent all the clean energy benefits of electricity generated from a solar energy system. SRECs can be sold or traded separately from the power, providing owners a source of revenue to help offset the cost of installation. All solar project owners in New Jersey with electric distribution grid-connected systems are eligible to generate SRECs. Each time a system generates 1,000 kWh of electricity an SREC is earned and placed in the Applicant's account on the web-based SREC tracking system. SRECs are used to help fund solar projects and can be given to third-party developers in order to supplement project costs.

Under the State's RPS, energy suppliers are required to purchase a specific amount of renewable energy, including solar energy each energy year. Suppliers can meet their obligation through payment of a Solar Alternative Compliance Payment (SACP) that is set by the BPU, or by purchasing SRECs. Since a supplier can meet its RPS obligation through either SREC purchases, or by paying the SACP payment, the SACP serves as a ceiling for which the SREC prices will not exceed.

In March, 2011, SRECs were selling for $605.00 each, because there was a shortage in the amount of SRECs that were available for compliance. As of October 31, 2010, there was 498 MW of solar energy installed in New Jersey with a requirement of only 405 MW by May 31, 2012. This oversupply of SRECs is resulting in SREC values declining by more than 60% since March.

The RPS mandates that solar capacity increase annually to a level of 2,299.5 MW by 2021 and 4,854.8 MW by 2026. This balance between supply and demand of SRECs is likely to fluctuate over the next several years, which will have an impact on SREC values. This is still an emerging market with significant long-term uncertainties and it is recommended that NJ TRANSIT implement measures to decrease SREC price risk.

To reduce SREC revenue uncertainty, solar developers can explore longer term contracts. There are some electric suppliers who may still contract to purchase future SRECs for multiple years; however, longer term contracts receive lower SREC pricing. Currently, 3-year contracts have an average SREC value of $180. Table 6.2.1-1 shows the SREC value assumptions that can be made for the 550 kW solar energy array at the Meadowlands Maintenance Complex. These numbers assume that NJ TRANSIT is able to garner an average of $204 per SREC in the first four years of the project. This may be achieved by selling SRECs on the spot market, or by entering into a SREC purchase agreement averaging for two to three years and selling the remaining SRECs on the spot market. These assumptions assume the system will not be installed and generating SRECs until calendar year 2011.

Table 6.2.1-1 – SREC Value

NJ Transit Solar Project
SREC Revenue

	Year	SRECs Generated	SREC Value $ per MWH	SREC Revenue
1	2012	837.09	$160	$133,934
2	2013	832.90	$149	$124,102
3	2014	828.74	$210	$174,035
4	2015	824.59	$297	$244,904
5	2016	820.47	$354	$290,446
6	2017	816.37	$326	$266,136
7	2018	812.29	$300	$243,686
8	2019	808.22	$280	$226,303
9	2020	804.18	$270	$217,129
10	2021	800.16	$261	$208,842
11	2022	796.16	$256	$203,817
12	2023	792.18	$252	$199,629
13	2024	788.22	$248	$195,478
14	2025	784.28	$245	$192,148
15	2026	780.36	$242	$188,846
16	2027	776.45	$20	$15,529
17	2028	772.57	$20	$15,451
18	2029	768.71	$20	$15,374
19	2030	764.87	$20	$15,297
20	2031	761.04	$20	$15,221

Total	**$3,109,436**
NPV	**$1,992,763**

Assumptions

SREC Value: Gabel Associates conservative estimate.

Since the system is fully paid for from an ARRA award and previously budgeted funds from NJ TRANSIT, the SREC revenues can be used as a funding source to help implement the sustainability initiatives outlined in this report.

Application Process: The applicant submits a completed registration packet with all required documents. Registrations may be submitted at any time and will be processed in the order received. Before the project can be approved, final paperwork must be submitted. Final inspections may be scheduled upon project completion and submission of final paper work. Projects being developed through the Renewable Energy Incentive Program do not need to submit SREC Registration Program materials, but will still be registered with the SREC tracking system upon system and REIP process completion.

Utility SREC Securitization Program: In an effort to increase long term SREC price certainty, the BPU approved a program whereby JCP&L, ACE, and RECO will enter into 10 to 15 year SREC contracts (referred to as SREC Purchase Sales Agreements or PSAs) with solar projects.

The BPU found that the security of long term contract support is needed to give more certainty to the SREC revenue stream.

This program is concluding, but a similar program may be developed to encourage continued solar development in the state. Therefore, NJ TRANSIT is encouraged to follow the efforts of the BPU as it considers future actions regarding the New Jersey SREC market.

Solar PV Federal Tax Incentives: Federal tax incentives that support solar energy include a 30% ITC and accelerated depreciation (Modified Accelerated Cost Recover System, or MACRS), both of which are critical to the economic viability of solar installations. Combined, the value of these two incentives contributes approximately half of the total installation costs.

As a public entity, NJ TRANSIT cannot directly benefit from the federal tax credit or accelerated depreciation. Considering the large investment costs associated with solar PV installation, direct ownership by NJ TRANSIT is economically challenging.

Through contracting with a third-party to own and operate the solar PV system, NJ TRANSIT can indirectly benefit from the available federal subsidies. This third-party system owner would realize the NJ SREC revenues and federal tax credits while sharing these benefits with NJ TRANSIT by either:

1) Providing the host site a PPA with a price below utility costs; or
2) A direct lease payment to the NJ TRANSIT for the rooftop or land used for the installation.

PSE&G Solar Loan Program II: In the PSE&G's Solar Loan Program, PSE&G is providing $105 million in financing for solar photovoltaic system installations over the next two years. The program has been implemented across all customer classes within PSE&G's service territory. A major goal of the program is to reduce the overall cost of project development, installation, financing, and maintenance. The borrower will repay the loans with SRECs or cash. The loan interest rate is 11.11% for a 15-year non-residential loan. The SREC floor price for non-residential projects less than 150 kW will be from $410 to $360 for quarter one through eight. For project greater than 150 kW and less than 500 kW, the SREC floor price will be from $380 to $330 for quarters one through eight. If the loan is paid off before 15 years, PSE&G will have the option to purchase SREC's through a call option, at a price 75% of the market price. PSE&G is prepared to finance a total of 25 MW for non-residential greater than 150 kW up to 500 kW and 17 MW for non-residential up to 150 kW. This loan can be used by participating Applicant on its own or by a third party solar developer.

This program is concluding, but a similar program may be developed by the BPU and the utility companies to encourage continued solar development in the state. Therefore, NJ TRANSIT is encouraged to follow the efforts of the BPU as it considers future actions regarding the New Jersey SREC market.

PSE&G Solar 4 All: PSE&G's Solar 4 All is a program in which PSE&G will install, maintain, and operate solar systems on Applicant's rooftops. Installation will be owned by PSE&G and they will pay rent for use of the rooftop property to Applicant. PSE&G will receive all federal tax credits, SREC revenue, and connect installations into the grid and sell power into the PJM wholesale power grid. By BPU order, PSE&G will install 10 MW of Solar Systems on third-party owned sites. All solar systems installed on third-party sites will be 500 kW or larger and must be in PSE&G territory. The plan calls for three tranches of projects totaling 10 MW of capacity, to be contracted over the 2009-2011 period.
This program is concluding, but a similar program may be developed by the BPU and the utility companies to encourage continued solar development in the state. Therefore, NJ TRANSIT is encouraged to follow the efforts of the BPU as it considers future actions regarding the New Jersey SREC market.

6.3. Funding for Alternative Energy Systems

EDA CHP Program: On March 31, 2009, Bill No. A2507/S1932 was signed into law which authorizes the BPU to use, at minimum, up to $60 million of the Retail Margin Fund to provide grants for CHP production, energy efficiency projects, and programs promoting renewable energy and energy efficiency. This money is used to provide rebates of up to $450 for every kw of capacity installed, based on efficiency levels and performance. The amount of the grant is based on the actual electric and thermal energy production on an annual basis, which shall begin upon the commencement of operations of the CHP project. Grants shall be made only for performance based on kW per hour and per BTU delivered. The grant will be calculated based on a 75 percent capacity factor over four years.

This program is to be used for CHP electricity generating capacity up to 133 MW at new or existing sites serving New Jersey's Commercial and Industrial Energy Pricing (CIEP) electric customers. Grants are not to fund the costs of development, design, or construction of the CHP project. Funds may not be used for conducting feasibility studies or location research. The CHP project must serve a commercial, institutional, or industrial electricity customer in New Jersey with electric demand of at least 750 kW.

However, there is uncertainty regarding the availability of this program. State budgetary constraints and interest in this program could effectively limit the availability or eligibility of this program. Therefore, NJ TRANSIT should monitor the availability of this program.

Application Process: The CHP Program is designed to complement Clean Energy Solutions Capital Investment (CESCI). Grants will be awarded on a first-come, first-serve basis. The

applicant must demonstrate an ability to finance construction through market sources, which may include Bond Financing through the EDA. Applicants may request funding for more than one CHP project. Applicant fills out a pre-installation application prior to EDA online application. Upon review, applicants will be notified via e-mail as to whether or not they are eligible for the CHP Program. Applicants that are notified of meeting eligibility requirements may then move forward to complete the EDA online application. The EDA is currently not accepting applications for this project.

NJCEP Pay for Performance: CHP projects are eligible for incentives up to $1,000,000. Eligible technology receives different incentives amounts based on type of CHP system ranked in levels 1 though 3. Level 1, fuel cells not fueled by Class I renewable fuel receive an incentive of $4.00 per Watt and the incentive cannot exceed 60% of the project cost. Level 2, which include microturbines, internal combustion engines, and combustion turbines, receive $1.00 per Watt and the incentive cannot exceed 30% of the total project cost if a cooling application is not used and 40% if a cooling application is used or included in the CHP system. Level 3 which is heat recovery or other mechanical recovery from existing equipment receive $0.50 per Watt and the incentive cannot exceed 30% of the project cost.

Application Process: The Program Partner to submit an application and participation agreement to New Jersey's Clean Energy Program c/o TRC Energy Services. Once the Application Package is approved, a Notice to Proceed will be sent and a Case Manager will be assigned to the project. Applicant and Partner work together to develop goals and create an ERP to achieve no less than 15% energy savings. Along with the ERP, Partner will submit a complete Benchmarking Report, the Partner-Participant Contracts, and a request for Incentive 1, which will be received upon approval. Eventually, Applicant will submit forms for Incentives 2 and 3 upon completion of specific stages. Applicant will also submit the CHP Application Package during the program and before installation of new CHP.

FTA Clean Fuels Grant Program: This program was developed to assist nonattainment and maintenance areas in achieving or maintaining the National Ambient Air Quality Standards for ozone and carbon monoxide (CO). Also, the program supports emerging clean fuel and advanced propulsion technologies for transit buses and markets for those technologies.

Application Process: Several factors FTA considers while evaluation applicants are:

- Demonstrated Need
- Planning and Prioritization at Local/ Regional Level
- The Project Is Ready To Implement
- The applicant demonstrates the benefits of the proposed project in reducing transportation related pollutants.
- The proposed project supports emerging clean fuels technologies or advanced technologies for transit buses.

- The applicant demonstrates the technical, legal, and financial capacity to carry out the

7. Conclusion

Since 1994, NJ TRANSIT has implemented a series of initiatives to reduce operation costs and minimize the impacts on the environment. This document provides NJ TRANSIT with a plan to further reduce its operating costs and protect the environment. Section 5 of this report provides a series of four goals and 15 action items to be implemented by NJ TRANSIT over the next five years. These goals and action items should be administered and updated by an internal NJ TRANSIT Committee.

The economic and environmental benefits of this plan make a strong business case for NJ TRANSIT to make increasing public transportation ridership its top priority. Over the past year, the BTU per passenger has increased, due to increases in energy consumption of NJ TRANSIT's rail operations. Energy expenditures per passenger mile decreased since 2008, but this is because energy prices declined due to the global economic recession. NJ TRANSIT should focus on reducing its energy consumption and energy expenditures per passenger mile traveled to improve the efficiency of its operations. Increasing ridership at a higher rate than energy consumption and energy expenditures will reduce the need for fare hikes by providing NJ TRANSIT with increasing fare revenues while freezing or decreasing operating costs. It will also reduce GHG emissions by taking more people out of their cars.

This report also includes a list of ECMs to be implemented by NJ TRANSIT. These ECMs, which were identified in energy audits commissioned by NJ TRANSIT and performed in 2009, provide a collective IRR of nearly 50 percent, and therefore should be implemented in a timely manner. This plan provides NJ TRANSIT with sample schedules, and alternative financing methods to pay for these and other clean energy improvements, including:

- SREC revenues to fund energy improvements
- Energy savings contracts
- PPA
- State energy programs, including the NJ CEP
- Federal programs, such as ARRA and TIGGER

Together, the recommendations in this report provide NJ TRANSIT with the resources, goals and action items necessary to reduce energy consumption and expenditures, while improving the sustainability of its operations.

Appendices

Appendix A
New Jersey Transit
Total Energy Project
Assumptions
April 19, 2011

System Savings: Energy Efficiency	
Electric Demand Savings (kW)	1,768
Electric Usage Savings (kWh)	14,338,639
Natural Gas Savings (Therms)	56,608
Oil Savings (gal)	41,910
System size and Output: Solar	
DC kW (kW-DC)	550
First Year kWh [1]	674,080
Annual kWh degradation	0.50%

Economic Variables	
Energy Efficiency Installation Total Cost (2008)	$5,692,829
2010 Forecast Electricity Avg Value ($/kWh) [2]	$0.1200
Electricity escalation (%)	3.3%
2010 Forecast Natural Gas Avg Value ($/therm) [3]	$1.3000
Natural gas escalation (%)	3.5%
2010 Forecast Fuel Oil Avg Value ($/gal) [4]	$2.5378
Fuel Oil escalation (%)	3.3%
SREC value ($ per MWh)	Est 4-yr Contract, then Forecast
SREC Period (Years)	15
Capital Recovery Period	15
Project Life (Years)	20
Discount Rate / Cost of Capital	4.5%

Economic Incentives	
One-Time Rebate	$539,298

[1]
Assumes a conservative derate of .77, tilt of 10 degrees and azimuth of 170 degrees

[2],[3],[4]
Blended rate based on information obtained from SAIC reports

Appendix A.1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ECM Count	ECM	Useful Life (Years)	Investment (2008 $)	Annual Electric Savings (kWh)	Annual Electric Savings ($)	Avg. Demand Reduction (kW)	Annual Gas Savings (Therms)	Gas Annual Savings ($)	Annual Fuel Oil Savings (Gals)	Oil Annual Savings ($)	Annualized Net Change in O&M ($)	Annual Savings ($)	One Time Incentive	Simple Payback (years)
	Big Tree Garage													
1	Lighting Retrofits	20	$ 100,227	243,018	$ 29,162	28	-2073	$ (2,695)				$ 28,172	$ 17,050	2.95
2	Lighting Controls	15	$ 1,180	3,907	$ 469	0	0	$ -				$ 508	$ 160	2.01
	Subtotal		**$ 101,407**	**246,925**	**$ 29,631**	**28**	**-2073**	**$ (2,695)**	**0**	**$ -**	**$ -**	**$ 28,680**	**$ 17,210**	**2.94**
	Newark Penn Station													
3	BAS Revisions	10	$ 13,400	87,000	$ 10,440	14	538	$ 699		$ 2,458	$ -	$ 15,676	$ -	0.85
4	VFDs for Heating-Only AHUs	10	$ 17,171	83,499	$ 10,020	0	0	$ -		$ -	$ -	$ 10,437	$ 5,365	1.13
5	Premium Efficiency Motors	10	$ 1,620	6,000	$ 720	1.5	0	$ -		$ -	$ -	$ 903	$ 270	1.50
6	Domestic Hot Water Renovation	10	$ 10,400	21,383	$ 2,566	0	2091	$ 2,718		$ 3,902	$ 3,200	$ 6,220	$ 200	1.64
7	Lighting Retrofits	10	$ 50,316	196,284	$ 23,554	25.4	0	$ -		$ -	$ -	$ 27,126	$ -	1.85
8	Lighting Controls	10	$ 8,510	5,866	$ 704	0	0	$ -		$ -	$ -	$ 733	$ 1,295	9.84
	Subtotal		**$ 101,417**	**400,032**	**$ 48,004**	**41**	**2629**	**$ 3,418**	**0**	**$ 6,360**	**$ 3,200**	**$ 61,095**	**$ 7,130**	**1.54**
	Egg Harbor													
9	Lighting Retrofits	20	$ 161,483	729,568	$ 87,548	62.3	-6225	$ (8,093)				$ 81,174	$ 37,550	1.53
10	Lighting Controls	15	$ 10,515	25,828	$ 3,099	0	0	$ -				$ 3,229	$ 1,255	2.87
11	Premium Efficiency Motors	15	$ 17,207	22,121	$ 2,655	2.5	0	$ -				$ 2,765	$ 1,172	5.80
12	Reduce Boiler Water Supply Temperature	10	$ 1,384	0	$ -	0	142	$ 185				$ 229	$ -	6.04
	Subtotal		**$ 190,589**	**777,517**	**$ 93,302**	**65**	**-6083**	**$ (7,908)**	**0**	**$ -**	**$ -**	**$ 87,397**	**$ 39,977**	**1.72**
	Fairview Garage													
13	Lighting Retrofits	20	$ 50,268	167,763	$ 20,132	19	-1,431	$ (1,860)				$ 21,155	$ 6,290	2.08
14	Lighting Controls	15	$ 708	2,265	$ 272	0	0	$ -				$ 317	$ 90	1.95
	Subtotal		**$ 50,976**	**170,028**	**$ 20,403**	**19**	**-1431**	**$ (1,860)**	**0**	**$ -**	**$ -**	**$ 21,472**	**$ 6,380**	**2.08**
	General Office Building													
15	Install Natural Gas Line on Dual-Fuel Boilers	20	$ 15,000	0	$ -	0	-31,056	$ (40,373)	41910	$ 100,000		$ 46,584	$ -	0.32
16	Computer Auto-Shutdown	10	$ 2,000	5,110	$ 613	0	0	$ -	0	$ -		$ 675	$ -	2.96
	Subtotal		**$ 17,000**	**5,110**	**$ 613**	**0**	**-31056**	**$ (40,373)**	**41910**	**$ 100,000**	**$ -**	**$ 47,259**	**$ -**	**0.36**
	Greenville													
17	Control Bay A and Bay B Exhaust Fan	10	$ 118,560	65,545	$ 7,865	0	53,915	$ 70,090				$ 96,090	$ -	1.23
18	Lighting Retrofits	20	$ 79,473	529,753	$ 63,570	68	-5,632	$ (7,322)				$ 52,745	$ 18,440	1.16
19	Lighting Controls	15	$ 11,070	44,910	$ 5,389	0	0	$ -				$ 5,254	$ 1,070	1.90
20	Heat Recovery from Bays A,B and C	15	$ 291,551	-101,756	$ (12,211)	-12	55117	$ 71,652				$ 78,487	$ -	3.71
21	Reset Boiler Water Supply Temperature	10	$ 899	0	$ -	0	135	$ 176				$ 221	$ -	4.07
22	Replace PTAC Units	20	$ 5,394	7,370	$ 884	4.2	0	$ -				$ 862	$ 195	6.03
23	Premium Efficiency Motors	15	$ 46,179	18,641	$ 2,237	3.1	0	$ -				$ 2,181	$ 2,935	19.83
24	Replace Packaged Rooftop AC Units	20	$ 69,099	19,415	$ 2,330	7.8	0	$ -				$ 2,272	$ 2,767	29.20
	Subtotal		**$ 622,225**	**583,878**	**$ 70,065**	**71**	**103,535**	**$ 134,596**	**0**	**$ -**	**$ -**	**$ 238,112**	**$ 25,407**	**2.51**
	Hamilton													
25	Install Variable Frequincy Drives (VFDs)	15	$ 4,560	20,244	$ 2,429	0	0	$ -				$ 2,348	$ 1,975	1.10
26	Lighting Retrofits	20	$ 151,710	777,581	$ 93,310	63.6	-6635	$ (8,626)				$ 79,185	$ 23,900	1.61
27	Lighting Controls	15	$ 12,236	36,932	$ 4,432	0	0	$ -				$ 4,284	$ 1,440	2.52
28	Premium Efficiency Motors	15	$ 2,287	2,291	$ 275	0	0	$ -				$ 266	$ 171	7.95
	Subtotal		**$ 170,793**	**837,048**	**$ 100,446**	**64**	**-6635**	**$ (8,626)**	**0**	**$ -**	**$ -**	**$ 86,083**	**$ 27,486**	**1.66**

	Headquarters Building														
29	Exhaust Air Heat Recovery	20	$ 44,500	-16,970	$ (2,036)	0	7,976	$ 10,369				$ 11,018	$ -	4.04
30	Computer Auto-Shutdown	10	$ 22,000	96,360	$ 11,563	0	0	$ -				$ 12,623	$ -	1.74
	Subtotal		**$ 66,500**	**79,390**	**$ 9,527**	**0**	**7976**	**$ 10,369**	**0**	**$ -**	**$ -**	**$ 23,641**	$ -	**2.81**
	Hilton Garage														
31	Lighting Retrofits	20	$ 129,141	450,722	$ 54,087	53	-4,807	$ (6,249)				$ 52,813	$ 15,500	2.15
32	Lighting Controls	15	$ 1,180	4,408	$ 529	0	0	$ -				$ 582	$ 175	1.73
33	Repair Compressed Air Leaks	20	$ 1,750	58,823	$ 7,059	13.4	0	$ -				$ 7,765	$ -	0.23
34	Duct OA to Compressor Intake	20	$ 580	25,404	$ 3,048	5.8	0	$ -				$ 3,353	$ -	0.17
35	Reduce Compressed Air Line Pressure	20	$ -	53,786	$ 6,454	12.3	0	$ -				$ 7,100	$ -	0.00
	Subtotal		**$ 132,651**	**593,143**	**$ 71,177**	**85**	**-4807**	**$ (6,249)**	**0**	**$ -**	**$ -**	**$ 71,613**	**$ 15,675**	**1.63**
	Howell Garage														
36	Reset Boiler Water Supply Temperature	10	$ 1,798	0	$ -	0	8,439	$ 10,971				$ 15,697	$ -	0.11
37	Reduce Water Tower Boiler Water Temperature	10	$ 899	0	$ -	0	2,219	$ 2,885				$ 4,127	$ -	0.22
38	Lighting Controls	15	$ 8,652	47,423	$ 5,691	0	0	$ -				$ 6,592	$ 1,190	1.13
39	Install Variable Frequincy Drives (VFDs)	10	$ 4,110	10,879	$ 1,305	0	0	$ -				$ 1,512	$ 775	2.21
40	Lighting Retrofits	20	$ 170,287	526,940	$ 63,233	60.2	-4,495	$ (5,844)				$ 64,884	$ 4,100	2.56
41	Replace Packaged Rooftop AC Units	20	$ 66,767	24,872	$ 2,985	10	0	$ -				$ 3,457	$ 3,184	18.39
42	Premium Efficiency Motors	15	$ 110,792	37,073	$ 4,449	6.5	0	$ -				$ 5,153	$ 7,039	20.13
	Subtotal		**$ 363,305**	**647,187**	**$ 77,662**	**77**	**6,163**	**$ 8,012**	**0**	**$ -**	**$ -**	**$ 101,422**	**$ 16,288**	**3.42**
	Market Street Garage														
43	Lighting Retrofits	20	$ 19,996	31,561	$ 3,787	4.5	-337	$ (438)				$ 3,551	$ 3,050	4.77
44	Lighting Controls	15	$ 944	4,198	$ 504	0	0	$ -				$ 546	$ 140	1.47
45	Repair Compressed Air Leaks	20	$ 1,750	104,507	$ 12,541	11.9	0	$ -				$ 13,586	$ -	0.13
46	Duct OA to Compressor Intake	20	$ 580	22,426	$ 2,691	2.6	0	$ -				$ 2,915	$ -	0.20
47	Reduce Compressed Air Line Pressure	20	$ -	30,748	$ 3,690	3.5	0	$ -				$ 3,997	$ -	0.00
	Subtotal		**$ 23,270**	**193,440**	**$ 23,213**	**23**	**-337**	**$ (438)**	**0**	**$ -**	**$ -**	**$ 24,595**	**$ 3,190**	**0.82**
	Meadowlands Maintanance Garage														
48	Lighting Retrofits	20	$ 170,287	481,474	$ 57,777	71	-4,107	$ (5,339)				$ 75,608	$ 27,730	1.89
49	Lighting Controls	15	$ 8,652	81,096	$ 9,732	0	0	$ -				$ 13,786	$ 1,260	0.54
50	Premium Efficiency Motors	15	$ 28,250	8,418	$ 1,010	2	0	$ -				$ 1,431	$ 1,350	18.80
	Subtotal		**$ 207,189**	**570,988**	**$ 68,519**	**73**	**-4107**	**$ (5,339)**	**0**	**$ -**	**$ -**	**$ 90,825**	**$ 30,340**	**1.95**
	Meadows Maintanance Complex														
51	Lighting Retrofits	20	$ 141,725	2,697,713	$ 323,726	344	-28,828	$ (37,476)				$ 251,488	$ 131,018	0.04
52	Lighting Controls	15	$ 4,012	301,414	$ 36,170	0	0	$ -				$ 33,156	$ 460	0.11
53	Install Heat Recovery Units in Locomotive Shop	15	$ 1,918,800	0	$ -	0	50,381	$ 65,495				$ 79,098	$ -	24.26
	Subtotal		**$ 2,064,537**	**2,999,127**	**$ 359,895**	**344**	**21553**	**$ 28,019**	**0**	**$ -**	**$ -**	**$ 363,742**	**$ 131,478**	**5.31**
	Newark Bus Maintanance Center Ironbound Garage														
54	Lighting Retrofits	20	$ 309,654	2,023,309	$ 242,797	270	-21,586	$ (28,062)				$ 185,868	$ 89,065	1.19
55	Lighting Controls	15	$ 5,192	302,786	$ 36,334	0	0	$ -				$ 33,307	$ 660	0.14
56	Replace Packaged Units	15	$ 58,050	32,988	$ 3,959	100.2	0	$ -				$ 3,629	$ 2,963	15.18
	Subtotal		**$ 372,896**	**2,359,083**	**$ 283,090**	**370**	**-21586**	**$ (28,062)**	**0**	**$ -**	**$ -**	**$ 222,804**	**$ 92,688**	**1.26**

	Newton													
57	Lighting Retrofits	20	$ 198,786	454,435	$ 54,532	13.38	-3,876	$ (5,039)				$ 55,956	$ 18,500	3.22
58	Lighting Controls	15	$ 16,810	33,749	$ 4,050	0	0	$ -				$ 4,691	$ 2,170	3.12
59	Install Variable Frequincy Drives (VFDs)	10	$ 8,496	45,181	$ 5,422	6.8	0	$ -				$ 6,280	$ 2,825	0.90
60	Premium Efficiency Motors	15	$ 32,192	60,030	$ 7,204	0	0	$ -				$ 8,344	$ 2,113	3.60
61	Reset Boiler Water Supply Temperature	10	$ 1,798	0	$ -	0	2,532	$ 3,292				$ 4,710	$ -	0.38
62	Replace Constant Volume AC Unit	20	$ 6,000	4,760	$ 571	1.7	0	$ -				$ 662	$ 460	8.37
63	Replace Reciprocating Chillers	20	$ 110,000	85,200	$ 10,224	42.6	0	$ -				$ 11,843	$ 2,860	9.05
	Subtotal		**$ 374,082**	**683,355**	**$ 82,003**	**64**	**-1,344**	**$ (1,747)**	**0**	**$ -**	**$ -**	**$ 92,486**	**$ 28,928**	**3.73**
	Oradell Bus Maintanance Garage													
64	Lighting Retrofits	20	$ 62,313	215,222	$ 25,827	30	-2,298	$ (2,987)				$ 22,942	$ 10,400	2.26
65	Lighting Controls	15	$ 6,360	46,759	$ 5,611	0	0	$ -				$ 5,798	$ 820	0.96
	Subtotal		**$ 68,673**	**261,981**	**$ 31,438**	**30**	**-2298**	**$ (2,987)**	**0**	**$ -**	**$ -**	**$ 28,740**	**$ 11,220**	**3.22**
	Orange Garage													
66	Lighting Retrofits	20	$ 55,769	285,271	$ 34,233	34.3	-3,043	$ (3,956)				$ 32,441	$ 3,790	1.60
67	Lighting Controls	15	$ 5,428	104,053	$ 12,486	0	0	$ -				$ 13,631	$ 770	0.34
	Subtotal		**$ 61,197**	**389,324**	**$ 46,719**	**34.3**	**-3043**	**$ (3,956)**	**0**	**$ -**	**$ -**	**$ 46,072**	**$ 4,560**	**1.94**
	Rail Facility Hoboken													
68	Lighting Retrofits	20	$ 113,878	288,593	$ 34,631	74.9	-3,078	$ (4,001)				$ 32,242	$ 12,710	3.14
69	Lighting Controls	15	$ 2,360	11,170	$ 1,340	0	0	$ -				$ 1,441	$ 350	1.39
	Subtotal		**$ 116,238**	**299,763**	**$ 35,972**	**74.9**	**-3078**	**$ (4,001)**	**0**	**$ -**	**$ -**	**$ 33,683**	**$ 13,060**	**3.06**
	Washington Township Garage													
70	Lighting Retrofits	20	$ 174,750	684,498	$ 82,140	74.3	-5,839	$ (7,591)				$ 84,285	$ 43,000	1.56
71	Lighting Controls	15	$ 7,475	18,172	$ 2,181	0	0	$ -				$ 2,526	$ 915	2.60
72	Install Variable Frequincy Drives (VFDs)	10	$ 7,896	38,725	$ 4,647	5.8	0	$ -				$ 5,383	$ 2,225	1.05
73	Premium Efficiency Motors	15	$ 27,993	61,999	$ 7,440	0	0	$ -				$ 8,618	$ 1,823	3.04
74	Reset Boiler Water Supply Temperature	10	$ 3,856	0	$ -	0	10,588	$ 13,764				$ 19,694	$ -	0.20
75	Replace Constant Volume AC Unit	20	$ 20,450	12,000	$ 1,440	4.8	0	$ -				$ 1,668	$ 1,288	11.49
	Subtotal		**$ 242,420**	**815,394**	**$ 97,847**	**85**	**4749**	**$ 6,174**	**0**	**$ -**	**$ -**	**$ 122,174**	**$ 49,251**	**1.58**
	Wayne Garage													
76	Lighting Retrofits	20	$ 137,940	248,368	$ 29,804	29	-2,119	$ (2,755)				$ 25,789	$ 18,060	4.65
77	Lighting Controls	15	$ 2,124	9,568	$ 1,148	0	0	$ -				$ 1,129	$ 270	1.64
	Subtotal		**$ 140,064**	**257,936**	**$ 30,952**	**29**	**-2119**	**$ (2,755)**	**0**	**$ -**	**$ -**	**$ 26,918**	**$ 18,330**	**4.52**
	Secaucus Transfer Station													
78	Shut Down Escalators	10	$ -	475,230	$ 57,028	91		$ -				$ 62,730	$ -	0.00
79	Delamp NJT Offices	10	$ -	175,200	$ 21,024	20		$ -				$ 23,126	$ -	0.00
80	Utility Data Monitering	10	$ 24,000	166,000	$ 19,920	30		$ -				$ 21,912	$ -	1.10
81	Install Escalator Controls	10	$ 93,000	271,560	$ 32,587	31		$ -				$ 35,846	$ 700	2.57
82	BAS Revisions	10	$ 88,400	80,000	$ 9,600	40		$ -				$ 10,560	$ -	8.37
	Subtotal		**$ 205,400**	**1,167,990**	**$ 140,159**	**212**	**0**	**$ -**	**0**	**$ -**	**$ -**	**$ 154,174**	**$ 700**	**1.33**

Total		$ 5,692,829	14,338,639	$ 1,720,637	1787.88	56608	$ 73,590	41910.072	$ 106,360	$ 3,200	$ 1,972,987	$ 539,298	**2.61**
Average		$ 271,087	682,792	$ 81,935	85	2,696	$ 3,504	1,996	$ 5,065	$ 152	$ 93,952	$ 25,681	2.35

Appendix A.2
NJ TRANSIT
Total Energy Project
Project Economics with Solar Project

		COSTS		BENEFITS			
	Year	Capital Investment	Rebates	ECM Utility Revenues ($)	Solar Net Revenues	Net Cashflow	Cumulative Cashflow
0	2010	$5,692,829	$539,298	0	0	-$5,153,531	-$5,153,531
1	2011	$0		$1,900,587	$385,657	$2,286,244	-$2,867,287
2	2012	$0		$1,904,952	$622,873	$2,527,825	-$339,462
3	2013	$0		$1,998,908	$654,782	$2,653,690	$2,314,228
4	2014	$0		$2,093,935	$605,651	$2,699,586	$5,013,814
5	2015	$0		$2,191,625	$747,174	$2,938,799	$7,952,613
6	2016	$0		$2,254,187	$2,018,698	$4,272,885	$12,225,498
7	2017	$0		$2,283,833	$2,044,375	$4,328,208	$16,553,706
8	2018	$0		$2,336,675	$2,167,029	$4,503,704	$21,057,410
9	2019	$0		$2,420,301	$2,237,721	$4,658,022	$25,715,432
10	2020	$0		$2,502,550	$2,321,099	$4,823,650	$30,539,082
11	2021	$0		$356,496	$2,381,172	$2,737,668	$33,276,749
12	2022	$0		$369,309	$2,082,132	$2,451,442	$35,728,191
13	2023	$0		$382,103	$2,062,363	$2,444,466	$38,172,657
14	2024	$0		$395,508	$2,124,871	$2,520,379	$40,693,036
15	2025	$0		$409,211	$2,188,191	$2,597,402	$33,136,484
16	2026	$0		$184,894	$514,136	$699,030	$33,975,779
17	2027	$0		$190,351	$491,496	$681,847	$36,410,038
18	2028	$0		$195,984	$270,091	$466,076	$38,638,732
19	2029	$0		$201,800	$277,586	$479,387	$41,172,422
20	2030	$0		$207,804	$285,344	$493,148	$33,629,632
TOTAL		$5,692,829		$24,781,014	$26,482,442	$46,109,925	
NPV				$17,840,845	$16,441,909	$29,351,145	

IRR assumes that projects are completed within one year.

IRR 52.5%

Appendix A.3
NJ TRANSIT
BAS Revisions
Project Economics

		COSTS		BENEFITS		
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$101,800	$0	$0	-$101,800	-$101,800
1	2011	$0		$23,197	$23,197	-$78,603
2	2012	$0		$23,283	$23,283	-$55,320
3	2013	$0		$24,413	$24,413	-$30,907
4	2014	$0		$25,557	$25,557	-$5,350
5	2015	$0		$26,733	$26,733	$21,383
6	2016	$0		$27,501	$27,501	$48,884
7	2017	$0		$27,887	$27,887	$76,771
8	2018	$0		$28,545	$28,545	$105,316
9	2019	$0		$29,562	$29,562	$134,878
10	2020	$0		$30,565	$30,565	$165,443
11	2021	$0		$31,760	$31,760	$197,203
12	2022	$0		$32,974	$32,974	$230,177
13	2023	$0		$34,149	$34,149	$264,326
14	2024	$0		$35,396	$35,396	$299,723
15	2025	$0		$36,658	$36,658	$202,101
16	2026	$0		$0	$0	$197,203
17	2027	$0		$0	$0	$230,177
18	2028	$0		$0	$0	$264,326
19	2029	$0		$0	$0	$299,723
20	2030	$0		$0	$0	$202,101
TOTAL		$101,800		$438,181	$336,381	
NPV				$292,240	$194,823	

IRR assumes that projects are completed within one year.

IRR 24.5%

Appendix A.4
NJ TRANSIT
Computer Auto Shutdown
Project Economics

		COSTS	BENEFITS			
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$24,000	$0	$0	-$24,000	-$24,000
1	2011	$0		$12,176	$12,176	-$11,824
2	2012	$0		$12,164	$12,164	$341
3	2013	$0		$12,785	$12,785	$13,125
4	2014	$0		$13,411	$13,411	$26,536
5	2015	$0		$14,055	$14,055	$40,591
6	2016	$0		$14,448	$14,448	$55,039
7	2017	$0		$14,607	$14,607	$69,647
8	2018	$0		$14,929	$14,929	$84,575
9	2019	$0		$15,466	$15,466	$100,041
10	2020	$0		$15,992	$15,992	$116,033
11	2021	$0		$0	$0	$116,033
12	2022	$0		$0	$0	$116,033
13	2023	$0		$0	$0	$116,033
14	2024	$0		$0	$0	$116,033
15	2025	$0		$0	$0	$116,033
16	2026	$0		$0	$0	$116,033
17	2027	$0		$0	$0	$116,033
18	2028	$0		$0	$0	$116,033
19	2029	$0		$0	$0	$116,033
20	2030	$0		$0	$0	$116,033
TOTAL		$24,000		$140,033	$116,033	
NPV				$104,832	$81,866	

IRR assumes that projects are completed within one year.

IRR 52.5%

Appendix A.5
NJ TRANSIT
Control Bay A and Bay B Exhaust Fan
Project Economics

		COSTS	BENEFITS			
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$118,560	$0	$0	-$118,560	-$118,560
1	2011	$0		$77,955	$77,955	-$40,605
2	2012	$0		$80,400	$80,400	$39,795
3	2013	$0		$83,340	$83,340	$123,135
4	2014	$0		$86,372	$86,372	$209,507
5	2015	$0		$89,508	$89,508	$299,015
6	2016	$0		$92,577	$92,577	$391,593
7	2017	$0		$95,594	$95,594	$487,186
8	2018	$0		$98,817	$98,817	$586,003
9	2019	$0		$102,285	$102,285	$688,288
10	2020	$0		$105,855	$105,855	$794,142
11	2021	$0		$0	$0	$794,142
12	2022	$0		$0	$0	$794,142
13	2023	$0		$0	$0	$794,142
14	2024	$0		$0	$0	$794,142
15	2025	$0		$0	$0	$794,142
16	2026	$0		$0	$0	$794,142
17	2027	$0		$0	$0	$794,142
18	2028	$0		$0	$0	$794,142
19	2029	$0		$0	$0	$794,142
20	2030	$0		$0	$0	$794,142
TOTAL		$118,560		$912,702	$794,142	
NPV				$682,602	$569,148	

IRR assumes that projects are completed within one year.

IRR 68.7%

Appendix A.6
NJ TRANSIT
Domestic Hot Water Renovation
Project Economics

		COSTS	BENEFITS			
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$10,400	$200	$0	-$10,200	-$10,200
1	2011	$0		$9,186	$9,186	-$1,014
2	2012	$0		$9,408	$9,408	$8,394
3	2013	$0		$9,770	$9,770	$18,164
4	2014	$0		$10,141	$10,141	$28,305
5	2015	$0		$10,524	$10,524	$38,829
6	2016	$0		$10,863	$10,863	$49,692
7	2017	$0		$11,161	$11,161	$60,853
8	2018	$0		$11,502	$11,502	$72,355
9	2019	$0		$11,898	$11,898	$84,253
10	2020	$0		$12,301	$12,301	$96,554
11	2021	$0		$0	$0	$96,554
12	2022	$0		$0	$0	$96,554
13	2023	$0		$0	$0	$96,554
14	2024	$0		$0	$0	$96,554
15	2025	$0		$0	$0	$96,554
16	2026	$0		$0	$0	$96,554
17	2027	$0		$0	$0	$96,554
18	2028	$0		$0	$0	$96,554
19	2029	$0		$0	$0	$96,554
20	2030	$0		$0	$0	$96,554
TOTAL		$10,400		$106,754	$96,554	
NPV				$79,880	$70,119	

IRR assumes that projects are completed within one year.

IRR 93.0%

Appendix A.7
NJ TRANSIT
Exhaust Air Heat Recovery
Project Economics

		COSTS	BENEFITS			
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$44,500	$0	$0	-$44,500	-$44,500
1	2011	$0		$8,332	$8,332	-$36,168
2	2012	$0		$8,697	$8,697	-$27,470
3	2013	$0		$8,969	$8,969	-$18,501
4	2014	$0		$9,253	$9,253	-$9,248
5	2015	$0		$9,548	$9,548	$300
6	2016	$0		$9,899	$9,899	$10,199
7	2017	$0		$10,303	$10,303	$20,502
8	2018	$0		$10,695	$10,695	$31,197
9	2019	$0		$11,067	$11,067	$42,264
10	2020	$0		$11,457	$11,457	$53,721
11	2021	$0		$11,845	$11,845	$65,566
12	2022	$0		$12,248	$12,248	$77,814
13	2023	$0		$12,674	$12,674	$90,488
14	2024	$0		$13,112	$13,112	$103,600
15	2025	$0		$13,567	$13,567	$67,288
16	2026	$0		$14,062	$14,062	$79,627
17	2027	$0		$14,560	$14,560	$92,374
18	2028	$0		$15,077	$15,077	$105,565
19	2029	$0		$15,611	$15,611	$119,211
20	2030	$0		$16,165	$16,165	$83,454
TOTAL		$44,500		$237,142	$192,642	
NPV				$140,321	$97,738	

IRR assumes that projects are completed within one year.

IRR 21.6%

Appendix A.8
NJ TRANSIT
Heat Recovery from Bays A,B and C
Project Economics

		COSTS	BENEFITS			
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$291,551	$0	$0	-$291,551	-$291,551
1	2011	$0		$59,441	$59,441	-$232,110
2	2012	$0		$61,961	$61,961	-$170,148
3	2013	$0		$63,935	$63,935	-$106,213
4	2014	$0		$65,993	$65,993	-$40,220
5	2015	$0		$68,128	$68,128	$27,908
6	2016	$0		$70,611	$70,611	$98,519
7	2017	$0		$73,430	$73,430	$171,949
8	2018	$0		$76,191	$76,191	$248,140
9	2019	$0		$78,843	$78,843	$326,983
10	2020	$0		$81,618	$81,618	$408,600
11	2021	$0		$84,394	$84,394	$492,994
12	2022	$0		$87,281	$87,281	$580,275
13	2023	$0		$90,319	$90,319	$670,594
14	2024	$0		$93,444	$93,444	$764,037
15	2025	$0		$96,696	$96,696	$505,296
16	2026	$0		$0	$0	$492,994
17	2027	$0		$0	$0	$580,275
18	2028	$0		$0	$0	$670,594
19	2029	$0		$0	$0	$764,037
20	2030	$0		$0	$0	$505,296
TOTAL		$291,551		$1,152,284	$860,733	
NPV				$767,348	$488,351	

IRR assumes that projects are completed within one year.

IRR 22.3%

Appendix A.9
NJ TRANSIT
Install Escalator Controls
Project Economics

	Year	COSTS Capital Investment	Rebates	BENEFITS Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$93,000	$700	$0	-$92,300	-$92,300
1	2011	$0		$32,587	$32,587	-$59,713
2	2012	$0		$32,555	$32,555	-$27,158
3	2013	$0		$34,215	$34,215	$7,057
4	2014	$0		$35,891	$35,891	$42,948
5	2015	$0		$37,614	$37,614	$80,562
6	2016	$0		$38,667	$38,667	$119,230
7	2017	$0		$39,093	$39,093	$158,323
8	2018	$0		$39,953	$39,953	$198,275
9	2019	$0		$41,391	$41,391	$239,666
10	2020	$0		$42,798	$42,798	$282,465
11	2021	$0		$0	$0	$282,465
12	2022	$0		$0	$0	$282,465
13	2023	$0		$0	$0	$282,465
14	2024	$0		$0	$0	$282,465
15	2025	$0		$0	$0	$282,465
16	2026	$0		$0	$0	$282,465
17	2027	$0		$0	$0	$282,465
18	2028	$0		$0	$0	$282,465
19	2029	$0		$0	$0	$282,465
20	2030	$0		$0	$0	$282,465

TOTAL	$93,000		$374,765	$282,465
NPV			$280,558	$192,232

IRR assumes that projects are completed within one year.

IRR 36.0%

Appendix A.10
NJ TRANSIT
Install Heat Recovery Units in Locomotive Shop
Project Economics

		COSTS	BENEFITS			
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$1,918,800	$0	$0	-$1,918,800	-$1,918,800
1	2011	$0		$65,495	$65,495	-$1,853,305
2	2012	$0		$67,788	$67,788	-$1,785,517
3	2013	$0		$70,160	$70,160	-$1,715,357
4	2014	$0		$72,616	$72,616	-$1,642,741
5	2015	$0		$75,157	$75,157	-$1,567,584
6	2016	$0		$77,788	$77,788	-$1,489,796
7	2017	$0		$80,510	$80,510	-$1,409,285
8	2018	$0		$83,328	$83,328	-$1,325,957
9	2019	$0		$86,245	$86,245	-$1,239,712
10	2020	$0		$89,263	$89,263	-$1,150,449
11	2021	$0		$0	$0	-$1,150,449
12	2022	$0		$0	$0	-$1,150,449
13	2023	$0		$0	$0	-$1,150,449
14	2024	$0		$0	$0	-$1,150,449
15	2025	$0		$0	$0	-$1,150,449
16	2026	$0		$0	$0	-$1,150,449
17	2027	$0		$0	$0	-$1,150,449
18	2028	$0		$0	$0	-$1,150,449
19	2029	$0		$0	$0	-$1,150,449
20	2030	$0		$0	$0	-$1,150,449
TOTAL		$1,918,800		$768,351	-$1,150,449	
NPV				$574,581	-$1,261,591	

IRR assumes that projects are completed within one year.

IRR -13.4%

Appendix A.11
NJ TRANSIT
Install Natural Gas Line on Dual-Fuel Boilers
Project Economics

		COSTS	BENEFITS			
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$15,000	$0	$0	-$15,000	-$15,000
1	2011	$0		$59,627	$59,627	$44,627
2	2012	$0		$61,514	$61,514	$106,141
3	2013	$0		$63,461	$63,461	$169,602
4	2014	$0		$65,468	$65,468	$235,070
5	2015	$0		$67,539	$67,539	$302,609
6	2016	$0		$69,675	$69,675	$372,285
7	2017	$0		$71,879	$71,879	$444,163
8	2018	$0		$74,151	$74,151	$518,315
9	2019	$0		$76,496	$76,496	$594,810
10	2020	$0		$78,914	$78,914	$673,724
11	2021	$0		$81,408	$81,408	$755,132
12	2022	$0		$83,980	$83,980	$839,112
13	2023	$0		$86,634	$86,634	$925,746
14	2024	$0		$89,371	$89,371	$1,015,117
15	2025	$0		$92,194	$92,194	$765,918
16	2026	$0		$95,105	$95,105	$850,237
17	2027	$0		$98,109	$98,109	$937,221
18	2028	$0		$101,206	$101,206	$1,026,953
19	2029	$0		$104,401	$104,401	$1,119,518
20	2030	$0		$107,696	$107,696	$873,614
TOTAL		$15,000		$1,628,828	$1,613,828	
NPV				$968,883	$954,529	

IRR assumes that projects are completed within one year.

IRR 400.7%

Appendix A.12
NJ TRANSIT
Install Variable Frequency Drives (VFDs)
Project Economics

		COSTS		BENEFITS		
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$25,062	$7,800	$0	-$17,262	-$17,262
1	2011	$0		$13,803	$13,803	-$3,459
2	2012	$0		$13,790	$13,790	$10,331
3	2013	$0		$14,493	$14,493	$24,824
4	2014	$0		$15,203	$15,203	$40,027
5	2015	$0		$15,933	$15,933	$55,960
6	2016	$0		$16,379	$16,379	$72,339
7	2017	$0		$16,559	$16,559	$88,898
8	2018	$0		$16,923	$16,923	$105,822
9	2019	$0		$17,533	$17,533	$123,354
10	2020	$0		$18,129	$18,129	$141,483
11	2021	$0		$18,854	$18,854	$160,337
12	2022	$0		$19,589	$19,589	$179,926
13	2023	$0		$20,294	$20,294	$200,221
14	2024	$0		$21,045	$21,045	$221,266
15	2025	$0		$21,803	$21,803	$163,286
16	2026	$0		$0	$0	$160,337
17	2027	$0		$0	$0	$179,926
18	2028	$0		$0	$0	$200,221
19	2029	$0		$0	$0	$221,266
20	2030	$0		$0	$0	$163,286
TOTAL		$25,062		$260,331	$243,069	
NPV				$173,625	$157,107	

IRR assumes that projects are completed within one year.

IRR 82.4%

Appendix A.13
NJ TRANSIT
Lighting Controls
Project Economics

		COSTS	BENEFITS			
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$113,408	$14,490	$0	-$98,918	-$98,918
1	2011	$0		$130,140	$130,140	$31,222
2	2012	$0		$130,010	$130,010	$161,233
3	2013	$0		$136,641	$136,641	$297,874
4	2014	$0		$143,336	$143,336	$441,210
5	2015	$0		$150,216	$150,216	$591,426
6	2016	$0		$154,422	$154,422	$745,849
7	2017	$0		$156,121	$156,121	$901,970
8	2018	$0		$159,556	$159,556	$1,061,526
9	2019	$0		$165,300	$165,300	$1,226,826
10	2020	$0		$170,920	$170,920	$1,397,746
11	2021	$0		$0	$0	$1,397,746
12	2022	$0		$0	$0	$1,397,746
13	2023	$0		$0	$0	$1,397,746
14	2024	$0		$0	$0	$1,397,746
15	2025	$0		$0	$0	$1,397,746
16	2026	$0		$0	$0	$1,397,746
17	2027	$0		$0	$0	$1,397,746
18	2028	$0		$0	$0	$1,397,746
19	2029	$0		$0	$0	$1,397,746
20	2030	$0		$0	$0	$1,397,746
TOTAL		$113,408		$1,496,664	$1,397,746	
NPV				$1,120,437	$1,025,779	

IRR assumes that projects are completed within one year.

IRR 133.6%

Appendix A.14
NJ TRANSIT
Lighting Retrofits
Project Economics

		COSTS	BENEFITS			
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$2,278,003	$480,153	$0	-$1,797,850	-$1,797,850
1	2011	$0		$1,185,517	$1,185,517	-$612,333
2	2012	$0		$1,179,352	$1,179,352	$567,019
3	2013	$0		$1,241,789	$1,241,789	$1,808,808
4	2014	$0		$1,304,712	$1,304,712	$3,113,520
5	2015	$0		$1,369,332	$1,369,332	$4,482,851
6	2016	$0		$1,406,562	$1,406,562	$5,889,413
7	2017	$0		$1,418,091	$1,418,091	$7,307,503
8	2018	$0		$1,447,078	$1,447,078	$8,754,582
9	2019	$0		$1,499,349	$1,499,349	$10,253,931
10	2020	$0		$1,550,145	$1,550,145	$11,804,075
11	2021	$0		$0	$0	$11,804,075
12	2022	$0		$0	$0	$11,804,075
13	2023	$0		$0	$0	$11,804,075
14	2024	$0		$0	$0	$11,804,075
15	2025	$0		$0	$0	$11,804,075
16	2026	$0		$0	$0	$11,804,075
17	2027	$0		$0	$0	$11,804,075
18	2028	$0		$0	$0	$11,804,075
19	2029	$0		$0	$0	$11,804,075
20	2030	$0		$0	$0	$11,804,075
TOTAL		$2,278,003		$13,601,925	$11,804,075	
NPV				$10,184,039	$8,463,609	

IRR assumes that projects are completed within one year.

IRR 68.0%

Appendix A.15
NJ TRANSIT
Premium Efficiency Motors
Project Economics

		COSTS		BENEFITS		
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$266,520	$16,873	$0	-$249,647	-$249,647
1	2011	$0		$25,989	$25,989	-$223,658
2	2012	$0		$25,963	$25,963	-$197,695
3	2013	$0		$27,287	$27,287	-$170,409
4	2014	$0		$28,624	$28,624	-$141,785
5	2015	$0		$29,998	$29,998	-$111,787
6	2016	$0		$30,838	$30,838	-$80,949
7	2017	$0		$31,177	$31,177	-$49,772
8	2018	$0		$31,863	$31,863	-$17,909
9	2019	$0		$33,010	$33,010	$15,101
10	2020	$0		$34,132	$34,132	$49,233
11	2021	$0		$35,498	$35,498	$84,731
12	2022	$0		$36,882	$36,882	$121,613
13	2023	$0		$38,210	$38,210	$159,823
14	2024	$0		$39,624	$39,624	$199,446
15	2025	$0		$41,050	$41,050	$90,283
16	2026	$0		$0	$0	$84,731
17	2027	$0		$0	$0	$121,613
18	2028	$0		$0	$0	$159,823
19	2029	$0		$0	$0	$199,446
20	2030	$0		$0	$0	$90,283
TOTAL		$266,520		$490,143	$240,496	
NPV				$326,896	$88,000	

IRR assumes that projects are completed within one year.

IRR 9.0%

Appendix A.16
NJ TRANSIT
Reduce Boiler Water Supply Temperature
Project Economics

		COSTS	BENEFITS			
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$1,384	$0	$0	-$1,384	-$1,384
1	2011	$0		$185	$185	-$1,199
2	2012	$0		$191	$191	-$1,008
3	2013	$0		$198	$198	-$811
4	2014	$0		$205	$205	-$606
5	2015	$0		$212	$212	-$394
6	2016	$0		$219	$219	-$175
7	2017	$0		$227	$227	$52
8	2018	$0		$235	$235	$287
9	2019	$0		$243	$243	$530
10	2020	$0		$252	$252	$782
11	2021	$0		$0	$0	$782
12	2022	$0		$0	$0	$782
13	2023	$0		$0	$0	$782
14	2024	$0		$0	$0	$782
15	2025	$0		$0	$0	$782
16	2026	$0		$0	$0	$782
17	2027	$0		$0	$0	$782
18	2028	$0		$0	$0	$782
19	2029	$0		$0	$0	$782
20	2030	$0		$0	$0	$782
TOTAL		$1,384		$2,166	$782	
NPV				$1,619	$295	

IRR assumes that projects are completed within one year.

IRR 8.6%

Appendix A.17
NJ TRANSIT
Replace Constant Volume AC Unit
Project Economics

		COSTS	BENEFITS			
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$26,450	$1,748	$0	-$24,702	-$24,702
1	2011	$0		$2,011	$3,759	-$20,943
2	2012	$0		$2,009	$2,009	-$18,934
3	2013	$0		$2,112	$2,112	-$16,822
4	2014	$0		$2,215	$2,215	-$14,607
5	2015	$0		$2,321	$2,321	-$12,285
6	2016	$0		$2,386	$2,386	-$9,899
7	2017	$0		$2,413	$2,413	-$7,486
8	2018	$0		$2,466	$2,466	-$5,020
9	2019	$0		$2,555	$2,555	-$2,466
10	2020	$0		$2,641	$2,641	$176
11	2021	$0		$2,747	$2,747	$2,923
12	2022	$0		$2,854	$2,854	$5,777
13	2023	$0		$2,957	$2,957	$8,734
14	2024	$0		$3,066	$3,066	$11,800
15	2025	$0		$3,177	$3,177	$3,352
16	2026	$0		$0	$0	$2,923
17	2027	$0		$0	$0	$5,777
18	2028	$0		$0	$0	$8,734
19	2029	$0		$0	$0	$11,800
20	2030	$0		$0	$0	$3,352
TOTAL		$26,450		$37,931	$14,977	
NPV				$25,298	$3,260	

IRR assumes that projects are completed within one year.

IRR	**6.4%**

Appendix A.18
NJ TRANSIT
Replace Packaged Rooftop AC Units
Project Economics

		COSTS	BENEFITS			
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$135,866	$5,951	$0	-$129,915	-$129,915
1	2011	$0		$5,314	$11,265	-$118,650
2	2012	$0		$5,309	$5,309	-$113,340
3	2013	$0		$5,580	$5,580	-$107,761
4	2014	$0		$5,853	$5,853	-$101,907
5	2015	$0		$6,134	$6,134	-$95,773
6	2016	$0		$6,306	$6,306	-$89,467
7	2017	$0		$6,375	$6,375	-$83,092
8	2018	$0		$6,516	$6,516	-$76,576
9	2019	$0		$6,750	$6,750	-$69,826
10	2020	$0		$6,980	$6,980	-$62,846
11	2021	$0		$7,259	$7,259	-$55,587
12	2022	$0		$7,542	$7,542	-$48,045
13	2023	$0		$7,814	$7,814	-$40,232
14	2024	$0		$8,103	$8,103	-$32,129
15	2025	$0		$8,394	$8,394	-$54,452
16	2026	$0		$0	$0	-$55,587
17	2027	$0		$0	$0	-$48,045
18	2028	$0		$0	$0	-$40,232
19	2029	$0		$0	$0	-$32,129
20	2030	$0		$0	$0	-$54,452
TOTAL		$135,866		$100,229	-$23,735	
NPV				$66,847	-$52,024	

IRR assumes that projects are completed within one year.

IRR -2.4%

Appendix A.19
NJ TRANSIT
Replace Packaged Units
Project Economics

		COSTS	BENEFITS			
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$58,050	$2,963	$0	-$55,087	-$55,087
1	2011	$0		$3,959	$6,922	-$48,165
2	2012	$0		$3,955	$3,955	-$44,211
3	2013	$0		$4,156	$4,156	-$40,055
4	2014	$0		$4,360	$4,360	-$35,695
5	2015	$0		$4,569	$4,569	-$31,125
6	2016	$0		$4,697	$4,697	-$26,428
7	2017	$0		$4,749	$4,749	-$21,679
8	2018	$0		$4,853	$4,853	-$16,826
9	2019	$0		$5,028	$5,028	-$11,798
10	2020	$0		$5,199	$5,199	-$6,599
11	2021	$0		$5,407	$5,407	-$1,192
12	2022	$0		$5,618	$5,618	$4,426
13	2023	$0		$5,820	$5,820	$10,246
14	2024	$0		$6,035	$6,035	$16,281
15	2025	$0		$6,253	$6,253	-$346
16	2026	$0		$0	$0	-$1,192
17	2027	$0		$0	$0	$4,426
18	2028	$0		$0	$0	$10,246
19	2029	$0		$0	$0	$16,281
20	2030	$0		$0	$0	-$346
TOTAL		$58,050		$74,658	$22,534	
NPV				$49,792	-$209	

IRR assumes that projects are completed within one year.

IRR 4.4%

Appendix A.20
NJ TRANSIT
Replace PTAC Units
Project Economics

		COSTS	BENEFITS			
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$5,394	$195	$0	-$5,199	-$5,199
1	2011	$0		$884	$884	-$4,315
2	2012	$0		$884	$884	-$3,431
3	2013	$0		$929	$929	-$2,503
4	2014	$0		$974	$974	-$1,528
5	2015	$0		$1,021	$1,021	-$508
6	2016	$0		$1,049	$1,049	$542
7	2017	$0		$1,061	$1,061	$1,603
8	2018	$0		$1,084	$1,084	$2,687
9	2019	$0		$1,123	$1,123	$3,810
10	2020	$0		$1,162	$1,162	$4,972
11	2021	$0		$1,208	$1,208	$6,180
12	2022	$0		$1,255	$1,255	$7,435
13	2023	$0		$1,300	$1,300	$8,735
14	2024	$0		$1,348	$1,348	$10,084
15	2025	$0		$1,397	$1,397	$6,369
16	2026	$0		$1,437	$1,437	$7,617
17	2027	$0		$1,485	$1,485	$8,920
18	2028	$0		$1,534	$1,534	$10,269
19	2029	$0		$1,585	$1,585	$11,668
20	2030	$0		$1,637	$1,637	$8,006
TOTAL		$5,394		$24,357	$19,158	
NPV				$14,448	$9,473	

IRR assumes that projects are completed within one year.

IRR 19.2%

Appendix A.21
NJ TRANSIT
Replace Reciprocating Chillers
Project Economics

		COSTS	BENEFITS			
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$110,000	$2,860	$0	-$107,140	-$107,140
1	2011	$0		$10,224	$10,224	-$96,916
2	2012	$0		$10,214	$10,214	-$86,702
3	2013	$0		$10,735	$10,735	-$75,968
4	2014	$0		$11,261	$11,261	-$64,707
5	2015	$0		$11,801	$11,801	-$52,906
6	2016	$0		$12,132	$12,132	-$40,774
7	2017	$0		$12,265	$12,265	-$28,509
8	2018	$0		$12,535	$12,535	-$15,974
9	2019	$0		$12,986	$12,986	-$2,988
10	2020	$0		$13,428	$13,428	$10,440
11	2021	$0		$13,965	$13,965	$24,405
12	2022	$0		$14,509	$14,509	$38,914
13	2023	$0		$15,032	$15,032	$53,946
14	2024	$0		$15,588	$15,588	$69,534
15	2025	$0		$16,149	$16,149	$26,589
16	2026	$0		$16,617	$16,617	$41,022
17	2027	$0		$17,166	$17,166	$56,080
18	2028	$0		$17,732	$17,732	$71,678
19	2029	$0		$18,317	$18,317	$87,851
20	2030	$0		$18,922	$18,922	$45,511
TOTAL		$110,000		$281,578	$174,438	
NPV				$167,024	$64,497	

IRR assumes that projects are completed within one year.

IRR	**10.1%**

Appendix A.22
NJ TRANSIT
Reset Boiler Water Supply Temperature
Project Economics

		COSTS	BENEFITS			
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$8,351	$0	$0	-$8,351	-$8,351
1	2011	$0		$28,202	$28,202	$19,851
2	2012	$0		$29,189	$29,189	$49,040
3	2013	$0		$30,211	$30,211	$79,251
4	2014	$0		$31,268	$31,268	$110,520
5	2015	$0		$32,363	$32,363	$142,882
6	2016	$0		$33,495	$33,495	$176,378
7	2017	$0		$34,668	$34,668	$211,045
8	2018	$0		$35,881	$35,881	$246,926
9	2019	$0		$37,137	$37,137	$284,063
10	2020	$0		$38,437	$38,437	$322,500
11	2021	$0		$0	$0	$322,500
12	2022	$0		$0	$0	$322,500
13	2023	$0		$0	$0	$322,500
14	2024	$0		$0	$0	$322,500
15	2025	$0		$0	$0	$322,500
16	2026	$0		$0	$0	$322,500
17	2027	$0		$0	$0	$322,500
18	2028	$0		$0	$0	$322,500
19	2029	$0		$0	$0	$322,500
20	2030	$0		$0	$0	$322,500
TOTAL		$8,351		$330,851	$322,500	
NPV				$247,414	$239,423	

IRR assumes that projects are completed within one year.

IRR 341.2%

Appendix A.23
NJ TRANSIT
Utility Data Monitoring
Project Economics

		COSTS	BENEFITS			
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$24,000	$0	$0	-$24,000	-$24,000
1	2011	$0		$19,920	$19,920	-$4,080
2	2012	$0		$19,900	$19,900	$15,820
3	2013	$0		$20,915	$20,915	$36,735
4	2014	$0		$21,940	$21,940	$58,675
5	2015	$0		$22,993	$22,993	$81,668
6	2016	$0		$23,637	$23,637	$105,305
7	2017	$0		$23,897	$23,897	$129,201
8	2018	$0		$24,422	$24,422	$153,624
9	2019	$0		$25,302	$25,302	$178,925
10	2020	$0		$26,162	$26,162	$205,087
11	2021	$0		$0	$0	$205,087
12	2022	$0		$0	$0	$205,087
13	2023	$0		$0	$0	$205,087
14	2024	$0		$0	$0	$205,087
15	2025	$0		$0	$0	$205,087
16	2026	$0		$0	$0	$205,087
17	2027	$0		$0	$0	$205,087
18	2028	$0		$0	$0	$205,087
19	2029	$0		$0	$0	$205,087
20	2030	$0		$0	$0	$205,087
TOTAL		$24,000		$229,087	$205,087	
NPV				$171,500	$148,534	

IRR assumes that projects are completed within one year.

IRR 85.2%

Appendix A.24
NJ TRANSIT
VFDs for Heating-Only AHUs
Project Economics

		COSTS	BENEFITS			
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$17,171	$5,365	$0	-$11,806	-$11,806
1	2011	$0		$10,020	$10,020	-$1,786
2	2012	$0		$10,010	$10,010	$8,224
3	2013	$0		$10,520	$10,520	$18,744
4	2014	$0		$11,036	$11,036	$29,780
5	2015	$0		$11,566	$11,566	$41,346
6	2016	$0		$11,889	$11,889	$53,235
7	2017	$0		$12,020	$12,020	$65,255
8	2018	$0		$12,285	$12,285	$77,540
9	2019	$0		$12,727	$12,727	$90,267
10	2020	$0		$13,160	$13,160	$103,426
11	2021	$0		$13,686	$13,686	$117,112
12	2022	$0		$14,220	$14,220	$131,332
13	2023	$0		$14,732	$14,732	$146,064
14	2024	$0		$15,277	$15,277	$161,340
15	2025	$0		$15,827	$15,827	$119,253
16	2026	$0		$0	$0	$117,112
17	2027	$0		$0	$0	$131,332
18	2028	$0		$0	$0	$146,064
19	2029	$0		$0	$0	$161,340
20	2030	$0		$0	$0	$119,253
TOTAL		$17,171		$188,973	$177,167	
NPV				$126,034	$114,736	

IRR assumes that projects are completed within one year.

IRR	**87.3%**

Appendix A.25
NJ TRANSIT
Duct OA to Compressor Intake
Project Economics

		COSTS	BENEFITS			
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$1,160	$0	$0	-$1,160	-$1,160
1	2011	$0		$5,740	$5,740	$4,580
2	2012	$0		$5,734	$5,734	$10,313
3	2013	$0		$6,026	$6,026	$16,340
4	2014	$0		$6,322	$6,322	$22,661
5	2015	$0		$6,625	$6,625	$29,286
6	2016	$0		$6,811	$6,811	$36,097
7	2017	$0		$6,885	$6,885	$42,982
8	2018	$0		$7,037	$7,037	$50,019
9	2019	$0		$7,290	$7,290	$57,309
10	2020	$0		$7,538	$7,538	$64,848
11	2021	$0		$7,840	$7,840	$72,687
12	2022	$0		$8,145	$8,145	$80,833
13	2023	$0		$8,439	$8,439	$89,271
14	2024	$0		$8,751	$8,751	$98,022
15	2025	$0		$9,066	$9,066	$73,913
16	2026	$0		$0	$0	$72,687
17	2027	$0		$0	$0	$80,833
18	2028	$0		$0	$0	$89,271
19	2029	$0		$0	$0	$98,022
20	2030	$0		$0	$0	$73,913
TOTAL		$1,160		$108,248	$107,088	
NPV				$72,195	$71,085	

IRR assumes that projects are completed within one year.

IRR 495.6%

Appendix A.26
NJ TRANSIT
Reduce Water Tower Boiler Water Temperature
Project Economics

		COSTS	BENEFITS			
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$899	$0	$0	-$899	-$899
1	2011	$0		$2,885	$2,885	$1,986
2	2012	$0		$2,986	$2,986	$4,971
3	2013	$0		$3,090	$3,090	$8,062
4	2014	$0		$3,198	$3,198	$11,260
5	2015	$0		$3,310	$3,310	$14,570
6	2016	$0		$3,426	$3,426	$17,996
7	2017	$0		$3,546	$3,546	$21,542
8	2018	$0		$3,670	$3,670	$25,212
9	2019	$0		$3,799	$3,799	$29,011
10	2020	$0		$3,932	$3,932	$32,943
11	2021	$0		$0	$0	$32,943
12	2022	$0		$0	$0	$32,943
13	2023	$0		$0	$0	$32,943
14	2024	$0		$0	$0	$32,943
15	2025	$0		$0	$0	$32,943
16	2026	$0		$0	$0	$32,943
17	2027	$0		$0	$0	$32,943
18	2028	$0		$0	$0	$32,943
19	2029	$0		$0	$0	$32,943
20	2030	$0		$0	$0	$32,943
TOTAL		$899		$33,842	$32,943	
NPV				$25,307	$24,447	

IRR assumes that projects are completed within one year.

IRR 324.4%

Appendix A.27
NJ TRANSIT
Repair Compressed Air Leaks
Project Economics

		COSTS	BENEFITS			
	Year	Capital Investment	Rebates	Utility Revenues ($)	Net Cashflow	Cumulative Cashflow
0	2010	$3,500	$0	$0	-$3,500	-$3,500
1	2011	$0		$19,600	$19,600	$16,100
2	2012	$0		$19,580	$19,580	$35,680
3	2013	$0		$20,579	$20,579	$56,258
4	2014	$0		$21,587	$21,587	$77,845
5	2015	$0		$22,623	$22,623	$100,468
6	2016	$0		$23,257	$23,257	$123,725
7	2017	$0		$23,512	$23,512	$147,237
8	2018	$0		$24,030	$24,030	$171,267
9	2019	$0		$24,895	$24,895	$196,161
10	2020	$0		$25,741	$25,741	$221,903
11	2021	$0		$26,771	$26,771	$248,673
12	2022	$0		$27,815	$27,815	$276,488
13	2023	$0		$28,816	$28,816	$305,304
14	2024	$0		$29,882	$29,882	$335,187
15	2025	$0		$30,958	$30,958	$252,861
16	2026	$0		$0	$0	$248,673
17	2027	$0		$0	$0	$276,488
18	2028	$0		$0	$0	$305,304
19	2029	$0		$0	$0	$335,187
20	2030	$0		$0	$0	$252,861
TOTAL		$3,500		$369,645	$366,145	
NPV				$246,531	$243,182	

IRR assumes that projects are completed within one year.

IRR 560.7%

Appendix B
Gabel Associates
NJ Transit Solar Project
Project Economics
November 16, 2011

		COSTS			BENEFITS				
	Year	Capital Investment	Other Costs	O&M Costs	BPU Grant	Electric Savings	SREC Sales	Net Cashflow	Cumulative Cashflow
0	2011	$3,166,721			$3,166,721			$0	$0
1	2012	$0	$15,834	$14,107		$87,810	$133,934	$191,803	$191,803
2	2013	$0	$16,309	$14,530		$91,652	$124,102	$184,916	$376,719
3	2014	$0	$16,798	$14,966		$95,572	$174,035	$237,842	$614,561
4	2015	$0	$17,302	$15,415		$97,756	$244,904	$309,943	$924,504
5	2016	$0	$17,821	$15,878		$98,337	$290,446	$355,085	$1,279,589
6	2017	$0	$18,355	$16,354		$99,998	$266,136	$331,424	$1,611,013
7	2018	$0	$18,906	$16,845		$103,080	$243,686	$311,015	$1,922,028
8	2019	$0	$19,473	$17,350		$106,052	$226,303	$295,531	$2,217,559
9	2020	$0	$20,058	$17,871		$109,743	$217,129	$288,944	$2,506,503
10	2021	$0	$20,659	$18,407		$113,453	$208,842	$283,229	$2,789,732
11	2022	$0	$21,279	$18,959		$116,949	$203,817	$280,528	$3,070,261
12	2023	$0	$21,917	$19,528		$120,670	$199,629	$278,854	$3,349,115
13	2024	$0	$22,575	$20,114		$124,389	$195,478	$277,179	$3,626,294
14	2025	$0	$23,252	$20,717		$127,356	$192,148	$275,535	$3,901,829
15	2026	$0	$23,950	$21,338		$130,394	$188,846	$273,953	$4,175,782
16	2027	$0	$24,668	$21,979		$133,505	$15,529	$102,387	$4,278,169
17	2028	$0	$25,408	$22,638		$136,690	$15,451	$104,095	$4,382,264
18	2029	$0	$26,171	$23,317		$139,950	$15,451	$105,914	$4,488,178
19	2030	$0	$26,956	$24,017		$143,289	$15,374	$107,691	$4,595,869
20	2031	$0	$27,764	$24,737		$146,707	$15,297	$109,503	$4,705,372

TOTAL	$3,166,721	$425,455	$379,067	$3,166,721	$2,323,354	$3,186,539	$4,705,372
NPV		$230,562	$205,423	$2,987,473	$1,265,548	$2,019,879	$2,688,153

Appendix C
Gabel Associates
NJ Transit Solar Project
Project Economics
November 16, 2011

		COSTS					BENEFITS							
	Year	Capital Investment	Development Costs	Other Costs	O&M Costs	ECM Cost	Grant	One-Time Incentive	Solar Electric Savings	SREC Sales	ECM Savings	Net Cashflow to Spend	Total Net Cashflow	Cumulative Cashflow
0	2011	$3,166,721					$3,166,721					$0	$0	$0
1	2012	$0	$72,000	$15,834	$14,107	$118,967			$87,810	$133,934		$119,803	$836	$836
2	2013	$0	$72,000	$16,309	$14,530	$368,772		$14,490	$91,652	$124,102	$246,560	$373,966	$5,194	$6,030
3	2014	$0	$72,000	$16,798	$14,966	$547,851		$16,008	$95,572	$174,035	$466,200	$648,050	$100,199	$106,229
4	2015	$0	$72,000	$17,302	$15,415	$266,520		$2,860	$97,756	$244,904	$484,222	$725,025	$458,505	$564,734
5	2016	$0	$72,000	$17,821	$15,878	$0		$16,873	$98,337	$290,446	$531,406	$831,364	$831,364	$1,396,098
6	2017	$0		$18,355	$16,354	$2,278,003			$99,998	$266,136	$553,146	$884,571	-$1,393,432	$2,666
7	2018	$0		$18,906	$16,845	$2,112,716		$480,153	$103,080	$243,686	$1,757,029	$2,548,197	$435,481	$438,147
8	2019	$0		$19,473	$17,350			$8,914	$106,052	$226,303	$1,838,396	$2,142,841	$2,142,841	$2,580,989
9	2020	$0		$20,058	$17,871				$109,743	$217,129	$1,918,326	$2,207,270	$2,207,270	$4,788,259
10	2021	$0		$20,659	$18,407				$113,453	$208,842	$2,004,053	$2,287,282	$2,287,282	$7,075,541
11	2022	$0		$21,279	$18,959				$116,949	$203,817	$2,092,043	$2,372,572	$2,372,572	$9,448,112
12	2023	$0		$21,917	$19,528				$120,670	$199,629	$1,867,121	$2,145,975	$2,145,975	$11,594,088
13	2024	$0		$22,575	$20,114				$124,389	$195,478	$1,705,404	$1,982,583	$1,982,583	$13,576,670
14	2025	$0		$23,252	$20,717				$127,356	$192,148	$1,744,059	$2,019,594	$2,019,594	$15,596,264
15	2026	$0		$23,950	$21,338				$130,394	$188,846	$1,806,603	$2,080,556	$2,080,556	$17,676,820
16	2027	$0		$24,668	$21,979				$133,505	$15,529	$1,868,138	$1,970,525	$1,970,525	$19,647,345
17	2028	$0		$25,408	$22,638				$136,690	$15,451	$328,544	$432,639	$432,639	$20,079,985
18	2029	$0		$26,171	$23,317				$139,950	$15,451	$207,864	$313,778	$313,778	$20,393,762
19	2030	$0		$26,956	$24,017				$143,289	$15,374	$214,239	$321,929	$321,929	$20,715,692
20	2031	$0		$27,764	$24,737				$146,707	$15,297	$178,259	$287,762	$287,762	$21,003,454
TOTAL		$3,166,721	$360,000	$425,455	$379,067	$5,692,829	$3,166,721		$2,323,354	$3,186,539	$21,811,613	$26,696,283	$21,003,454	
NPV		$2,987,473	$303,290	$230,562	$205,423	$4,122,513	$2,987,473		$1,265,548	$2,019,879	$12,475,448	$13,850,543	$9,961,380	