TRANSPORTATION LEARNING CENTER



TRANSIT GREEN JOBS TRAINING PARTNERSHIP

Transit Green Jobs Training Partnership¹

Foreword

The transit industry and its frontline workforce development systems are facing numerous challenges: an aging workforce, a shortage of workers willing and capable of becoming technicians and vehicle operators, a more diverse population for recruitment, and limited national investment in education and training opportunities for young adults not heading for a traditional four-year college education. The Department of Labor selected the Transportation Learning Center as a Green Jobs funds recipient because the Center has been at the forefront of addressing the issue of insufficient training in the transit industry and building constructive partnerships between labor and management to address this critical issue. The grant succeeded in creating new training approaches and providing training to thousands of workers in key transit occupations, with a consistent focus on greening the economy and our communities.

The Green Jobs Training Partnership is built on the Center's successful model of creating and supporting labor-management partnerships to plan and deliver transit training that provides instruction based on national standards. The Partnerships plan and carry out training, to help transit employees obtain the skills they need to stay current in an industry that is ever changing.

It has been a pleasure working with our four partner transit labor unions and management in Utah, New Jersey, Columbus, Ohio and New York City during the course of the Transit Green Jobs Training Partnership. Each of these localities has accomplished much in the way of workforce training and enhanced the transit industry's contributions to a greener future for all Americans.

I hope you enjoy reading the following report of the Partnership activities, and the accomplishments of each of the transit agencies that participated in this program.

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Brian J. Turner Executive Director

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The American Recovery and Reinvestment Act of 2009

In February 2009, President Obama signed the American Recovery and Reinvestment Act (Recovery Act) to provide funding for training in careers that embrace energy efficiency and renewable energy industries. The purpose behind the bill was to create and preserve jobs during the country's economic downturn. Energy Training Partnership Grants were made available through the Green Jobs program.

The US Department of Labor (DOL) recognized transportation as an inherently

green industry; it was singled out for inclusion among those entities and industries eligible for Green Jobs grants because the act of publicly transporting people naturally reduces energy consumption and carbon emissions. Accordingly, all transit employees are green workers. The average operating and maintenance employee in transit annually saves 134 tons of carbon from the atmosphere by shifting travel from cars to public transportation. Transit employees can further their "green" credentials by learning new skills for driving practices that save fuel and limit environmental pollution, introducing green practices in the buildings they occupy, and using cutting-edge green technology to service and power the vehicles they use to transport people.

Transit has also been at the forefront of incorporating green technology. The public is rapidly embracing transit as its local transportation choice, with national ridership up 38 percent since 1995 to 10.7 billion annual rides, according to the American Public Transportation Association (APTA):

"Every day is Earth Day for the tens of millions of Americans who use public transportation. Riders not only help the environment, but save money and beat the high cost of gas. They get a two-fer," said former APTA President William Millar. "Public transit could play an even larger role, but unfortunately, only 54 percent of the households in the United States have access to public transportation. The United States must expand public transportation to take full advantage of its environmental and economic benefits."

DOL invited organizations to submit proposals to provide training for existing occupations in green industries that have experienced significant change to the work and worker requirements. Transit is an industry that has changed dramatically in the last 20 years, as new technology requires that workers use computers to perform many bus maintenance activities. While more advanced maintenance tasks require a sophisticated grasp of electronic systems, the training of maintenance employees in the new technological areas including those pertaining to more efficient propulsion systems and emissions reduction has

not kept pace. Compounding this problem, as many as 40 percent of transit's front-line workers are poised to retire in the next five years just when the demand for public transportation is increasing, putting the need for worker training at a critical level.

The Transportation Learning Center (Center) Green Jobs proposal to DOL outlined a plan to provide training to transit operators and maintenance employees, both incumbents and newly hired. The goal was to ensure that transit employees are prepared to adequately maintain and operate the nation's transit systems, including servicing and repairing the increasingly advanced green technologies in this critical industry.

In January 2010, DOL notified the Center that it was one of 25 grant recipients chosen to administer a national training program, with training efforts in four partner transit agencies. The Center is honored to have had the opportunity to serve such a substantial role in achieving positive outcomes for individuals, public transit agencies, and ultimately toward improved environmental quality in our country. As stated by Secretary of Labor Hilda Solis, Green Jobs grant funding is:

"an investment that will help American workers succeed while doing good. Our outstanding award recipients were selected because their proposed projects will connect workers to career pathways in green industries and occupations through critical, diverse partnerships."

Through preexisting or newly-created labor-management training partnerships at four major transit agencies: Utah Transit Authority (UTA) with Local 382 of the Amalgamated Transit Union (ATU), New Jersey Transit (NJT) with the ATU New Jersey State Council, New York City Transit (NYCT) with Local 100 of the Transport Workers Union (TWU), and Central Ohio Transit Authority (COTA) with Local 208 TWU located in Columbus, Ohio, training programs were successfully planned and delivered by partnership committees at each of the sites. These training opportunities have resulted in furthering the education of over 3,000 new and existing employees at the agencies, and have strengthened the bonds between labor and management transit employees. The Center believes that this project, focusing on transit industry training, has accomplished exactly what Secretary Solis was hoping would happen -- solid career training in a green industry planned and executed by critical partnerships between labor and management employees at four transit agencies, as well as on a national level. This report examines some of the accomplishments of the Green Jobs project.

The National Aspects of the Transportation Learning Center Green Jobs Program

In its Green Jobs Partnership proposal to DOL, the Center anticipated that it would:

- 1. Build strong Labor-Management partnerships that would plan and implement training for transit workers on-site at four different transit agencies,
- 2. Gather data on workers' skills to perform a skills gap analysis at the four partner sites,
- 3. Cement the process for validating local courseware to national standards,
- 4. Establish or enhance national standards for training for bus operators through the convening of a National Bus Operators Committee and further the national training qualification system for bus operators,
- 5. Establish training standards for advanced emission controls maintenance, and
- 6. Help create over 3,000 job training opportunities at the partner sites, at the same time plan and implement apprenticeship opportunities, strengthen the career ladder progression for incumbent training, and use skills gap analysis materials to determine the most useful training.

1. Building Strong Labor-Management Partnerships

Typically, blue collar jobs comprise 80-85 percent of all transit agency jobs, and up to 95 percent of those employees are union members. This dynamic would suggest that a strong and stable partnership between management and the representatives of the workforce should be standard practice in the transit sector. Unfortunately, building labor-management partnerships can be challenging. Since transit work is structured around the need to meet a schedule, transit agencies in many cases have evolved a "command and control" workplace culture which is often not conducive to productive workplace partnerships. Unions have fought this culture with tough bargaining over wages and working conditions. Pressures on public budgets since the beginning of the Great Recession in 2008 have led budget cuts for transit agencies, cutbacks in service and increases and fares, and in many cases shrinking the transit workforce with reductions or freezes in benefits and salary. These circumstances have created rocky terrain for creating new labor-management partnerships.

Fortunately, the Center has over a decade of experience building joint labor-management partnerships in the transit industry. The Green Jobs project provided money for training the blue collar workforce, a unique endeavor in the transit industry and a highly desirable end product, appreciated by both management and labor. Prior to submitting the proposal, all four partner agencies and their unions pledged to work together to plan and implement the trainings, contributing to the ultimate success in creating partnerships. Two of the transit agencies had separate labor-management entities that existed primarily to plan and implement trainings, as well as other projects that lend themselves to agency-wide leadership, prior to the start of the Green Jobs project.

There were labor-union partnerships already in place in New York and Utah that the Center had previous experience working with. In 2005 UTA and Local 382 created the Intermountain Transit Career Ladder Partnership (the Partnership). The Intermountain Partnership was created as a nonprofit entity to help plan and lead the training effort at UTA. The Partnership helped to establish a successful apprenticeship program at UTA

based on classroom and on-the-job training. Much like Utah, MTA New York City Transit (NYCT) and Transport Workers United Local 100 (TWU 100) created a labor-union partnership called the NYC Training and Upgrade Fund (TUF). Having those independent joint labor-management entities already in place helped with the process of planning and implementing training at these two locations throughout the Green Jobs grant period.

Unlike UTA and NYCT, neither New Jersey Transit (NJT) nor Central Ohio Transit Authority (COTA) had a partnership entity or joint committee in place with their unions. The first step at both of these agencies was to convene a group of interested labor and management representatives who could work and plan together to carry out the project goals. Committee members at both agencies demonstrated some initial resistance to working together, much of it emanating from a lack of trust. Eventually, the committee members were able to overcome their doubts and commit to working together to provide training to new and incumbent employees. While not a simple process, it was ultimately a successful one, and both labor and management have been pleased with the results

2. Performing a Skills Gap Analysis

Public transportation faces a technical skills shortage driven by pervasive technological and operational advances, impending largescale retirements of skilled operators, changing workforce demographics, and the continuing expansion of transit systems and users. As a result, current transit employees may not possess all the required skills to operate or maintain vehicles efficiently, effectively and safely. To address this issue of potential skills gaps, the Center has become expert in identifying training priorities for maintenance workers and "I would definitely like to see a program like this again. It not only benefits the employees, it benefits the partnership between the union and the authority. Other than the first 6 months, we have worked well together. We stand 100 percent behind this program." *Andrew Jordan, President, TWU Local 208 (COTA)*



"The biggest success to date has been the partnership that has been extended truly between our Local 208 and management. When you talk about the typical union – management relationships, there are going to be differences, there are going to be agreements and disagreements. But I think the biggest success with this has been the attitude toward training. There's been truly a common ground that's been established: Let's improve the overall training so we can deliver the best product." *Pat Stephens, Vice President, COTA*



operators through a data-driven skill gap analysis.

The skill gap analysis survey compares worker current skills and knowledge with the skills and knowledge required of top-flight experts in their occupation. Workers rate their mastery of their job and the various skills they must have to perform their job effectively and efficiently. The Center then analyzes the workers' responses and compares the worker's current capabilities to the knowledge, skills and abilities that someone in that position must have to perform at the highest level of expertise using today's advanced vehicles. The tasks and responsibilities in the analysis are based on the new National Training Standards developed by transit experts from labor and management working with the Center.

This skill gap analysis survey method provides a simple and clear mechanism for comparing current employee knowledge, skills and abilities to industry skill standards. It is a reliable technique for benchmarking job competency skills, assessing individual workers and developing individual and corporate training plans. This method minimizes the questions of reliability and validity associated with other skill surveys, and virtually eliminates concerns related to disparate impact. Most importantly, the analysis serves to pinpoint specific areas where training needs to be focused to close gaps and build needed skills.



The skill gap analysis survey is typically administered to transit workers through a training workgroup. The surveys are taken on a strictly confidential basis, so results cannot be tied to any individual. Survey results are recorded in a database that allows for analysis and comparison of the data in multiple ways, including by job classification, location and skill set. Because it is impossible to predict exactly what information the gap analysis will yield, the exact format of the gap analysis reports

will be determined based on input from local stakeholders. Once all the steps are completed, the Center holds a closeout meeting with the transit agency, the union leadership, and the training work group to analyze the results of the skill gap analysis and to help develop training priorities to address identified skill deficiencies. The survey results and any other data at the individual level are held in strictest confidence, and only aggregate data on group skill gaps is shared. The final report is delivered within three months of the first meeting and it provides the aggregate group results needed for prioritizing training development to meet objectively determined workforce needs.

Using funds from the Green Jobs project, the Intermountain Partnership, New Jersey Transit's Partnership Committee, and the COTA Policy Committee all decided to conduct a skills gap analysis as their first step to assess and identify training needs. Based on the results, the Partnership and Policy Committees at each site determined which trainings to plan and implement at their individual location. Early training in New York City focused on fiber optics and maintaining solar arrays. Workers had such little prior training in those areas that a skills gap analysis would not prove useful. New York's Training and Upgrade Fund (TUF) did conduct later skills gap analyses for rail car maintenance, in HVAC and handling of refrigerants and a broader survey of apprentices near the completion of their training. At all four sites, targeted training resulted in a better targeted training and better-trained workforce more capable of carrying out their jobs with the necessary skills for working in the increasingly complex transit environment of today.

3. Cementing Process for Validating Local Courseware to National Standards

Many transit agencies have developed courseware over the years, but until recently, there were no national standards underpinning the courseware or curriculum. Due in large part to programs initiated by the Center and its dozens of national and local partners from transit labor and management, national standards for technical training now abound in the transit industry. These standards provide firmer ground for employee training, courseware development, skills gap analysis, and certification. Transit agencies are eager to base their instruction on these national standards to ensure that their employees are being trained at the highest level possible.



Jim Condi has led courseware validation efforts on behalf of COTA in Columbus, Ohio.

Validating local training to the national training standards is now a practical possibility. Joint transit labor-management teams in Ohio, Utah and New Jersey worked intensively in the Partnership to validate training courseware for consistency with industry-wide training standards developed by the Center and industry partners over the past few years. In an indepth effort under the Center's DOL-funded Green Jobs training program, teams begin the validation process by identifying learning objectives from the applicable national training standard (for example, Bus Brakes) that the course intends to achieve (e.g., determine if brakes are within wear limits), then identifying specific courseware that supports each of the learning objectives. (A complete description of the courseware validation process is described below in Section 5 under Emissions Controls.)

John Schiavone, the Center's Program Director for Technical Training is an expert in national transit skills validation. John, a former mechanic, trainer, and a prolific writer and researcher who has published numerous TCRP studies on electronic and digital systems and how to train on those systems, helped draft and refine numerous national standards in bus maintenance. John also led the development of the courseware validation process. As part of the Green Jobs project, John helped New Jersey, Ohio and Utah validate the courseware they used to deliver Green Jobs training courses against nationally developed standards. Doing so provided assurances that the Green Job courses did in fact comply with nationally established training standards developed jointly by both labor and

management. As part of the validation process John also captured the level of hands-on instruction provided during the training. Although standards in this area do not yet exist, the Center recommends a minimum of 50 percent hands-on learning take place as part of every course delivered.

John worked with instructors and frontline labor representatives in New Jersey, Columbus and Utah, and all three locations were pleased with the results. Courseware validation results from New Jersey, Utah and Columbus were impressive. In total, 19 courses were validated among the three sites. As presented in Tables 1-3 of Section II in this report, the original classroom courseware at the three agencies was found to meet the requirements of the national training standards at levels between 91 percent and 100 percent compliance. For hands-on training, where the Center recommends a minimum application of 50 percent, the three agencies averaged between 59 percent and 76 percent. This validation process provided opportunities for agencies to upgrade their training programs to fully meet the national standards.

Under the Center's Courseware Sharing Program, courseware identified through the validation process gets catalogued under major systems groups such as engine, transmission, brakes, etc. In cases where agencies have missing courseware, the Center will assist them in locating specific courseware material from other locations to fill those gaps. Locating missing courseware helps agencies strengthen their training program, thereby allowing them to improve compliance to the National Training Standards. With agencies struggling over shrinking training budgets, sharing courseware allows them to build new courses and enhance existing courses in a cost-effective manner.

In cases where courseware validations took place, the Center issued certificates. The certificates went to UTA and COTA participants who successfully completed training courses in these validated areas. Most courses provided by NYCT under the Green Jobs have no corresponding National Training Standards to validate against, so they have not received certificates. NJT has informed the Center that they do not want certificates to be issued.

4. Bus Operators National Training Standards Committee

Following up on earlier programs in maintenance occupations, the Center proposed under Green Jobs to expand the application of training standards to other transit occupations. A national labor-management Bus Operators National Training Standards Committee was just being created at the time that the Center submitted its Green Jobs Partnership proposal to the Department of Labor. The Center planned to build upon the existing national transit bus operator training standards to expand them and include practices that may have been previously overlooked. The first meeting of the Bus Operators Training Committee convened under the Green Jobs Program was held in Philadelphia, Pennsylvania in June, 2011, hosted by TWU Local 234. The purpose of this initial meeting was to develop the work plan for the Committee, discuss methods and questions for a skills gap analysis, review best practices at other locations, and listen to a health and wellness presentation by Robin Gillespie, the Center's expert Program Director for Safety and Health. Some of the Committee members expressed frustration that their health and safety needs were getting

little attention at work, and a lively discussion ensued. The Committee meeting ended on a positive note, with a realization that more work lay ahead.

A second meeting was held in Seattle, Washington, October, 2011, hosted by the local transit agency, King County Metro. The Committee was tasked with producing two deliverables:

- An Addendum to the Recommended Practice for Transit Bus Operator Training (which had been created earlier by APTA) and,
- Best practices in bus operator training for the transit industry.

The Committee reviewed the previously issued APTA Recommended Practice (RP) for operator training and suggested that further training be conducted for transit operators in a variety of areas, including:

- Customer Service training
- Technical Training (Energy sources, Vehicle Inspections, Bus Operating Skills, Inservice operations)
- Safety and Security (Wellness/quality of life, Security awareness and emergency procedures, Operator emergency procedures)



Bus Operator Training in Utah

Once the Committee approved the proposed additions to the APTA RP for Transit Bus Operator Training, the Committee discussed the operator skill gap analysis that was developed by UTA. This discussion led the labor and management representatives from NJT to express their interest in pursuing the idea of conducting the industry's first skills gap analysis for bus operators as a value-added activity in New Jersey.

The operators skills gap

analysis was performed at NJT using the same process that had been used in prior Center maintenance skill gap analysis. The first step was for NJT and the ATU New Jersey State Council to create a workgroup to help tailor the skills gap analysis to their specific local practices. Once the skill gap analysis survey was created, it was filled out confidentially by operators at NJT locations around the state. Based on the results of the skills gap analysis, the training department decided to post flyers and send out communications to make operators aware of the skills that were found to need strengthening based on the survey.

Best practices for bus operator training were initially discussed at the meeting in Philadelphia and were followed up by presentations at the meeting held in Seattle, WA. In Seattle, the Committee members heard presentations on best practices regarding King County pedestrian awareness training, Indianapolis Public Transportation Corporation selfdefense training, and adult-learning styles. Based on these presentations, the members of the Bus Operators Committee voted to incorporate the King County pedestrian awareness training, the Indianapolis Public Transportation Corporation self-defense training, and the implementation of a skills gap analysis as operator training best practices for the Center's Green Jobs report to DOL.

In May 2012, the Center held the final meeting via the internet (Go-to-Meeting) for the National Bus Operator Committee meeting under the Green Jobs Training grant. By that date, the Committee had taken its recommendations for the addendum to the APTA Recommended Practices and submitted them to APTA to undergo their formal review and comment process prior to adoption. At this meeting an APTA representative informed the Committee of the progress of their recommendations in the APTA process. NJ Transit Committee members reported on the results of their bus operator skill gap analysis and the new training implemented as a result. This meeting also provided an opportunity for Committee structure, progress, and content as a whole. Overall, the Bus Operator National Training Standards Committee participants were pleased with the focus of the Committee. Management and the labor representatives expressed their enthusiasm about being able to sit at the table together and address common concerns.

5. Establish Emissions Controls Training Standards for Maintenance Employees for 2010 EPA Standards

As part of the Green Jobs project, the Center worked with industry partners to create an emission control training standard for bus maintenance personnel that complies with 2007 and 2010 Environmental Protection Agency (EPA) standards. To carry out this task, the Center worked with the joint National Bus Maintenance Committee, which consists of some 30 subject matter experts (SMEs) involved in the transit industry representing both labor and management. The Committee meets approximately twice a year to discuss standards involving bus maintenance.

The process of developing National Training Standards is carried out by SMEs from the Committee by identifying detailed learning objectives in each major subject area to be covered (for example, brakes, transmissions, etc). Learning objectives represent the essential skills and knowledge that training must impart to students. Establishing learning objectives on a joint labor-management basis ensures that they are appropriate and address all pertinent topics.

5a. Bus Emissions Training Standard

The process to establish a standard specifically for bus emissions to satisfy EPA's new emissions regulations took a similar approach, but this effort was noteworthy in that it represented new information on the cusp of cutting edge technology. The Center's Program Director John Schiavone took a lead role in developing the Bus Emissions Training Standard. John began working on diesel engines as former mechanic over 30 years ago, and while at APTA assisted EPA in formulating some of its emissions regulations for transit buses. To save the Committee time, John prepared a set of learning objectives for the Committee to review and modify at its first meeting. The learning objectives were then modified during subsequent meetings and approved by the Committee during its last

meeting held in June, in Minneapolis, MN. The standard is intended as a complete set of instructions needed to develop and deliver a course on the subject of bus emissions. It includes four modules for presenting the course (see Appendix A). The standard has now been submitted to APTA to undergo public review and comment as part of APTA's final adoption process.

Module I: Emissions Control Theory: The objectives of this module is to familiarize students with the basics of servicing engine intake and exhaust systems, identify various common components, identify the emissions regulated by the EPA, purpose of low sulfur fuel, types of and effects of particulate matter, and safety considerations.

Module II: Operations, Diagnostics and Best Practices for EGR / DOC Systems: The objective of this module is to familiarize students with the emissions control technology of engines with exhaust gas recirculation (EGR) and diesel oxidation catalysts (DOC), and to practice connecting and using original equipment manufacturer (OEM) software for these engines.

Module III: Operations, Diagnostics and Best Practices for DOC w/ DPF Systems: The objective of this module is to familiarize students with the intake, exhaust and after treatment components used to achieve EPA standards. Technicians will learn the role of diesel particulate filters (DPF), how and why to perform system regenerations, as well as other critical servicing and common troubleshooting tasks. Continued practice with using OEM software for hands-on diagnosis is emphasized.

Module IV: Operations, Diagnostics and Best Practices for DPF w/ SCR Systems: The objective of this module is to familiarize students with the intake, exhaust and after treatment components used to achieve the 2010 EPA standards. Technicians will learn the role of diesel exhaust fluid and selective catalyst reduction (SCR); performing system regenerations for these newer engines, as well as other critical servicing and common troubleshooting tasks. Continued practice with using OEM software for hands-on diagnosis is emphasized.

An appendix contained in the standard includes curriculum for teaching each of the four training modules, consisting of:

- Goal and objectives
- Related Job tasks / OJT checklist
- Course Description
- Recommended Class Size
- Delivery Method
- Course Duration
- Target Audience
- Classroom Equipment and Supplies
- Course Materials, Training Aids, and References
- Instructor and Course Evaluation

Also included in the standard are certain prerequisites that must be met such as having basic skills and knowledge in the operation of a computer in a Microsoft Windows environment. Learning objectives contained in the standard are structured under key heading groups:

- Safety
- Theory and Understanding
- Maintenance and Repair Procedures
- Testing, Diagnostics and Troubleshooting

This structure gives organization to the standard, assists students to study and prepare for testing, and assists the Center with its Courseware Sharing project. Establishing training standards that allow transit agencies and their maintenance staff to better understand how to service the new diesel engines that comply with the EPA standards was a significant accomplishment. Green Jobs Partners New York City Transit and Utah Transit participated in this standards-development effort.

5b. Using the Standard to Validate Courseware

Once the Committee had nearly finalized the Bus Emissions Training Standard, courseware materials used to deliver Green Jobs bus emissions training at NJT, COTA and UTA were validated against the standard.

The validation process determines if each applicable learning objective contained in the standard is supported by courseware. The process, led by the Center, involves members of both labor and management to first make a listing of all courseware used to deliver the training. Each of the learning objectives is then reviewed by the team to determine if supporting courseware exits. Courseware is defined as written material the instructor uses as part of the training. For example, one learning objective for the emissions training standard is to have the student "Explain why ultra low sulfur diesel fuel is needed to reduce exhaust emissions." The joint labor-management team, consisting of the instructor offering the course and a technician who has taken the course, determine if written material exists to support this particular learning objective.

Having written material (courseware) is essential in that it provides reference documentation for the current instructor and instructors that follow in the future, and also serves as study material for student use. Having written training material also assists the Center's courseware sharing effort, where specific materials (cataloged to each learning objective) can be shared with other agencies looking to develop their own training courseware. The sharing process greatly reduces the costs associated with having each agency develop course materials on their own.

Having labor representatives participating in the courseware validation process helps ensure that the supporting courseware is in fact appropriate. Although instructors are often former technicians, they are frequently out of touch with technology advancements and shop floor procedures. Having labor experts on the validation team provides valuable insights into the type of instruction that works best for them as opposed to having others dictate what instructional approach is "appropriate." The validation process continues for each learning objective contained in the relevant training standard. In some cases a particular learning objective is not applicable to the course because it is covered elsewhere in another related course, or the technology referenced in the objective does not apply to the agency's particular equipment. In those cases the learning objective is removed from the validation process. Where both sides agree a learning objective is included in the course but courseware does not exist or is inadequate, the representatives note the missing elements. In other cases the team, upon hearing a particular learning objective contained in the standard, may realize it needs to be added to their training curriculum.

For maintenance related subjects, the team is also asked if each learning objective is supported by hands-on exercises. Not all learning objectives, however, lend themselves to hands-on applications. Taking that into consideration, the Center recommends that a minimum of 50 percent hands-on is appropriate for technical training. The review process continues for each learning objective contained in the standard. A tally is then made to reveal the percentage of applicable learning objectives contained in the standard that are supported by courseware and the percentage supported by hands-on instruction.

5c. Best Practices In Bus Emissions Training

This section describes how three transit agencies, Seattle's King County Transit, Utah Transit Authority (UTA) and New Jersey Transit (NJT) use different but effective approaches to train their bus technicians on new diesel engine emission technology. Assisting the training efforts is the fact that there is one predominant manufacturer of emissions-compliant engines to the US transit market: Cummins Engine Company, which significantly contributes resources to assist the training process.

New Jersey Transit (NJT)

The first best practice example focuses on NJT, which uses modified courseware produced by Cummins as the basis for its bus emissions training. Bus procurement specifications issued by NJT include provisions for a host of technical training. For engine and related emissions training, the successful bus manufacturer, North American Bus Industries (NABI), turned over the engine training to Cummins. Under terms specified in the procurement, Cummins provided NJT with all needed courseware materials and conducted the initial training. Because the courseware was produced by Cummins, NJT is assured that the training materials used to instruct its employees are comprehensive and accurate. The initial training provided by Cummins also allowed NJT's instructors to sit in on the first set of courses to become familiar with the training content and delivery methods, a process known as "train the trainer." After sitting in on several classes and interacting with Cummins' factory trained instructors, NJT's teaching staff were prepared to carry out the instruction using the Cummins-provided courseware in an effective manner.

Unlike King Country Metro described in greater detail below, however, the training at NJT does not allow their technicians to perform repairs under warranty. 2010 engines with advanced emission control systems installed in NJT buses are serviced by the local Cummins dealer throughout the warranty period.

About 1,400 NJT technicians and maintenance supervisors received the engine emissions training. About 50 percent of the training is hands-on where students can interact with the



engine and related emission-control technology. To facilitate this, NJT received a fully functioning 2010 Cummins engine mockup as part of the bus procurement with NABI. The mockup is fully functioning engine, but instead of being mounted in a vehicle it is placed on its own rolling assembly complete with fuel storage, cooling system, battery and charging system, exhaust and all other equipment

NJT Engine Mock-Up Used for Emissions Training

needed to operate the engine as a stand-alone training device. The engine mock-up can be moved from one location to another as needed, and because the engine is not installed in an actual bus, components are easier to see and gain access to. A specially built control panel allows the engine to be started and stopped, and includes all needed instrumentation.

Various courseware materials were also developed and provided by Cummins. Presentation material entitled "ISC8.3 & ISL9 CM2250 Introduction" is intended to give non-qualified technicians a basic understanding of how the engine and exhaust systems of these two Cummins engines differ from previous models and how they reduce emissions to meet 2010 levels. Topics covered include internal engine, fuel, lubrication, cooling, turbocharger, air intake, exhaust, and compressed air systems. A second document, "2010 Midrange CM2250 Technical Training SCR Aftertreatment System," focuses exclusively on the exhaust aftertreatment system. Topics include the various subsystems including the selective catalytic reduction (SCR) catalyst, particulate filter, decomposition reactor, diesel exhaust fluid (DEF), DEF dosing valve, and onboard diagnostics.

In summary, using a training program and courseware developed by engine manufacturer assures NJT that its technicians will have the required skills and knowledge to properly maintain and repair these highly advanced engines once the warranty period is over.

Utah Transit Authority (UTA)

UTA took a different approach to emissions training by contracting with Educational Data Systems Inc. (EDSI) to develop curriculum and courseware tailored specifically to UTA's specific workforce needs and bus equipment. The courseware was also developed to conform to the National Training Standard for EPA Emissions, which was developed by subject matter experts (SMEs) from both labor and management.

The first step in the process was to conduct a skills gap analysis to determine the proficiency levels of technicians as they pertain to maintaining and repairing emission control equipment and systems. Skill gap surveys are based on nationally-developed skill

standards developed by SMEs across the country jointly to identify the current skills of an agency's workforce compared to its operational needs. Technicians are anonymously asked to rank on a scale of 0-4 how well they can perform certain job related tasks ranging from having no abilities at all in the given job task, to having the proficiency to teach that task to others. The result is objective determination of the group's skill gaps.

Labor-management workgroups then reviewed and validated the skill gap data and identified specific training priorities related to bus emissions technology. EDSI used the data along with the National Training Standard to develop the curriculum and training materials for a three-day course on the subject.

The first day of the course is designed to familiarize or re-familiarize students with the operation and servicing of engine's intake and exhaust systems, and the emissions control technology of engines with emissions gas recirculation (EGR) and diesel oxidation catalysts. In Day 1 students also practice connecting and using computer-based diagnostic equipment consisting of Cummins INSITE and Detroit Diesel Diagnostic Link. Learning objectives include the ability to identify and explain the purpose of common components related to the turbocharger, measure exhaust backflow and check for air restrictions, perform common diagnosis and repair tasks, explain why low sulfur diesel fuel is needed to reduce exhaust emissions, explain the inverse relationship that exists between particulate matter (PM) and nitrogen oxides (NOx) when reducing emissions in a diesel engine, and identify common acronyms associated with emission control technologies. Other learning objectives include being able to explain the operation of variable vane turbochargers (VGT), the function and benefit of a cooled EGR system, and the role crankcase ventilation plays in reducing diesel emissions.

Day 2 of the course provides a detailed overview of the intake, exhaust, and after-treatment components of newer UTA buses. Technicians learn the role of diesel particulate filters, the reasons why those filters need to be regenerated, as well as performing troubleshooting tasks using manufacturer's diagnostic software and equipment. Other objectives include being able to explain the role of exhaust after-treatment in reducing emissions in diesel engines, the operation of the dosing valve injector and active regeneration injectors, operation of differential pressure sensors and NOx sensors, and operation of DPF (catalyst filters). The second day of instruction also addresses faults related to DPF injection system including clogged filter, fuel injection, the onboard warning system, and excessive temperatures. Students inspect the control system associated with active PM filter including wiring harness and functionality.

The final day of instruction provides students with a detailed overview of the intake, exhaust, and after-treatment components found on 2010 buses. Technicians learn the role of Diesel Exhaust Fluid (DEF) and Selective Catalyst Reduction (SCR), performing system regenerations, as well as other critical servicing and common troubleshooting tasks. As part of the instruction students learn the operation and major functions and components associated with the 2010 emission control system, and why additional engine cooling capacity is needed to meet EPA 2010 regulations. Students also diagnose, maintain and replace the DEF injection system, differential pressure sensors, NOx sensors, the DEF tank, the SCR system, and other emissions related equipment.

Students sign in for each course and are given a complete set of courseware consisting of student workbooks, supplemental courseware, and other materials. Instructors first

administer a short pre-test questionnaire, which is designed to identify student's understanding of the subject material in advance of instruction, along with their expectations for the class. Instructors then use the results to emphasize certain points in the course based on the interest revealed by the questionnaire. A post-test is given after each course to determine just how much students learned, and to reveal where follow-up training may be needed with specific students in specific subject areas.

Instructors review the ground rules and learning objectives before beginning. Instructors also broadly review the topics to be covered and lead informal discussions to serve as an icebreaker and to gauge overall understanding of the subject. Examples of the questions asked by instructors before beginning formal presentations instruction include: Why is controlling emissions important? Why is understanding and maintaining the emissions systems critical? What time and money can be saved from a better understanding of these systems?

Hands-on instruction plays a key role in UTA's three-day engine emissions course. Buses with appropriately equipped engines are made available for the training, along with tools, specialized diagnostic equipment, and laptop computers with software needed to support the diagnostic programs. Class size ranges between four to six students, thereby allowing the instructor to supervise the hands-on instruction and devote the necessary time to ensure learning objectives are being met.

King County Transit (Seattle, WA)

King County Transit's approach to Cummins engine training is to make certain that the training provided through the agency is officially recognized by Cummins, not only assuring that technicians can correctly maintain and repair these engines but to receive financial compensation for repairs made during the warranty period. Cummins specifies that in order to receive warranty reimbursement technicians must first gain Qualification Status through Cummins' own training program. Cummins insists on a structured qualification process to make certain that any work done by agency technicians to repair defects or faulty workmanship during the warranty period is properly diagnosed, properly corrected, and accomplished as efficiently as possible.

By controlling the training program and certifying that technicians have successfully completed the qualification program, Cummins is assured that agency technicians will perform warranty repairs in the same manner as their own factory trained technicians. Doing so minimizes any disputes that may arise over whether warranty repairs are justified, or the amount of labor and parts consumed during the warranty repair, since technicians not properly trained often take longer and replace unnecessary parts when making repairs. Having properly trained technicians minimizes Cummins' warranty costs and also minimizes any collateral damage that may be caused by an improper repair. The training also assures King County that technicians are capable of protecting the sizable investments made in the engines and minimizes downtime and service disruptions to passengers.

Cummins' engine training begins with Cummins Virtual College, an interactive computerbased self-study learning system where agencies such as King County Transit use their own instructors to guide student technicians through the Cummins-developed process. Cummins insists that computer-based training be provided in advance of formal instructor-led training as a way of preparing students. The computer-based training is targeted to the specific needs of technicians and is designed to allow them to work at their own pace. Successfully completing the computer-based training lets Cummins know that technicians have basic engine knowledge and understanding in place, making them eligible to progress to the more detailed instructor-led training that follows.

All computer-based Virtual College training taken by Metro technicians is done on agency time with an agency instructor available for assistance, although students are free to study or progress through the instruction on their own. King County Transit, however, does not require students to use any of their personal time for any computer-based instruction.

King County assigns each student a unique password, which he/she uses to log into Cummins' Virtual College program. As students complete each computer-based training module, they upload their progress to Cummins via the Internet. Cummins tracks each technician's training progress, both the initial instruction first taken through the computerbased program and the instructor-led training that follows, for life via the technician's unique ID number. Technicians and agency instructors can monitor that progress over time to see what courses have been completed. To complete each computer based training module students must correctly answer 100 percent of the module's test questions. Instructor-led training includes both written and hands-on assessments as part of the technician qualification process.

Training associated with King County's newer 2010 EPA compliant engines follows the same Cummins certified approach. Due to the complexities involved with these engines, students first use the Virtual College computer-based instruction to prove that they have a basic understanding of diesel engines and related emissions controls. Test questions are given during the computer-based portion of the training to prove that students have successfully grasped each level of instruction.

Once technicians have successfully passed the computer-based training they attend instructor-led engine training provided by a Cummins certified instructor. The Cummins instructor-led portion of the training consists of a combination of classroom and hands-on shop training. There are hands-on demonstrations of various maintenance and test procedures, along with hands-on troubleshooting of the engine with a laptop computer and other diagnostic tools. Students get to keep all training materials used in class such as training manuals and personal notes. King County Transit also provides Cummins engine shop manuals, troubleshooting manuals, engine schematics, etc. to its maintenance shops for technician use. These manuals are also available on-line at "quickserve.cummins.com" for technicians who have their own username and password. The online manuals are continuously updated and are more accurate. A technician can enter a specific engine serial number when searching for information online. Since the information is tied to the engine serial number, it is assured to be accurate for the specific application. The on-line documentation provided by Cummins allows less room for errors due to outdated information typically found in paper manuals.

King County Transit contracts with Cummins Northwest (the local dealer) to provide instructor-led training at their own location in Renton, WA. This location has a Cummins Classroom, training engines and other equipment needed for hands-on instruction. Technicians who successfully complete the program are then recognized by Cummins Engine Company as Qualified Technicians. In the near future, Cummins Northwest will move their training location to South Seattle Community College, where King County will then send technicians for the instructor led portion of the training package. The agency will, however, continue to use its own computer lab for the CD-Based and web-based training.

Those at other agencies that operate Cummins engines need to understand Cummins' requirements for having Qualified Technicians perform warranty repairs. Agencies may want to consider provisions in their bus procurements that require Cummins to provide this training, thereby assuring that technicians will be properly prepared and allowed to perform warranty repairs.

6. Transit Agency Training Opportunities

Over 6,000 training opportunities were provided to transit workers under the Transit Green Jobs Training Partnership through various methods created by each labor-management partnership. Central Ohio chose to focus on bus maintenance, while New York City was able to send its employees to workshops on installation of photovoltaics, as well as installation and maintenance of fiber optics. New Jersey Transit put part of its training funds into bus operator training with a focus on customer service, a strategy designed to increase transit ridership. NJT also recreated and created a whole series of electronics courses, and providing training in HVAC, engines, exhaust emissions and air systems. Utah Transit planned and executed trainings on Apprentice Brake and Air System, Apprentice Steering; Apprentice Transmission, Electrical Schematics, Hybrid Propulsion, EPA Exhaust Emissions, Aluminum TIG Welding, Customer service, New Rail Operator training and New Operator training. The remainder of this report shines a spotlight on the accomplishments of each of these partnerships at the aforementioned agencies and the successful programs they are building.

Overview of the Four Sites



NEW YORK CITY

MTA New York City Transit Agency-NYCT



In New York, the Transportation Learning Center (Center) partnered with MTA New York City Transit (NYCT) and Transport Workers Union Local 100 (TWU 100) to develop and conduct training for NYCT employees. NYCT is the largest public transportation agency in North America and one of the largest in the world. The subway system has a daily ridership of more than five million, and an annual ridership close to 1.6 billion. The NYCT fleet of 6,380 subway cars travels almost 345 million miles a year along 660 miles of track, 24 hours a day, seven days a week; there are 468 subway stations,

including 89 made accessible to customers with disabilities via elevators and ramps. NYC Transit Subway serves Brooklyn, the Bronx, Manhattan, and Queens on 8,279 runs each weekday. MTA Staten Island Railway (SIR) serves Staten Island.

The NYC bus fleet, which has over 5,900 vehicles, is the largest in North American with an average weekday ridership of 2.69 million a day, 846 million annually, on more than 280 local and express routes throughout the five boroughs, traveling more than 130,000 miles a day. NYC had the first bus fleet in the world to become 100 percent accessible to customers with disabilities. NYCT and MTA Bus Company (another affiliate agency of the MTA) run the largest 'green' fleet in the world. In addition, between NYCT, MTA Bus Company, and MTA Long Island Bus, there are more than 1,100 compressed natural gas (CNG) buses in service along with a similar number of hybrid-electric buses.

TWU Local 100

TWU Local 100 is an affiliate of the Transport Workers Union (TWU) of America, a union that represents transportation workers in transit, airlines and railroads nationwide. The Local primarily represents workers in the New York City public transportation system and at some private bus lines serving the New York City metropolitan area. It has approximately 38,000 members who are actively working at jobs and also covers about 26,000 retirees.

In the City's subway lines, Local 100 represents virtually all frontline employees including those who operate trains, maintain the trains and tracks, staff the token booths, clean platforms and subway cars, and service and repair mechanical equipment such as elevators and escalators. Local 100 also represents many of the men and women who drive and maintain public buses in New York City under the umbrellas of MABSTOA (Manhattan and Bronx Surface Transportation Operations Authority) in Manhattan and the Bronx, NYC Transit Surface Division in Brooklyn, and MTA Bus in Queens and the Bronx. The Amalgamated Transit Union (ATU) represents many bus drivers and mechanics in Queens and all transit workers on Staten Island.

Local 100 workers are organized by department as well as title, and the members at each location elect Union Chairs as well as Section and Vice Chairs who provide leadership, guidance, representation in work disputes and communication with the union's staff and elected officials at the Union Hall.

Green Jobs Training in New York City Transit

NYCT and Local 100 have a collectively-bargained Training and Upgrading Fund (TUF) that has provided more than 38,000 training opportunities since it was established in 2004. NYCT and Local 100 have participated in National Training Standards efforts for bus, rail car, elevator/escalator, and signals maintenance. The development of National Training

"We didn't have the expertise in photovoltaics to keep it in house, but CUNY's Center for Sustainable Energy already had it. A partnership like this, for us, is huge. Members love this program, both photovoltaics and fiber optics. I would love to see the partnership with CUNY expanded in the future."

Hector Ramirez, Director of TUF

I would love to see the partnership with CUNY expanded in the future and help employees obtain credit for programs that they are presently enrolled in. Not only was the Center for Sustainable Energy pleased with the outcome of the partnership, but so was TUF. *Mike Silegar, Dean for Planning, Center for Sustainable Future*

A key component to ensuring the sustainability of these trainings was to provide trainings in areas where they saw the transit systems evolving or had already installed this technology, as well as looking at what NYCT had already invested in. Having a workforce that can maintain that equipment is essential. Dylan Valle, TUF Standards is presented later in this report.

TUF was the local grant recipient on this project, with all Green Jobs funding administered by TUF. NYCT and Local 100, through TUF, planned and executed numerous training opportunities using Green Jobs funding to help defray the costs of trainers, materials, and equipment. In keeping with a desire to direct training funds into areas that will make use of new and better "green technology", a portion of the Green Jobs funds at NYCT were designated for training in photovoltaics (maintaining solar powered panels to generate electricity for use by NYCT) and installation and maintenance of fiber optics.

In both of these areas, new green technologies required skills that current NYCT employees did not possess. For photovoltaic panels, the green technology implications are clear. Capturing the power of the sun allows NYCT to draw less electricity from the grid for lighting and other electric needs in nearby stations. Besides saving money, the solar power reduces NYCT's carbon footprint enormously. Fiber optic cable has replaced older wiring throughout the system which allows more information to be transmitted more efficiently over the fiber optic cables. This affects everything from the electronic message boards informing passengers how long it will take for the next train to arrive to safety-critical signals letting train operators know when the track ahead is clear.

One unique aspect of the photovoltaic training was the partnership that TUF formed with the Center for Sustainable Energy at Bronx Community College. NYCT trainers lacked the training staff to instruct the workforce in maintaining the five solar installations once the contractor's warranties expired. As expressed by the Dean of Planning at Bronx Community College and the head of the Center for Sustainable Energy, Mike Seliger hopes that this initial effort will build into something bigger over time. Mike suggested that the college could also help the transit authority develop core programs that would provide college credit for training programs that employees are taking at their workplace, as well as a Solar Apprenticeship Program.

Green Jobs training classes were held in heating, ventilation and air conditioning (HVAC), brazing, flagging and EPA licensing to assist employees with improving their skills overall. More than 3000 training opportunities were delivered. Incumbent training ensured that employees would remain competitive and up to date, while training provided to new employees allowed them to better understand the latest technology. Most of the new rail cars are manufactured with HVAC systems incorporated into the body of the train. This requires all incumbent workers responsible for the maintenance of these rail cars to have comprehensive skills in HVAC, brazing and "People who had to do the work wondered, "What are they thinking about? Do they even know what my job is?" On paper it looks good but it is just not practical. With the initiatives through the TLC, what they are doing, it's a joint labormanagement committee. So you have the people on the ground, the ones who actually cut up their knuckles, as well as management's trainers, a few administrators, and they are combining all of their knowledge and experience to create a new curriculum and training standards. And that's a beautiful thing."

Hector Ramirez, Director of the Training and Upgrade Fund (TUF), NYCT

soldering. A prerequisite to the training is that workers first obtain EPA refrigerant handling certificates because improper handling of refrigerants used in HVAC systems can leak into

"We've never had anything like this here. It benefitted everybody. There was a good partnership working together to get it off the ground as quickly as it did."

Peter Gianno, Instructor, NYCT

the atmosphere causing serious environmental impacts.

Under the Green Jobs program NYCT also completed three skills gap analyses, one for rail car maintainers who are required to handle air conditioning refrigerants, a second for rail car maintainers who have graduated from the rail car (NYCT Car Inspector) apprenticeship program, and finally a skills gap analysis for soldering electronic components. The skill gap analyses indicated a need for improved training in all areas. The Center is continuing to work with joint training committees to address these training needs. All of these steps are leading to the further professionalization of transit worker positions and better-trained employees, capable of carrying out safety and technology upgrades that will increase the effectiveness and efficiency of NYCT.

NEW JERSEY

New Jersey Transit (NJT)



L-R: Tom Harney, Orlando Riley, Frank Olive, Mike Clifford, Ray Greaves

In New Jersey, the Center partnered with New Jersey Transit (NJT) and the Amalgamated Transit Union (ATU) New Jersey State Council to develop and conduct training for employees of NJT throughout the state. NJT is New Jersey's public transportation provider. It covers a service area of 5,325 square miles, and is the nation's third largest provider of bus, rail and light rail transit, linking major points in New Jersey, New York and Philadelphia. The agency operates a fleet of 2,027 buses, 711 trains and 45 light rail vehicles. On 236 bus routes and 11 rail lines statewide, NJT provides nearly 223 million passenger trips each year. NJT also administers several publicly funded transit programs for people with disabilities, senior

citizens and citizens living in the state's rural areas who have no other means of transportation. In addition, the agency provides support and equipment to privately-owned contract bus carriers. As the agency that connects its residents with employment, education, health care and recreational opportunities in and around the Garden State, NJT is vital to the state's economic and social well-being, as well as its quality of life.

ATU New Jersey State Council

The ATU New Jersey State Council is composed of a number of local unions representing various jurisdictions throughout the State. The State Council coordinates statewide advocacy actions, and matters that can potentially affect all of NJT union members such as training and collective bargaining agreements. Ray Greaves currently serves as the president of the ATU New Jersey State Council. ATU International Vice President John Costa served as the president of the ATU State Council when the grant began.

Green Jobs Training For New Jersey Transit

NJT and the ATU New Jersey State Council have worked with the Center in the past on a pilot program to provide training validated to the National Training Standards for bus mechanics at neighboring smaller properties. This previous partnership, where expert training offered by NJT was shared with agencies having limited training capacity, led the

Center to seek out NJT and the ATU New Jersey State Council for the Green Jobs partnership training program.

Unlike NYCT and Utah, NJT and the ATU New Jersey State Council had no pre-established labor-management partnership entity that could plan training opportunities for the workforce, so getting the joint committee up and running was quite a task. However, with diligent work by both labor and management, a working committee of NJ Transit and ATU representatives moved ahead with the Green Jobs grant. This Joint Policy Committee was established with equal representation from "It's a road trip. A road trip from Jersey to California, and we're not out of Jersey yet. But we'll get there. The foremen on the floor are seeing it. Electrical is a great foundation to move on. The benefit will be in years 3, 4, 5, 10. It's a really, really good thing, and only the first chapter, we hope." –

> George Krajewski Director of Maintenance

both labor and management representatives. Day to day coordination of grant activity was overseen by the training director and union coordinators. Once the group moved into the actual development of the trainings, the partnership was very productive and successful.

Under the Green Jobs Partnership NJT and the ATU New Jersey State Council have conducted more than 100 classes and provided over 600 training opportunities to new and incumbent employees, surpassing their commitment to provide 590 training opportunities. Over 40,000 hours of Green Jobs grant-funded training have been delivered to NJT employees, with more than \$500,000 in leveraged resources donated by NJT and the ATU New Jersey State Council. A total of \$1.2 million was expended in this very successful training effort.

With the support of the Green Jobs grant, NJT has offered bus maintenance training in HVAC, Navistar engine electronics, various levels of electrical and electronics, and exhaust emissions training to assist technicians maintain and repair advanced engines required to meet the recent EPA exhaust emissions requirements. All of these training courses offered through the Green Jobs program have been validated to the National Training Standards for Bus Maintenance.

For NJT to determine training deficiency areas, the Center helped them develop and deliver a skills gap analysis for their maintenance workers. Approximately 30 percent of the bus maintenance staff responded to the survey which allowed the Joint Policy Committee, comprised of management and union personnel, to recommend further training on advanced brakes, intermediate/advanced steering, beginning/intermediate/advanced electrical multiplexing, ADA/wheelchair lifts, and laptop use. Going over the detailed results in a joint meeting, labor and management experts noticed a clear pattern. The skills gap analysis in bus electronics itself stood out, but then looking in other areas, such as brakes and HVAC, fundamental mechanical skills were solid. On newer technologies, there was a clear drop off in the numbers of mechanics who could perform work independently. Prior to the Green Jobs grant, NJT offered a single course on electrical and electronics. As a direct result of the skills gap analysis, NJT developed four courses (Electrical I, Electrical II, MCI Multiplex, and NABI Multiplex) to cover the range of electrical and electronic skills that technicians need to master. "Frank Olive and I are coordinators on the training for ATU, and we're working mechanics. In our garages, people who have attended training aren't asking as many questions as they used to. They're more comfortable taking on new work. They're informal mentors, and other mechanics are benefitting from this knowledge. Mike Clifford Electrical I/II training created under the Green Jobs grant had a significant impact on NJT and its employees, proving technicians with a better understanding of electrical maintenance problems. A total of 268 members of the maintenance staff attended the electrical trainings which amounted to 26 percent of the total maintenance department. The feedback from those who attended the class was overall very positive. They felt like they were able to learn a great deal in the class and are eager to participate in other such opportunities. MCI Multiplex and NABI Multiplex courses were recently developed under the grant and are just now being delivered.

As part of the Green Jobs program, NJT and ATU

representatives jointly used the Center's courseware validation process to determine if the courseware used in the training courses complies with the National Training Standards for Bus Maintenance. The material contained in NJT's courseware and instruction compared extremely favorably to the National Training Standards. Table 1 below summarizes the results of Green Jobs courseware validation at NJT. 100 percent of learning objectives contained in the National Training Standards for the five maintenance courses provided under Green Jobs are supported by their final courseware. The result was that all of the technical training provided under Green Jobs was fully compliant with the National Training Standards developed jointly by labor and management.

Course	Percent of Learning Objectives from National Training Standard Applicable to Course that are Supported by	Percent of Learning Objectives from National Training Standard Applicable to Course that are Supported by Hands-
	Courseware	On Instruction
EPA 10 Emissions	100 percent	36 percent
Navistar Engine Electronics	100 percent	58 percent
Electric I	100 percent	90 percent
Electric II	100 percent	56 percent
HVAC	100 percent	82 percent
AVERAGE	100 percent	64.4 percent

Because the Center strongly advocates the use of hands-on training as an effective learning tool for technicians, it also tracked this important learning application as part of the validation process. Although no standards currently exist regarding the appropriate amount of hands-on training, the Center recommends a minimum of 50 percent hands-on learning in overall instruction, understanding that some courses may warrant more or less depending

on the subject. Assisting NJT with hands-on learning is a fully functioning engine mock-up that is used to assist with EPA 10 Emissions training. As shown in Table 1, NJT's Green Job courses contained over 64 percent on average of hands-on instruction.

Using the method listed above, the validation of the Electrical I/II courseware emphasized the need for higher-level electrical courses to better prepare the workforce for maintenance and repair of the more complex electrical systems in newly manufactured buses. In the past, many mechanics were able to learn basic vehicle systems while they worked on the job with much of the learning being intuitive. Oil leaks, for example, are visible and can be easily traced back to the source. Today, however, vehicle systems are controlled by highly complex electronic applications and computers that can only be mastered through formal training programs. The flow of electrons through wires is invisible, and finding the source of voltage leaks requires use of more advanced testing equipment and procedures. Green Jobs funding made this learning possible for NJT and the other site locations, and brought awareness to the need for additional electronics training.

Based on the validations conducted to date, NJT has developed two additional electrical/electronic courses, MCI Multiplex and NABI Multiplex, which will address training needs for new buses and related electrical schematics. NJT is also dedicating resources to develop an additional electrical/electronics course. Trainers will continue to use the validated lesson plans created under the grant and provide more in-depth training in electrical/electronics systems to NJT technicians even after the grant expires. These are examples of the many positive long-term effects of the grant.

To address the skills needs of bus operators (drivers), NJT and the ATU New Jersey State Council participated in the National Bus Operator Training Standards committee that was formed under the Green Jobs grant. This committee was tasked to create an addendum to the APTA Recommended Practice for Transit Bus Operator Training and to provide the industry with best practices for training bus operators. During a national committee meeting discussion detailing Utah Transit Authority's approach to creating a bus operator skill gap analysis, NJT decided to perform a skill gap analysis for their transit operators. Using the template created by the Utah Transit Authority Green Jobs team, NJT and the ATU State Council formed a working group to develop a skill gap analysis, tailored to their transit agency, to determine operator training deficiency areas. Based on the skills gap analysis results, NJT created posters and flyers to reinforce the steps in pre-trip inspections and fare collection procedures that operators must perform on a bus.

The New Jersey partnership has recognized its own success and is considering ways to inform the larger community of their accomplishments. They discussed creating a one-page poster, promoting a story in the quarterly newsletter, *En Route*, and asking ATU International to promote a story in its newspaper.

COLUMBUS, OHIO

Central Ohio Transit Authority- COTA



In Columbus, the Center partnered with Central Ohio Transit Authority (COTA) and **Transport Workers United Local** 208 (TWU 208) to develop and conduct training for COTA employees. COTA is a public sector transit agency that offers comprehensive bus service throughout Ohio's Franklin County, and parts of Delaware, Fairfield, Licking and Union Counties. They are currently ranked in the top 50 of America's largest transit agencies. COTA operates a fleet of 318 buses and 62 paratransit vehicles. They currently operate 19 local, 37

express, and 11 cross-town routes with an average weekday ridership of 62,600. In 2011, COTA topped the charts by increasing ridership by 10.2 percent over 2010.

TWU Local 208

Transport Workers Union Local 208 represents all transportation and maintenance employees at COTA. Like Local 100 in NYC, Local 208 is an affiliate of the Transport Workers Union International. Local 208 has represented transit workers in Columbus since the early 1940s. Leadership in Local 208 has actively pursued development of partnershipbased training for Ohio transit workers since 2004. Local 208 has participated in national work around development of training standards.

Green Jobs Training For COTA

Much like NJT, COTA management and Local 208 had no prior history of working on projects through a joint committee. Local 208 did have experience, however, in working with the Center to establish National Training Standards for bus maintenance technicians. Still, it took several months for COTA management and Local 208 to find the common ground necessary for planning jointly developed training programs. Once labor and management were able to work together on this project, they faced a daunting task. COTA had the smallest training program of all of the Green Jobs sites. Historically, COTA's training program primarily focused on contracting with OEM vendors for specific training on an as needed basis.

With support from Center staff, COTA and Local 208 were able to take several important steps: evaluate their training needs through a maintenance skill gap analysis, identify external training providers, validate courseware to national standards, and deliver the

training to COTA employees. Ultimately, their combined efforts lead to successful training efforts, as well as a deeper understanding of their agency's needs.

The COTA training provided under Green Jobs included eight bus maintenance classes on:

- Brakes Level 2 Diagnostics,
- Electric 1 Foundation of Electrical,
- Electronics 2 Basics of Bus Electronics,
- Electronics 2 Bus Multiplexing Systems,
- Transit Bus EPA 2010 Diesel Engine Emissions,
- Hybrid Bus Diagnostics and Safety,
- Door Diagnostics,
- ThermoKing HVAC Version 3.

COTA originally committed to providing 130 training opportunities during the grant period. In spite of the joint Training Policy Committee's late start, COTA surpassed this goal, providing more than 150 training opportunities. In order to make the most of their grant funding, the Policy Committee offered multiple training sessions so more employees could benefit from the training. Direct feedback from the employees who took part in the training was extremely positive. "I would like to see the program continue. The training has been beneficial to both our employees and the Authority as a whole. We plan to continue offering green training in applicable areas of our operations."

Drema Kirkling Director of Training and Development



Courseware used in seven of the eight Green Jobs maintenance classes was validated to the National Training Standards for Bus Mechanics. (The course on Door Diagnostics was not validated because there is no corresponding national standard.) Learning objectives in all seven courses were also examined to determine the extent in which they are supported by hands-on learning. As shown in Table 2, COTA scored extremely high with 92 percent of the learning objectives from the National Training Standards supported by courseware, and 59 percent of those learning objectives supported by hands-on instruction.

Table 2: Results of COTA Courseware Validation

Course	Percent of Learning Objectives from National Training Standard Applicable to Course that are Supported by Courseware	Percent of Learning Objectives from National Training Standard Applicable to Course that are Supported by Hands- On Instruction
Brakes – Level 2	80 percent	72 percent
Diagnostics		
Electric 1 - Foundation of	85 percent	60 percent
Electrical		
Electronics 2 - Basics of Bus	92 percent	67 percent
Electronics		
Electronics 2 - Bus	100 percent	92 percent
Multiplexing Systems		
Transit Bus EPA 2010	97 percent	26 percent
Diesel Engine Emissions		
Hybrid Bus Diagnostics and	93 percent	27 percent
Safety		
Thermoking HVAC - Version	94 percent	71 percent
3		
AVERAGE	92 percent	59 percent

The collaboration between labor and management working together to identify training needs was extended to include developing course materials for learning objectives currently not supported by courseware. The Center has committed to make available its library of training material when the parties meet to discuss their future courseware needs.

Another significant and positive outcome of this project is a commitment to sustain training for COTA employees by continuing to utilize the experienced technicians who were trained as maintenance trainers during the Green Jobs Training Program. Workers are now asking to be trained properly, and management is more willing to devote resources to training now that it has identified where training is needed and witnessed the positive impact that training has on the workforce and COTA operations. Based on this positive impact, the joint Training Policy Committee met to discuss additional classes for the no cost extension to the Green Jobs grant. Once training classes were agreed upon by the joint Training Policy Committee, they were communicated to all stakeholders.

UTAH

Utah Transit Authority-UTA



In Utah, the Center partnered with the Utah Transit Authority (UTA) and Amalgamated Transit Union Local 208 (ATU 382) to develop and conduct training for employees. UTA is a public sector transit agency that offers comprehensive bus service throughout Utah's metropolitan areas of Ogden, Salt Lake City, and Provo. They operate a fleet of 518 buses, 103 paratransit vehicles, 252 vanpool vehicles, and 40 light rail vehicles within their service area of 1400 square miles. They currently operate 131 routes with an average daily ridership of 154,600. UTA is one of the fastest growing transit systems in the United States.

ATU Local 382

Amalgamated Transit Union Local 382 represents 1200 workers at UTA in all frontline job titles, including

rail and bus operators and maintenance technicians.

Intermountain Transit Career Ladder Partnership

UTA and ATU Local 382 were a natural choice as Green Jobs partners because the Authority and Local have worked with the Center since 2005, when they jointly developed the Intermountain Transit Career Ladder Partnership. The Intermountain Transit Career Ladder Partnership, through its work with many of the smaller transit locations across the state, had provided over 1400 training opportunities prior to the launch of the Green Jobs program.

The Intermountain Partnership links together the Salt Lake City-based UTA, ATU Local 382 (which spans Northern Utah.) and Utah Urban, Rural and Specialized Transportation Association (URSTA) which represent smaller transit properties around the state.

The Partnership operates as a nonprofit organization (ITCLI) governed by a Board of Directors made up of seven representatives from labor and management and the Center. A goal of The Partnership is to develop training opportunities for smaller transit properties throughout the state. Using a nonprofit to run ITCLI is effective in advancing this goal because ITCLI provides the opportunity for smaller Transit Agencies to attend training that otherwise would not be provided.

Joint work groups have met to analyze and evaluate training needs. Work has been organized in the fields of bus maintenance, light rail/commuter rail maintenance, bus

operations and facilities maintenance. Mass transit, a rapidly growing industry in Utah, has become more successful due to this coordinated system of workforce training.

Green Jobs Training at Utah Transit Authority

The Partnership was perfectly poised to take full advantage of funding for training transit workers, and it has engaged in aspect of the Green Jobs program administered by the Center. With the financial help provided by the Green Jobs Program, The Partnership has:

- Helped plan the administration of an operator skills gap analysis.
- Initiated and provided more than 1300 training opportunities.
- Developed courseware for Bus Emissions, Hybrid Technology, Bus Schematics and Diagnostics for Light Rail.
- Identified courseware for validation against the corresponding national standards.

The Partnership also administered a skills gap analysis for bus operators and determined that there was a need to conduct customer service training refresher for operators on the job. Such training is typically difficult to conduct because the operators are on the road when they are at work. In Ogden, UT, the agency decided to throw a carnival to bring the drivers on a Sunday to perform this training. About 70 operators were trained in one weekend as a result of the extra effort made by human resources to create a fun and comfortable atmosphere.

The Partnership planned and carried out classes on the following topics: Apprentice Brake, Apprentice Air Systems. Apprentice Steering, Transit Bus EPA 2010 Diesel Engine Emissions, Hybrid Diagnostics and Maintenance, HVAC, Apprentice Transmission, Aluminum TIG Welding, Customer service, and New Operator training. This has spurred the agency and The Partnership to refocus efforts on redesigning new operator training manual to better align operations needs with training.

ITCLI provided a two-day *Train the Trainer* course to twenty six maintenance employees to teach skills about adult learning in an on-the-job situation. The attendees of the *Train the Trainer* course appreciated the expertise they gained from attending the course and expressed their desire for more such training. To further enhance their understanding of adult learning principless, Joint labor-management team members participated in a Mentoring Webinar organized and presented by the Center as part of the Green Jobs program. The Webinar included participation from all Green Job sites and included material pertaining to organizing an effective mentoring program. Subjects included recruiting technicians to be mentors, mentor incentives, selecting the right trainees, elements of a structured mentoring program, preparing mentors, and program oversight. The Webinar concluded with a review of mentoring benefits and a discussion by all participants.

The Center's resident expert in national standards, John Schiavone, has validated UTA's curriculum materials against corresponding national standards for seven courses:

- Transit Bus EPA 2010 Diesel Engine Emissions,
- Apprentice Air Systems,
- Troubleshooting with Schematics and Diagrams,
- Apprentice Brakes,
- Hybrid Diagnostics and Maintenance,
- Apprentice Transmission, and
- HVAC

Table 3 shows the results of UTA's courseware validation and hands-on applications where an impressive 91 percent of the learning objectives contained in the National Training Standards for Bus Maintenance are supported by courseware and 76 percent are supported by hands-on instruction.

The Train the Trainer class was "excellent, well-done, a very thought-out class. The presenter did a good job of engaging the class. It was interesting and I enjoyed it. Transportation is vital to our communities. Well-trained people make for a safer system." Mike Schaffer, Vanpool Fleet Maintenance Supervisor 31 years with UTA

Table 3: Results of UTA Courseware Validation

Course	Percent of Learning Objectives from National Training Standard Applicable to Course that are Supported by Courseware	Percent of Learning Objectives from National Training Standard Applicable to Course that are Supported by Hands- On Instruction
Transit Bus EPA 2010	97 percent	69 percent
Apprentice Air Systems	95 percent	70 percent
Troubleshooting with Schematics and Diagrams	96 percent	62 percent
Apprentice Brakes	76 percent	91 percent
Hybrid Diagnostics and Maintenance	99 percent	56 percent
Apprentice Transmission	77 percent	93 percent
HVAC	100 percent	91 percent
AVERAGE	91 percent	76 percent

While conducting the validations, the joint labor-management team worked together to add learning materials that addressed the courseware gaps. As a result, the process helped to improve the courses, as well as UTA's validation score.

Using UTA's 10-day HVAC course as an example, six days are spent in the classroom with four days spent participating in hands-on exercises. The hands-on portion of the class

involves use of an HVAC unit, which UTA staff built on a rolling cart complete with an electric motor powering the air conditioning compressor. The agency-made learning device is used to explain HVAC system operation and to plant faults for student technicians to diagnose.

The validation findings for all seven courses were overwhelmingly positive. As the Center's John Schiavone stated for the HVAC course, "Results here are extremely impressive. All 217 applicable learning objectives contained in the standard are supported by courseware; 91 percent of the learning objectives are supported by hands-on exercises in this comprehensive 10-day course." John further suggested that the curriculum and hands-on device used in the class be replicated for national use by transit agencies everywhere; they are simply that good.

UTA and ATU Local 382's partnership is yet another testament to the strength and versatility of collaborative training arrangements. Both labor and management continue to benefit not only from a structured training and apprenticeship program, but also from the positive working relationship that maintaining a training partnership generates.