Advanced Energy Design Guide for K-12 School Buildings (AEDG) Training

Cooperative Research and Development Final Report

CRADA Number: CRD-18-00761

NREL Technical Contact: Stacey Rothgeb

NREL is a national laboratory of the U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy
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Contract No. DE-AC36-08GO28308

Technical Report
NREL/TP-5500-80502
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NOTICE

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Cooperative Research and Development Final Report

Report Date: July 6, 2021

In accordance with requirements set forth in the terms of the CRADA agreement, this document is the final CRADA report, including a list of subject inventions, to be forwarded to the DOE Office of Scientific and Technical Information as part of the commitment to the public to demonstrate results of federally funded research.

Parties to the Agreement: The American Institute of Architects (AIA), American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), U.S. Green Building Council (USGBC), Illuminating Engineering Society (IES)

CRADA Number: CRD-18-00761

CRADA Title: Advanced Energy Design Guide for K-12 School Buildings (AEDG) Training

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Sponsoring DOE Program Office(s):

Office of Energy Efficiency and Renewable Energy (EERE), Building Technologies Office (BTO)

Joint Work Statement Funding Table showing DOE commitment:

Costs	NREL Shared Resources a/k/a Government In-Kind
Year 1	$100,000.00
Year 2	$50,000.00
TOTALS	$150,000.00

Executive Summary (Abstract) of CRADA Work:

U.S. Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy (EERE), Building Technologies Office (BTO), Commercial Buildings Integration (CBI) Program supports the adoption of zero energy ready buildings design practices through targeted Science, Technology, Engineering, and Mathematics (STEM) workforce development.

The National Renewable Energy Laboratory (NREL) identified the opportunity to provided targeted training to those professionals that have the greatest potential to impact adoption and successful design outcomes of zero energy ready buildings projects.

In January 2018, ASHRAE released Achieving Zero Energy: Advanced Energy Design Guide for K-12 School Buildings (AEDG). The AEDG was developed in collaboration with NREL, American Institute of Architects (AIA), American Society of Heating, Refrigeration and Air-conditioning Engineers (ASHRAE), U.S. Green Building Council (USGBC), and Illuminating Engineers Society (IES).

The purpose of this CRADA was to create a partnership between NREL, AIA, ASHRAE, USGBC, and IES to create and host on-demand, web-based training based on the AEDG.

Summary of Research Results:

Introduction:

The Advanced Energy Design Guides (AEDG) are a series of publications developed by a collaboration between the U.S. Department of Energy (DOE), the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), The American Institute of Architects (AIA), the Illuminating Engineering Society of North America (IES), and the U.S. Green Building Council (USGBC). Each Guide focuses on a different building type and a specific energy goal, providing expert insight on definitions and processes, solution sets by climate zone, guidance on strategies and whole-building integration approaches, recommended energy targets, and examples of buildings with performance data showing proven techniques.

With increasing market interest in Zero Energy Buildings, this collaboration of partner organizations has produced two AEDG's since 2018 that focus on achieving zero energy. To supplement these Guides, particularly *Achieving Zero Energy: Advanced Energy Design Guide for K-12 School Buildings*¸ NREL adapted this Guide into a zero energy building training course. The objective of this project was to achieve greater market penetration for various building types and to provide the building design professional societies with learning content to effectively produce zero energy buildings. This course will allow audiences such as building owners, architects, and engineers to develop the skills required to achieve the zero energy goal when planning, designing, constructing, and owning a new building.

As such, NREL developed the *Achieving Zero Energy Building Design* eLearning course, including 12 modules plus a Mastery Exercise, totaling approximately 9 hours of content. This includes 7 hours of joint content and two 1-hour modules for specific architecture and engineering audiences. The eLearning interface enables dynamic learning content with various

techniques to engage learners. It includes open-ended thought questions, real-world case studies, and video testimonials from leading design professionals.

With the eLearning course completed in July 2020, Task 1 has been completed and the course has been delivered to the professional organization partners to be hosted on their own Continuing Education platforms. Metrics such as attendance, survey results on the quality of the training, and the results of in-training knowledge checks and the Mastery Exercise will be provided to NREL and DOE for a minimum of 5 years.

Task 1: Training Development

1. Original Task Description:

NREL will lead development of training materials.

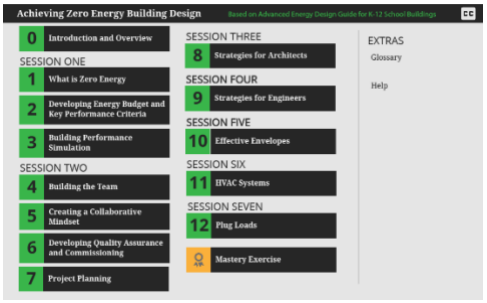
- NREL to engage and fund instructional designer subcontractor
- NREL to lead advisory group.
- Partners to provide participant for advisory group. Advisory group is anticipated to meet for one hour monthly by teleconference during period of training development (6 months).
- Partners will be asked to provide peer review of materials at two strategic points in training development processes.
- NREL to provide subject matter experts (AEDG authors) to support training development through participation in advisory group, review of developed content, and limited delivery of technical content.
- NREL will incorporate Partners minimum quality control requirements into training.
- NREL will provide training to Partners with no expectation of financial reimbursement.

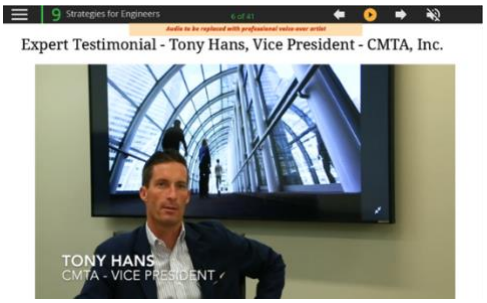
2. Explanation of Work Completed:

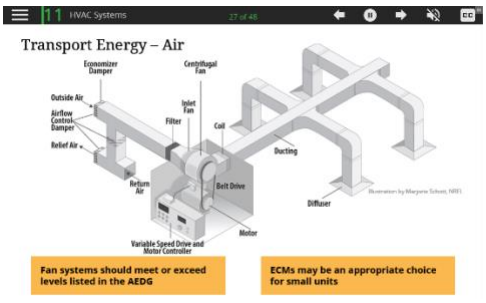
NREL developed the 12 AEDG eLearning modules, plus a Mastery Exercise, in-house. These 12 modules cover approximately 9 hours of content, which is an increase from the originally scoped 6 hours. These extra hours of content were a necessary addition to appropriately cover the course material.

NREL successfully led the Advisory Group (AG). meeting approximately once per month during the period of training development. Members of this AG, as well as other subject matter experts, provided technical peer review at two strategic points in the training development process, as planned. A total of 740 peer review comments were received and addressed by NREL.

The completed eLearning course was delivered to Partners with the incorporation of technical specifications that meet the minimum requirements for all Partners.







The thumbnail images above show examples of the content presented in this eLearning course. The top-left image shows the Main Menu screen, where 12 modules plus an introduction and a Mastery Exercise can be accessed. The top-right image shows an example of the various case study examples used throughout the course. Discovery Elementary School is one particular zero energy case study that is used in almost every module to illustrate the application of design strategies presented in the course. The bottom-left image shows and example of video testimonials from subject matter experts. These videos are used to share these experts' insight into suggested strategies for engineers and architects. The bottom-right image shows an example of the illustrations that were used throughout the training course to provide a visual supplement to the audio narration.

Task 2: Hosting

1. Original Task Description:

Partners will host training materials.

- Partners to host training materials on established e-learning sites.
- Partners may charge fee to participants for training to cover operational costs.
- Partners to manage process to provide continuing education credits for completion of training.
- Partners to track training metrics of success and provide to NREL on an annual basis for minimum of 5 years:
    - Number of participants in training
    - Quality of training as ranked by participants
    - Results of in-training knowledge tests

2. Explanation of Work Completed:

As of August 2020, training materials developed by NREL were delivered to Partner Organizations for hosting on their respective e-learning websites. At their discretion, Partners will charge a fee to access the training course on their platforms. Additionally, Partners will provide continuing education credits by measuring learners' successful completion of the course using the Mastery Exercise developed by NREL as part of the delivered training materials.

Going forward, Partners have agreed to provide training metrics to NREL on at least an annual basis for a minimum of 5 years. Quarterly reporting of these metrics will be provided in the first year of hosting. The training metrics to be reported by Partners to NREL include:

- Number of participants in training
- Quality of training as ranked by participants
- Results on in-training knowledge tests

Links to select hosting platforms:

- https://www.usgbc.org/education/sessions/achieving-zero-energy-building-design-12846187
- https://aiau.aia.org/courses/achieving-zero-energy-building-design
- https://elearning.ies.org/products/achieving-zero-energy-building-design-k-12-school-buildings#tab-product_tab_overview
- https://myelearning.ashrae.org/local/catalog/view/product.php?productid=125

Task 3: Outreach

1. Original Task Description:

NREL and Partners will work collaboratively to promote training. NREL and Partners will be notified of and be giving opportunity to review all publicity materials.

2. Explanation of Work Completed:

Collaborative outreach materials include a joint press release issued by ASHRAE on August 4, 2020. NREL will also produce an internal NREL Now article on the effort scheduled for release the week of August 10, 2020. Messaging will be amplified by use of social media across all partner organizations.

Links to promotional materials:

- https://www.ashrae.org/about/news/2020/new-advanced-energy-design-guide-course-available-to-achieve-zero-energy-school-buildings
- https://www.usgbc.org/articles/path-zero-energy-buildings?utm_source=linkedin&utm_medium=social&utm_campaign=education-resources
- https://www.nrel.gov/news/program/2020/zero-energy-schools-elevate-expectations.html

Partners were also provided Power Point slide deck to promote effort internally (Appendix A).

Subject Inventions Listing:

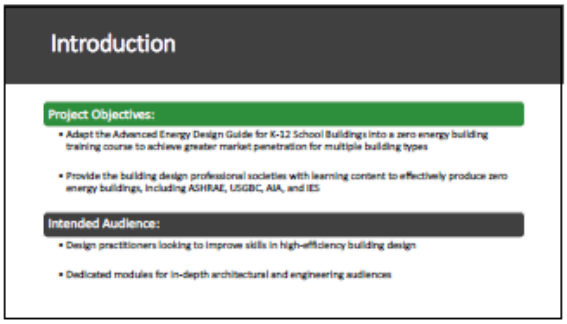
None

ROI #:

None

Appendix A: AEDG eLearning Summary Slides

1



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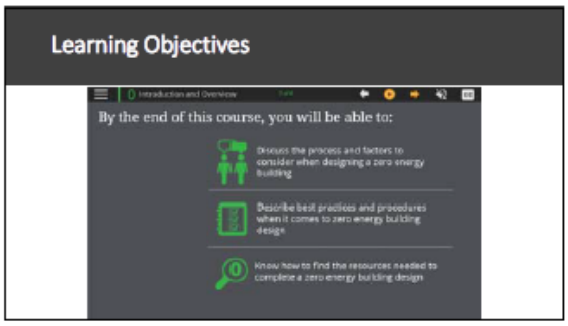

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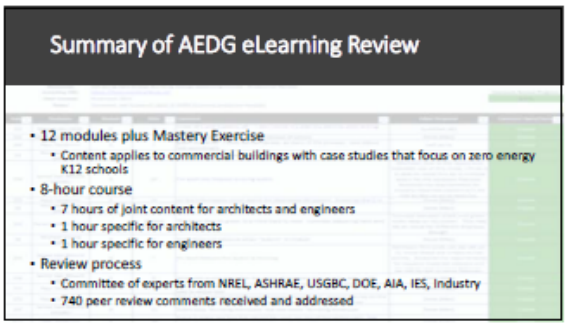

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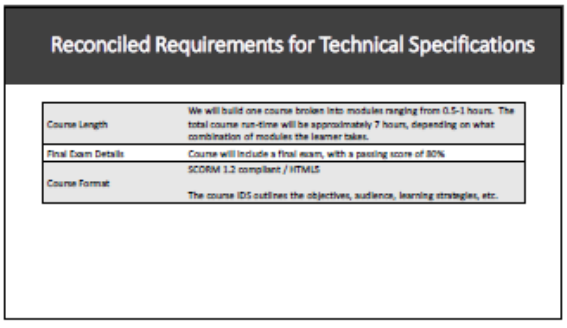

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Reconciled Requirements for Technical Specifications

Basic Course Requirements	Course will include: - Title - Feature image - Overview - Estimated time needed - Learning objectives - Applicable grade levels - Applicable subjects - Applicable themes - Preparation directives - At least one activity - Assessment options - Alignment with state or other accepted content standards - Price of course (if hosted outside of the subscription)

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Reconciled Requirements for Technical Specifications

PPT Specifications	1024x627 pixels for SCORMs - This is the standard size for online training courses - Page will scale the training to fit a user's window Formatting: Course uses Google Fonts
Video Specifications	No new video content will be produced for this course, but will ensure that any video used will meet the following: - .mp4 or .mov files - 16:9 aspect ratio - Highest resolution possible (depending on source file)
Video Additional Info	No new video content will be produced for this course
Audio Specifications	All audio will be recorded by a professional narrator in a studio, and files will be in .wav format
Editing Recommendations	Professional narrator will be sure that all audio edits are professional and complete

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Reconciled Requirements for Technical Specifications

File Size Requirements	The deliverable will be a zipped published SCORM file and will be under 1 GB
PC Requirements	This course will be published in HTML5; standard HTML5 requirements apply to view content
MAC Requirements	This course will be published in HTML5; standard HTML5 requirements apply to view content
Internet Browser / Connectivity	Latest Chrome, Firefox, Safari, and Internet Explorer for desktop/laptop Connectivity: broadband connection with 500+ kbps
eLearning Packages	The published course will be SCORM 1.2 compliant and published for HTML5
Mobile Responsive	The course will work across all platforms, but will be best viewed on a computer/laptop

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Reconciled Requirements for Technical Specifications

LEED – Specific Courses	Once we begin content development, we will determine if this course will fall under this umbrella
SITES – Specific Courses	Once we begin content development, we will determine if this course will fall under this umbrella
WELL – Specific Courses	Once we begin content development, we will determine if this course will fall under this umbrella

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Commitment / Timeframe

✓CRADA Task 1: Training Development
- Completed by NREL

❑CRADA Task 2: Hosting
- Partners will host training materials on established eLearning sites
- Partners may charge fee to participants for training to cover operational costs
- Partners will manage process to provide continuing education credits (CEUs) for completion of training
- Partners will track training metrics of success and provide to NREL on a quarterly basis for a minimum of 5 years
  - # of participants in training
  - Quality of training (as ranked by participants)
  - Results of in-training knowledge tests

❑CRADA Task 3: Outreach
- NREL and Partners will work collaboratively to promote training. NREL and Partners will be notified of and be given opportunity to review all publicity materials.

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Next Steps

- eLearning to be hosted by professional organization partners through CRADA agreement
  - Provide CEU credits
  - Training metrics to be reported back to NREL/DOE:
    - Number of Participants in training
    - Quality of training as ranked by participants
    - Results of in-training knowledge checks and open-ended thought questions
- Increased demand for virtual learning due to COVID-19 distancing

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