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Executive Summary

The energy development assumptions identified in the Department of Energy's position paper, *20% Wind Energy by 2030*, projected an exploding demand for wind energy-related workforce development. These primary assumptions drove a secondary set of assumptions that early stage wind industry workforce development and training paradigms would need to undergo significant change if the workforce needs were to be met. The current training practice and culture within the wind industry is driven by a relatively small number of experts with deep field experience and knowledge. The current training methodology is dominated by face-to-face, classroom based, instructor present training.

Given these assumptions and learning paradigms, the *purpose* of the National Wind Distance Learning Collaborative was to determine the feasibility of developing online learning strategies and products focused on training wind technicians. The initial project *scope* centered on (1) identifying resources that would be needed for development of subject matter and course design/delivery strategies for industry-based (non-academic) training, and (2) development of an appropriate Learning Management System (LMS). As the project unfolded, the initial scope was expanded to include development of learning products and the addition of an academic-based training partner. The core partners included two training entities, industry-based Airstreams Renewables and academic-based Lake Area Technical Institute. A third partner, Vision Video Interactive, Inc. provided technology-based learning platforms (hardware and software).

The revised scope yielded an expanded set of *results* beyond the initial expectation. Eight learning modules were developed for the industry-based Electrical Safety course. These modules were subsequently redesigned and repurposed for test application in an academic setting. Software and hardware developments during the project's timeframe enabled redesign providing for student access through the use of tablet devices such as iPads. Early prototype Learning Management Systems (LMS) featuring more student-centric access and interfaces with emerging social media were developed and utilized during the testing applications. The project also produced soft results involving cross learning between and among the partners regarding subject matter expertise, online learning pedagogy, and eLearning technology-based platforms.

The partners believe that the most significant, overarching accomplishment of the project was the development and implementation of goals, activities, and outcomes that significantly exceeded those proposed in the initial grant application submitted in 2009. Key specific accomplishments include: (1) development of a set of 8 online learning modules addressing electrical safety as it relates to the work of wind technicians; (2) development of a flexible, open-ended Learning Management System (LMS); (3) creation of a robust body of learning (knowledge, experience, skills, and relationships).

Project leaders have *concluded* that there is substantial resource equity that could be leverage and *recommend* that it be carried forward to pursue a Next Stage Opportunity relating to development of an online core curriculum for institute and community college energy workforce development programs.

Introduction

The National *Wind Distance Learning Collaborative* grant proposal (DE-EE0003541) was submitted in 2009 in response to DE-PS36-09G099009 – “20% Wind by 2030: Overcoming the Challenges.” Declined funding in the initial round, the grant was funded in July 2010 as an alternate award under Topic Area 5 – Workforce Development. The original grant period was extended to December 31, 2012, in order to maximize expansion of the outcomes initially identified in 2009. The expanded work plan and extended time frame was accomplished within the original budget parameters proposed in the grant application.

The core assumption underlying this project suggested that as the wind industry grows a significant increase in the number of trained wind technicians would be required. Given the limited number of potential instructors (Subject Matter Experts), current face-to-face training strategies need to be complemented by the introduction of distance-based learning programs. The original set of objectives described in the Statement of Project Objectives (SOPO) focused on processes and activities to **“identify”** subject matter, resources for course design, and delivery needs and strategies for distance-based learning driven by industry-based training companies (Airstreams Renewables, Inc.) The extended timeline enabled the partners to move from “identifying” needs to actual development of online learning modules. Additionally, the project was expanded to include an academic training partner – Lake Area Technical Institute (Watertown, SD). The transition to expanded objectives and partners is described in the **Background** section below.

During the initial consultation stages, the partners concluded that the technology platform (hardware and software) would be internet-based. The initial concept assumed that the primary learning methodology would be one (instructor) to many (students) in a synchronous timeframe across scattered geographical settings. As the project unfolded, the partners determined that a hybrid delivery strategy utilizing both synchronous and asynchronous applications offered the most flexibility for matching learner needs and circumstances. Secondly, the team decided to focus on online learning modules that could be accessed with limited instructor mediation.

From the outset, this project did not intend to develop a proprietary product with commercialization potential. The goal was and is to develop an “open-source” framework that could advance the utilization of distance-based learning within the wind industry. As this project draws to a close, it is our belief that the most significant opportunities for collaboration exist between and among the technical institutes and community colleges currently engaged in alternative energy workforce development. We have proposed a possible pathway forward to leverage the projects processes and products in the **Recommendations** section of this report.

Background

The predominant training practice and culture (state of the art) within the wind industry is driven by a relatively small number of experts with deep field experience and knowledge. This practice could be described as mentor-led and experienced-based. These subject matter experts have a deep reservoir of implicit knowledge – knowledge they have developed and carry in their mind.

These field-trained experts provide the instructional staff in both industry-based and academic-based wind technician training programs. The process of converting implicit knowledge to explicit knowledge (recorded) in the form of courses and lessons is in its early stages. The current training methodology was dominated by face-to-face, classroom-based, instructor present training. The industry was faced with the challenge of expanding explicit knowledge and developing dissemination strategies/processes that can transfer this explicit knowledge to far greater numbers of learners (workforce) in more efficient ways. Consequently, the specific area addressed was online curriculum development and delivery.

As noted earlier, the initial SOPO crafted in 2009 included discovery-based objectives primarily focused on identifying activities and resources that would be needed to develop online learning products to complement current face-to-face instructional strategies. As the project unfolded, increased resources within the Collaborative enabled partners to move beyond discovery-based objectives to development of specific learning modules and to add a second track involving an academic partner. The addition of Lake Area Technical Institute offered the opportunity to develop a second track of on-line learning products appropriate for the more traditional wind technician programs housed in academic entities. The enhanced project resources included:

- Increased and diversified staffing at Vision Video Interactive, Inc.;
- Development of new, cost-effective open-source software and technical platforms;
- Effective utilization of virtual collaboration tools.

The expanded work plan and extended time frame enabled the partners to continuously add scope to the project. Ultimately, the project objectives covered development of eight learning modules for Airstreams Renewables's Electrical Safety course and a pilot electrical safety learning prototype within Lake Area Technical Institute's energy management program. The essential development processes involved a close collaboration between the online learning/technical experts at Vision Video Inc. and the subject matter experts at Airstreams Renewables and Lake Area Technical Institute. The specific content of these learning modules and the process for their development is described in the Results and Discussion section below.

Given the fact that no online learning processes or products for industry-based training predated this project, the partners were required to create a new road map. ARI brought to the project a strong team of renewable energy experts with a combined 200+ years experience in the wind industry. While ARI programs cover all facets of wind technician training, its safety training programming is recognized as world class across the industry. Thus, the ultimate selection of Electrical Safety as the primary content area for the project's online learning modules represented a strong blend of need and expertise. It is noteworthy that during this collaborative project, ARI applied for and received national accreditation from the Accrediting Council for Continuing Education and Training (ACCET) and approval from the State of California for Veterans Administration educational benefits for veterans.

Vision Video Inc. staff included over 40 years of experience in corporate training support, interactive video product development, and application of distance (on-line) learning. More specifically, their staff has developed a number of "hybrid" learning applications (combination of on-line with face to face instruction) in the areas of energy technology and energy operations. While these energy courses were not wind specific, they included key components aligned with

wind technician training needs in electrical, mechanical, and hydraulic systems. VVI's extensive knowledge and skill set related to virtual collaboration enabled the partners to work effectively at a distance and resulted in reducing the projected travel expenses by over 90%.

While existing program development commitments limited their participation in the project, the addition of Lake Area Technical Institute enabled the collaborative to explore possible energy-centric online learning opportunities applicable to academic entities. LATI has a nationally recognized energy management program and is one of only 4 institutions in the country to be selected two years in a row as a finalist for the Aspen Prize recognizing outstanding 2-year colleges. Obviously, the academic sector offers broader opportunities and increased resources not available within industry-based training community.

Results

Airstreams Renewables, Inc.

The 8 modules that were developed for the "Electrical Safety" curriculum for Airstreams Renewables Inc. Learning Management System (see screenshots below) include:

- OL1001 Electrical Measurement Safety
- OL1002 Electrical Metering Safety
- OL1003 Electrical Multimeter Safety
- OL1004 Amp Clamp Training
- OL1005 Megohmmeter 101
- OL1006 Phase Rotation Meters
- OL1007 Infrared Testers
- OL1008 Tic Tracers

The screenshot shows the login interface of the Airstreams Renewables, Inc. Learning Management System. The header features the Airstreams logo and navigation links for 'Home' and 'All Courses'. A user status bar indicates 'You are not logged in' with a 'Login' button and a language selector set to 'English (en)'. The main content area is divided into two sections: 'Returning to this web site?' which includes a login form with fields for 'Username' and 'Password', a 'Login' button, and a link for 'Forgotten your username or password?'; and 'First Time Here? Play Overview Video' which features a video player icon and a 'Create new account' button.

Figure 1 - Airstreams Learning Management Login

Figure 2 - Airstreams Learning Management System Start Page

Figure 3 - Example of LMS Electrical Safety Module

Figure 4 - Example of Electrical Measurement Safety Content

An additional web and iPad application was developed to further enhance the "OL1003 Electrical Multi-meter Safety" course. This **interactive** application has 6 common scenarios and focuses on using the multi-meter in real-life situations (see screenshot below).

Figure 5 - Interactive Multi-meter Training

Once the integration of the all the electrical safety modules were developed into the LMS that is compatible with computer internet browsers, VVI upgraded the Airstreams Virtual Tour to render on iPads (HTML5) and upgraded all course modules to be iPad compatible using Articulate storyline (see images below).

Figure 6 - LMS iPad Compatibility Login Page

Figure 7 - LMS iPad Compatibility Module Example

Results

Lake Area Technical Institute

In addition to converting Airstreams Renewables' electrical safety content into interactive online training modules, VVI also created a new Moodle LMS for Lake Area Technical Institute. The electrical safety modules were rebranded for Lake Area Technical Institute and are HTML5 ready. All course modules and test banks for the new LATI Moodle LMS were developed and utilized in the Energy Technology department.

The following are the modules (see screenshots below) the LATI Energy Technology instructors selected:

- The Virtual Tour
- -Electrical Measurement safety
- -Electrical Metering safety
- -Electrical Multimeter Training (EST/Robotics would use this also)
- -Amp Clamps
- -Infared Tester

The Lake Area Technical Institute Energy Technology content was obtained by converted existing power point and pictures into Moodle to create online lessons. The questions from the final exam (word doc) were imported into an online format and new media (pictures and videos) was added that for supplementary reference. *Articulate Engage* (eLearning authoring software) was utilized to rework initial lessons to create more interactivity and engagement.

Lake Area Technical Institute You are not logged in.

[Home](#) > Login to the site

Returning to this web site?

Login here using your username and password
(Cookies must be enabled in your browser) ⓘ

Username

Password

☐ Remember username

[Forgotten your username or password?](#)

Some courses may allow guest access

Is this your first time here?

Hi! For full access to courses you'll need to take a minute to create a new account for yourself on this web site. Each of the individual courses may also have a one-time "enrolment key", which you won't need until later. Here are the steps:

1. Fill out the **New Account** form with your details.
2. An email will be immediately sent to your email address.
3. Read your email, and click on the web link it contains.
4. Your account will be confirmed and you will be logged in.
5. Now, select the course you want to participate in.
6. If you are prompted for an "enrolment key" - use the one that your teacher has given you. This will "enrol" you in the course.
7. You can now access the full course. From now on you will only need to enter your personal username and password (in the form on this page) to log in and access any course you have enrolled in.

You are not logged in.

Figure 8 - Lake Area Technical Institute LMS Login

Figure 9 - Lake Area Technical Institute LMS Menu

Figure 10 - Lake Area Technical Institute LMS Start Page

Figure 11 - Lake Area Technical Institute Electrical Safety Module

Discussion

Evolution of Technology (Hardware & Software)

In the brief time span of this grant/project (2+ years), hardware and software development experienced several rapid “generations” of advancement that continue to profoundly impact the technology of learning platforms and the pedagogy and delivery of new instructional strategies. The use of tablet devices (i.e. iPads) has exploded in the last several years. When Airstreams moved to introduce tablet-based instructional use early in 2012, Vision Video Interactive was able to draw upon the very latest software applications (*Articulate Storyline*) to make a pivot late in the project to reproduce all eight (8) of the Electrical Safety modules for iPad application.

Airstreams Renewables Project Applications

During development of the web-based learning modules, Airstreams continued to test student utilization both prior to and during face to face training activity. Airstreams positioned the prototype modules as a pre-class learning experience to expose students to the language and basic electrical safety requirements prior to attending our 25 day leader led course. Students receive an announcement that the courses are available online upon student enrollment via the enrollment confirmation letter.

Without question, the most significant and challenging element of the 8 module Electrical Safety course was development of the interactive multi-meter training module (Figure 5 above). Training programs typically include substantial hands-on learning activities. Thus, online

learning design for a training environment requires a blend of theory and practice (hands-on). The practice component of online learning requires more sophisticated and thus more costly interactive features. The project partnership team including subject matter experts (Airstreams), technology based learning platforms expertise (Vision Video Interactive), and eLearning pedagogy expertise (Rural Learning Center) spent considerable time consulting and designing the virtual reality-based simulation (practice) produced for the multi-meter module. The multi-meter simulation design evoked a very positive response from the instructors and wind technician trainees.

Developing the interactive multi-meter prototype required more time and resources than any other single project. Given the challenges presented by simulation products, the requirement was neither a surprise nor a concern. The project teams believed that this investment was appropriate and extraordinarily valuable to the project's overall body of learning. Should the Next Stage Opportunity described in the Recommendations section be pursued, assessing the scope of simulation-type exercises designed into the core curriculum courses will be an important element of any feasibility determination.

Airstreams instructors documented enhanced in pre-training knowledge for students using the online modules. As noted above, the iPad compatible applications were introduced at the very end of the project. The student response to iPad access has been very positive. With the launch of the free Articulate iPad Application, our students will have full access to the electrical safety web based courses. Based on the initial iPad student experience, Airstreams leased 40 iPads and converted from traditional paper text to digital-based classroom materials and information.

Future plans are to utilize these web/iPad courses as an alternative media to instructor lecture lessons. Currently these courses take up to 9 hours of instructor lecture time. Airstreams 25 day course has historically utilized instructor-based lectures to introduce the knowledge portion of electrical safety and electrical meters. The launch of the new courses will allow Airstreams to better engage the visual and kinesthetic learners using a more learner-focused approach. Instructors will continue to facilitate the learning as a resource before moving directly into the hands on lab and practical evaluation. *Consequently, the project has already had a profound impact on the construct and development of learning resources and teaching/learning pedagogy within the Airstreams training program.*

Lake Area Technical Institute Project Applications

The engagement of LATI faculty and students around the online Electrical Safety modules developed initially for Airstreams took place late in the project (second half of 2012). Faculty and staff reviewed the 8 modules produced for Airstreams and selected several for production and limited testing.

Utilizing eLearning authoring software, *Articulate* Engage, VVI worked with LATI staff and faculty to redesign the Electrical Safety modules to create more interactivity and student engagement specific to LATI energy management curriculum. The redesign team also examined new media (photos and video) to strengthen course content and presentation. Lessons sections were redesign for LATI students including testing units. A prototype lesson presentation was

implemented with student testing. Results were harvested for continuing course design and development.

During the prototyping activity at LATI, the interactive multi-meter module involving virtual reality-based simulations generated the most interest. Faculty and staff suggested that if a feasibility process relative to development of online core curriculum for energy training moved forward, incorporating practice simulations in the learning modules would be vital.

VVI in consultation with LATI staff created a prototype Moodle learning management system (LMS) for this first stage course presentation and testing activity.

Accomplishments

The most significant, overarching “accomplishment” of the project was the development and implementation of goals, activities, and outcomes that significantly exceeded those proposed in the initial grant application submitted in 2009. Essentially, the accomplishments centered around two elements: the addition of an academic partner (Lake Area Technical Institute) and the creation of three *products*: (1) development of a set of 8 online learning modules addressing electrical safety as it relates to the work of wind technicians; (2) development of a flexible, open-ended Learning Management System (LMS); (3) creation of a robust body of learning (knowledge, experience, skills, and relationships).

Learning Management System

- Utilization of open source “Moodle” to enable future flexibility;
- Creation of unique student access for future use of learning products;
- Creation of linkages to emerging social media.

On-line Learning Modules

- Utilization of cutting edge software (*Articulate-Engage/Storyline*);
- Utilization of “open source” software to take advantage of changing/evolving products;
- Development of virtual reality-based simulation for multi-meter training;
- Rapid Response to emerging tablet device usage;
- Adaptation of Airstreams modules for prototype testing in academic setting (LATI).

Body of Learning

- Knowledge cross learning between partners re: subject matter, online learning pedagogy, and technical platforms;
- Development of distance-based, virtual collaboration processes;
- Development of user-based (students) testing and feedback for product modification;
- Strategic resource development/investments by individual partners to achieve project goals;
- Early stage transformation of teaching-learning constructs by both partners.

Conclusions

As noted above, existing equity remaining from this project is substantial. The partners' enhanced organizational capacity reflected in the Achievements section has positioned them for continuing and expanded development of online learning infrastructure and content. At this point in time, Airstreams Renewables, Inc. is not in a position to continue development of their online learning program. The economic recession has caused them to suspend for the present their plans to establish multiple training centers across the United States. Thus, they are not seeking to develop further at this time their capacity to deliver online learning as a part of their training program.

However, while their participation was limited to the later stages of the project, Lake Area Technical Institute believes that there is a significant need and opportunity for online learning development at technical institutes and community colleges in the area of energy workforce development. The potential to develop cost effective processes for virtual reality-based simulations is very attractive. Obviously, from an impact and potential commercialization point of view, the institute/community college market represents a significant opportunity. The academic sector offers broader opportunities and increased resources not available within industry-based training community. A very cursory search identified 20+ technical institutes and community colleges currently delivering energy related training.

Recommendations

Next Stage Opportunity

Thus, we are proposing that DOE consider funding further investigation into the feasibility of technical institutes and community colleges collaborating around development of an online core curriculum to support a range of academic programs addressing workforce development needs related to alternative/renewable energy.

Finally, the partners would like to express their appreciation for the opportunities provided in this Department of Energy sponsored project. More specifically, we are grateful for the flexibility and responsiveness demonstrated by the DOE field team. This constructive and helpful relationship enabled the partners to continuously modify and expand the projects outcomes. Should DOE wish to consider the *Next Stage Opportunity* outlined above, we would be pleased to provide additional information and specificity.

Respectfully Submitted,

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