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National Grid's Approach to the Smart Energy Solutions Program Resource Training

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SUMMARY

As part of National Grid's Smart Energy Solutions Program that is being deployed in Worcester, MA, a comprehensive training curriculum was needed to ensure that all involved workforce personnel had the appropriate equipment understanding, tools, and procedures in place to safely and efficiently install, operate, and maintain this new technology. For each component of this program, process flow diagrams were created to identify which workforce functions would be impacted. From these diagrams, specific training documents were identified for Overhead & Underground Line Operations, Substation Operations & Maintenance, Protection and Telecommunications Operations, and the System Control Center for their respective roles and tasks. A gap analysis was performed to identify new requirements derived from the advanced technology being deployed through the program. Existing training material and work procedures were modified as required to accommodate for the technological enhancements of the program. This was achieved through working closely with Company Standards and Work Methods departments as well as vetting material through the Learning and Development organization. With draft documentation for each of the new components complete, dry-run training classes were conducted with a small sample of workforce personnel and preliminary installations of each of the identified devices were constructed in a training center environment. Training material was then further refined to account for additional learning that resulted from these 'mock-up' construction exercises. Refined training material for each impacted workforce area, in conjunction with a comprehensive Program overview, was then rolled-out as part of the 'Smart' workforce training initiative. This material has been extremely beneficial not only for workforce engagement and training, but also for communication to various internal and external stakeholders who may be looking for additional information on what the overall program will offer.

KEYWORDS

Smart Grid, Technology, Workforce Training, Process Flow, Advance Infrastructure, Learning & Development

INTRODUCTION

Terms such as "Smart Grid" or "Advanced Infrastructure" have tendency to mean different things to different organizations and stakeholders. At National Grid, the Worcester, MA Smart Energy Solutions Program is comprised of an entire suite of advanced utility technologies ranging from automated substation equipment, autonomous distribution equipment and control systems, an advanced smart metering architecture (AMI), in-home energy management technologies, as well as fully integrated back-office systems and data warehouses to support this new intelligent electrical infrastructure. When considering such a paradigm shift to the manner in which a power delivery utility plans, designs, builds, and maintains such an asset base, the importance of a comprehensive workforce training program becomes evident. This paper will focus on the workforce training required to implement such a complex system as part of National Grid's day-to-day business and the manner in which such a program was conceptualized, developed, and executed.

Due to the magnitude and complexity of National Grid's Smart Energy Solutions Program, a large group of both internal and external stakeholders are being impacted by the added technology and drastic change in system architecture and subsequent functionality. This magnifies the challenges to coordinate the proper training material that is required for each respective group. Identifying the appropriate stakeholders early is critical to maximize involvement and participation during the setup, review, and refinement of such training material documentation. Additional to the departments that were directly affected by the devices being installed, Company Standards Engineering and Work Methods groups were involved early in the process to enforce consistent procedures and to ensure that safe work practices were in place to the support the new technologies being deployed.

TRAINING PROGRAM DRIVERS

At National Grid process safety is critical to all that we do. It is vital that we develop the measures, systems, procedures and policies which prevent incidents and/or protect people and the environment from effects of major accidents. For the general public, it's providing education on how to use energy safely and to recognize and respond to risky situations. For employees, it's delivering training and defining procedures on working safely around live energy and equipment. For us, safety is not just a priority; it's a value that guides our actions. Smart Energy Solutions applications can serve to enhance system safety for both the general public and Company personnel. Recognizing the level of system complexity that a comprehensive Smart Energy Solutions Program architecture introduces, we found that thorough technical evaluation, system level testing, and a comprehensive rollout training program was necessary to ensure that all workforce personnel were provided with the appropriate knowledge and understanding of new equipment and technologies prior to implementation.

PROCESS FLOW

For each component of the Smart Energy Solutions Program, process flow diagrams were created to visually identify workforce functions that would be directly impacted by the fundamentally new system architecture. As a starting point, Subject Matter Experts (SME) were identified and assigned to the each of the various equipment 'experiments' incorporated as part of the overall Program. These SMEs were tasked with the creation of draft documentation with a focus to detail an exhaustive process path for complete implementation of each of the unique device installations. As a means to do this, existing practices and processes, identified in figure 1, were thoroughly examined to identify specific areas that required additional focus and subsequent work practice refinement to address the requirements of the new technologies being deployed.



EMS IT

Fig. 1. Existing Process Flow Structure



Fig. 2. New Process Flow Structure

Figure 2 is an illustrative example of a refined proposed process flow that was drafted to identify the required process enhancements associated with this new equipment. Once detailed diagrams were drafted, proposed process flow models were presented to key stakeholders during interactive review sessions. As a result of the presentation and review stages, process flow documents were then further modified to incorporate recommended enhancements.

TRAINING MODULE DEVELOPMENT

With conceptual process flow diagrams in place, the need for specific training documents was identified for Overhead & Underground Line Operations, Substation Operations & Maintenance, Protection and Telecommunications Operations, and the System Control Center for their respective roles and tasks. First, existing training material was reviewed to identify what components could be leveraged for the new technologies embodied in the Program in order to ensure consistency with training initiatives that are currently being practiced. The goal was to utilize existing practice and to not introduce an excessive amount of superfluous change. In some instances, requirements for new training modules were identified and addressed accordingly. In all cases, training material development carefully coordinated the safety, reliability, and efficiency. Training documents were created by the SMEs and then reviewed and refined by colleagues of the Learning and Development organization at National Grid.

A gap analysis was then performed to identify new requirements derived from the advanced technology being deployed through the program. Existing training material and work procedures were modified as required to accommodate for the technological enhancements of the program.

PRELIMINARY TRIAL INSTALLATIONS

As a means to validate the proposed training material for each of the various components, dry-run training classes were offered to a small group of representative Operations personnel. Following delivery of the proposed training material, mock-up installations for each of the devices were constructed at National Grid's training facility in Millbury, MA. This served as another means to verify that the training material being presented was clear, concise and provided the information required to successfully complete field construction activities in a safe and efficient manner. All "mock-up" or trial installations were built in compliance with Company Standards and leveraged full-size, fully dressed poles in an identical fashion to what would be replicated in field deployment as seen below in Fig 3. The use of the training yard allowed a new device, never installed before by National Grid to be installed in a safe "de-energized" environment. The line workers were able to become familiar with how the new equipment handles as well as how to safely setup the work site in the field for this new piece of equipment. This was the final check before the training was approved for use and we were able to catch critical issues that would have held up construction if this task was not performed.



Fig. 3. Mock-up Installation Construction Phase



Fig. 4. Completed Mock-up Installation

REFINEMENT & EXECUTION

Learning & Development is responsible for providing all training at National Grid which made it important for that organization to help review and approve the material. After performing dry-run activities to deliver training material and construct each of the various devices in a controlled training center environment, additional review sessions were held to discuss the end-to-end process and to identify additional areas for further product enhancement. Through doing so, it was found that further fine-tuning of the process flows were needed and training material was revised to tailor installation details based on lessons that were learned through these activities. Part of the ongoing support requires the SMEs to be in the field when needed by the line workers or their Supervisors. While this is currently a small scale "Pilot", the methods used for training will allow for larger scale deployment using existing material and methods. Also, the team building experience between Learning & Development Trainers, SMEs, and line workers are proving to be extremely valuable for the deployment of these devices in the field.

ADDITIONAL BENEFITS

This material has been extremely beneficial not only for workforce engagement and training, but also for communication to various internal and external stakeholders who may be looking for additional information on what the overall program architecture will offer. Internally, we were able to give the presentations to our Central Distribution Center personnel, Customer and Business Strategy group, Operations group and Network Strategy group by taking them to the training center showing them the material, and the mock-up installations indoors and outdoors. The training material and site demonstration efforts have been invaluable for educating external stakeholders on what National Grid's Smart Energy Solutions Program is delivering to our valued Customers in Worcester, MA. The feedback received to-date has been very encouraging and has been very useful for on-boarding various stakeholders.



Fig. 5. CAD Drawing of Actual Mock-up Installations