The Smart Grid Evolution

Impact on Skilled Utility Technician Positions

Definition

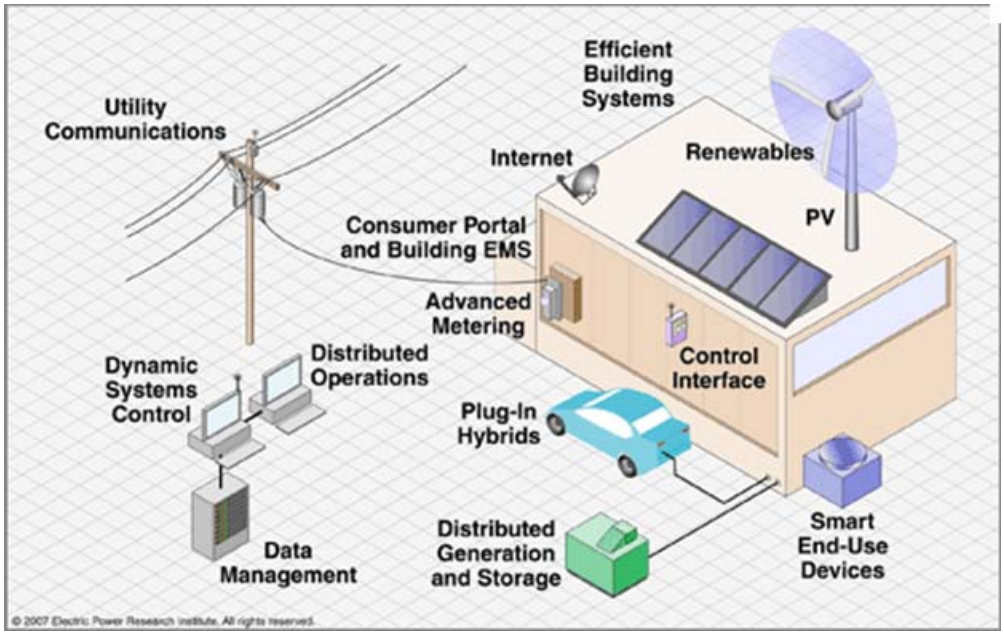
The Smart Grid is not just a compilation of smart meters, wind, solar, or plug-n electric vehicles. Instead it is a series of technologies that will allow companies to integrate, interface with and intelligently control all of these innovations. As the technology evolves, the Smart Grid will allow a two-way flow of electricity and information that is capable of monitoring everything from power plants to customer preferences and individual appliances/equipment. The Smart Grid will provide real-time information and near-instantaneous balance of supply and demand at the device level.

The Smart Grid will be implemented incrementally over the next two decades as technology, pricing, policy, and regulation changes. As such, the adoption of Smart Grid technologies will vary by Electric and Natural Gas Utility and their state position.

Smart Grid characteristics include:

1. More consumer participation in determining electric usage through an interactive electrical network. Consumers will have real-time information on pricing and usage which will allow for informed decisions on equipment/appliance usage. A Smart Grid will increase energy efficiency by allowing consumers to make decisions regarding when to run equipment and when to turn it off, such as during peak time or high cost periods. (Consumer Premises impact)
2. Two-way digital communications will provide distribution network operators with outage information and equipment in consumers' premises with demand and pricing information. (Distribution impact)
3. Ability to balance reliability and power quality where individually needed rather than wholesale across the network or a portion of the network. (Transmission impact)

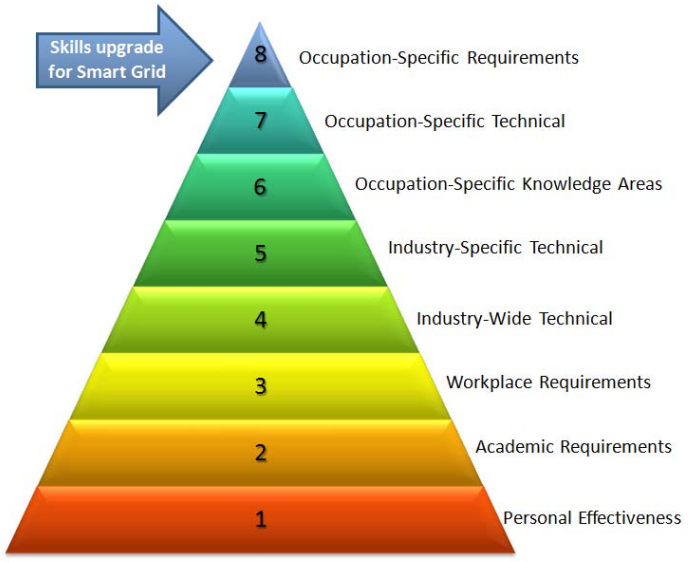
The components of a Smart Grid as shown in the chart (from presentation given at the CEWD 2009 Annual Summit by Barbara Tyran, Director, Washington Relations at EPRI) include communications, renewable energy sources that can provide consumers with their own power source but also be connected to the grid, advanced metering to provide real-time usage and pricing information, dynamic control operations



for utilities to monitor and manage the network during peak times and during outages, and "smart" appliances/equipment which will interpret the pricing and usage information to regulate usage, thereby increasing energy efficiency.

Implication to Industry Workforce

The skills and competencies defined in the Energy Competency Model: Generation, Transmission, and Distribution are the skills that will continue to be needed for the design, implementation, and maintenance of the Smart Grid network. Training will be required as new technologies are introduced, but the existing competencies will not change. For example, Information Technology is a competency in Tier 2 of the model, but will take on additional importance with Smart Grid technologies. Upgrading of Information Technology skills, particularly with engineer positions, will be critical. Managing the data required to operate and maintain the Smart Grid system will require data analytic and modeling skills. Individuals wishing to move into utility careers may need to have training to enhance their skills.



Energy Competency Model for Skilled Technician Positions in Energy Efficiency, Energy Generation and Energy Transmission and Distribution

The introduction of new technology does not, in and of itself, require new skills. The use of current two-way communications, such as SCADA, has prepared the substation, relay, and distribution network operators with the skills to manage data, troubleshoot problems, and initiate corrective actions where necessary. The following is an example of how the introduction of a new technology does not change the basic competency requirements but does add the need for a new competency (the first time introduced) or refresher training on a new version or type of equipment.

SPREADSHEET TECHNOLOGY			
Pencil & Ledger Paper	**Adding Machine / Calculator**	**Lotus 123**	**Excel**
Mathematics Planning & Organizing Problem Solving Attention to Detail	Mathematics Planning & Organizing Problem Solving Attention to Detail	Mathematics Planning & Organizing Problem Solving Attention to Detail	Mathematics Planning & Organizing Problem Solving Attention to Detail
Additional competency	Use of hand tools	Basic computer skills	New formula or structure

This review validates the importance of training on foundational skills, so that employees in skilled utility technician positions will have the critical skills and knowledge to adapt to industry changes.

Smart Grid Implementation impacts positions in Energy Transmission and Distribution and can be looked at in three groupings.

Consumer Premises –

Current Skilled Utility Technician Positions:

- Meter Readers
- Meter Technicians
- Mechanical Technicians (in large commercial and industrial customer premises)
- Electricians (in large commercial and industrial customer premises)

Smart Grid Impact on Work: Installation and maintenance of Smart Meters; Installation and maintenance of equipment for two-way communication with appliances and other in-home devices.

Impact on Skills and Competencies:
Utility workers will need to have more direct contact with customers. They will need to be able to understand pricing information, appliance/equipment connection to the grid, and data management in order to ensure that consumers understand the information they are receiving. There will also be an increased need for consumer education and public relations to simplify the information the consumer receives so that usage/demand decisions can be made easily. This will impact positions in Customer Service, Marketing, and Public Relations.

With the advent of automated meter reading and time of day metering, current meter readers are considering other opportunities within their company. One of those opportunities is to move to a meter technician position. The meter reader would need training to meet the skill requirements of this new job and to pass the pre-employment test for that job. However, the basic skills for the meter technician (whether in a Smart Grid environment or not) are the same. (See the Energy Competency Model for detailed competency definitions.)

Incumbent skilled craft workers that install and repair equipment in a consumer's premises will need training to up-skill themselves. For example, a mechanical technician works in a consumer's premise maintaining equipment. With the introduction of more sophisticated electronics to manage the equipment within a plant or home, the mechanical technician will need to enhance his/her skills to have electrical/electronic experience, including knowledge of programmable logic controls, basic electronics components (such as transistors BJT, FET, IGFET, MOSFET, SCR, and diodes), circuit functions (such as switching amplifiers, voltage regulation, limiters, and rectification), instrumentation schematics, control circuitry, ground detection and protective relaying (including the use of associated drawings for diagnosing circuit trouble), advanced electronics theory, including operational amplifiers, integrated circuits and solid state circuitry, digital electronics, including the different type of logics used and methods for programming and controlling circuit timing and electrical circuit and instrument loop schematics.

Distribution –

Current Skilled Utility Technician Positions:

- Lineworkers
- Substation Mechanics
- Substation Operators
- Relay Technicians

- Distribution Network Operators (not one of our specific jobs)

Smart Grid Impact on Work: Installation and maintenance of communication equipment at substations and switching stations or on pole tops will provide the distribution network operators with outage information and customer usage. Power quality issues and data on customer usage patterns will assist engineers in troubleshooting equipment configurations and installation or upgrading of equipment.

Impact on Skills and Competencies:
The ability to analyze the data from the two-way communications of the Smart Grid (consumer usage/demand, power quality, power outages, etc.) will be a critical skill for the distribution network operators. Today, these jobs use SCADA to manage the network, with data coming in on a periodic basis. Smart Grid implementation will provide that data on an instantaneous basis. Leveraging the equipment in the Smart Grid will require quick reflexes and troubleshooting abilities. Up-skilling of individuals to fit into other craft positions will be critical for the successful implementation of Smart Grid components.

Transmission –

Current Skilled Utility Technician Positions:

- Transmission Tower Worker
- Transmission Network Operator (not one of our skilled positions)

Smart Grid Impact on Work: Integration of renewable energy sources and distributed generation at a consumer's premise will be critical to the efficient and cost effective operation of the transmission network. Operators will have instantaneous information on plant availability and transmission line problems in order to rebalance the sources of generation.

Impact on Skills and Competencies:
Transmission workers will need to be able to ensure that alternative energy technologies, such as wind and solar, can be hooked up to the grid with sufficient transmission access. Distributed generation at a consumer's premises will be available to provide excess power to the grid. The management of the Transmission grid by Independent System Operators (ISO's) or Regional Transmission Organizations (RTO's) will be expanded with the integration of alternative fuel sources, distributed generation, and plug-in electric vehicles – each of which can contribute power to the grid.

Conclusion

The competencies required by lineworkers, power plant operators, relay and substation technicians, and other skilled craft positions in the electric energy industry will not change. New training will be required to understand the new technology and new procedures or protocols. Those individuals whose jobs may be eliminated or severely changed due to Smart Grid implementation, such as meter readers, will need to acquire new skills to move into a different utility position, i.e. meter technician or lineworker.

The implementation of Smart Grid technology will be an exciting time for the energy industry and consumers of electricity. The ability to manage one's own consumption based on pricing and need will help the reliability of the network by easing peak demands and improving energy efficiency.