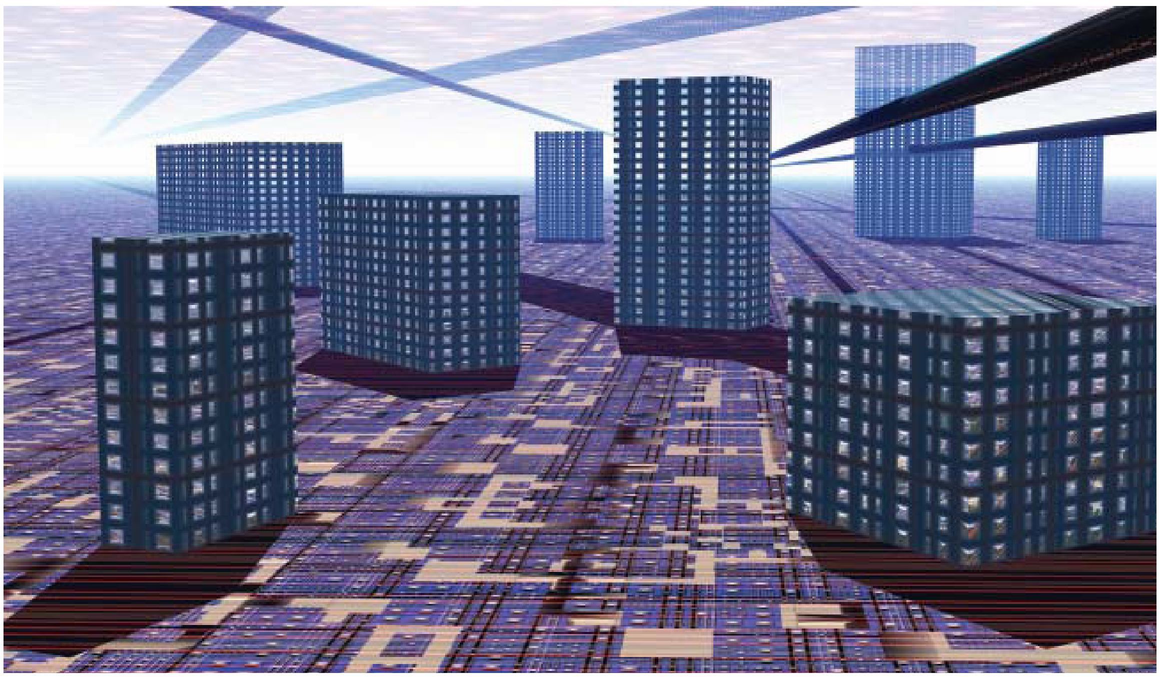
The U.S. Smart Grid Revolution
KEMA's Perspectives for Job Creation



Prepared for the GridWise Alliance

January 13, 2009

The GridWise Alliance® is a consortium of electricity industry stakeholders that advocates a vision of an electric system that integrates the infrastructure, processes, devices, information and market structure so that energy can be generated, distributed, and consumed more efficiently and cost effectively; thereby achieving a more resilient, secure and reliable energy system. Its 75 members include utilities, IT companies, equipment vendors, new technology providers and educational institutions.

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1. Executive Summary

During the next four years, KEMA's projection anticipates that a potential disbursement of $16 billion in Smart Grid incentives would act as a catalyst in driving associated Smart Grid[1] projects that are worth $64 billion. The impact of these projects would result in the direct creation of approximately 280,000 new positions across various categories, of which more than 150,000 will be created by the end of 2009. Furthermore, we estimate that nearly 140,000 new direct jobs would persist beyond the Smart Grid deployment as permanent, on-going high-value positions.

The indirect jobs, while more difficult to quantify, are substantially larger. Smart Grid is universally understood to be the key enabling technology for the nation's ambitions for renewable energy development, electric vehicle adoption, and energy efficiency improvements. In the absence of Smart Grid investments, many more hundreds of thousands of jobs in these related sectors will either be deferred or not created due to the inability of the electric infrastructure to incorporate these new technologies. Smart Grid is to the electric energy sector what the Internet was to the communications sector and should be viewed and supported on that basis.

Job creation projections by category are summarized in Exhibit 1. These jobs are created by Smart Grid projects which are already planned and "shovel ready"; however, some await final regulatory approval. The impetus of Smart Grid incentives should result in rapidly advancing the approval and commencement of these projects in 2009, in time to spur the employment growth forecast between 2009 and 2012, as shown in Exhibit 2, and to create 150,000 new jobs by the end of 2009.

[1] The term "Smart Grid" in this document refers to the networked application of digital technology to the energy delivery and consumption segments of the utility industry. More specifically, it incorporates advanced applications and use of distributed energy resources, communications, information management, advanced metering infrastructure (AMI), and automated control technologies to modernize, optimize, and transform electric power and gas infrastructure. The Smart Grid vision seeks to bring together these technologies to make the grid self-healing, more reliable, safer, and more efficient, as well as empower customers to use electricity more efficiently. It also seeks to contribute to a sustainable future with improvements to national security, economic growth, and climate change.

Category	Deployment Period (2009 to 2012)	Steady State Period (2013 to 2018)	Comments
Direct Utility Smart Grid	48,300	5,800	Direct utility jobs created by Smart Grid programs
Transitioned Utility Jobs	-11,400	-32,000	Utility positions (e.g. meter reading) transitioned to other roles
Contractors	19,000	2,000	External installation and service providers
Direct Utility Suppliers	117,700	90,000	Smart Grid equipment suppliers (e.g., metering)
Indirect Utility Supply Chain	79,300	22,500	Suppliers to Direct Utility Suppliers
New Utility / ESCO Jobs	25,700	51,400	New jobs from new Smart Grid business models
Total Jobs Created	**278,600**	**139,700**	Total new jobs at end of each period

Exhibit 1: Total Smart Grid Jobs Created and Transitioned

These positions would result from a number of key factors that are driven by the accelerated deployment of Smart Grid technologies and systems over the next 10 years. The analysis examines the net impact of increased jobs that would be required to satisfy the needs in the following areas:

- Direct Utility Smart Grid - this category is the net of the addition of new skills and transition of displaced, lower-skilled workers
- Contractors – employees and/or outside services providers who would be employed to accelerate the installation and deployment of these services
- Direct (Tier 1[2]) Utility Suppliers - supply chain providers whose equipment would be procured and deployed by utilities. This would include:
  - Meter manufacturers
  - Intelligent Transmission and Distribution (T&D) automation device producers
  - Communications system products and services providers

[2] Tier 1 suppliers are those firms that sell complete products and systems directly to utilities.

- Software system providers and integrators
- Indirect Utility Supply Chain – suppliers of raw materials and finished components to the direct, Tier 1, equipment manufacturers. Many meter manufacturers, for example, source components from third-party suppliers, who are expected to meet the volumetric requirements associated with market growth
- New Utility/ Energy Service Companies (ESCOs) - providers and aggregator jobs created in the broad "Energy Services" sector, whether at utilities or other independent firms, which would be derived from the richer and more varied business of structuring and managing consumer relationships with energy providers. While largely non-existent today, there is considerable expectation that multiple products and cottage industries will emerge in relation to the broader adoption of automation and communications technologies by the utility industry. As previously referenced, this includes new jobs formed for related service industries, including the installation, servicing, and operation of new technologies such as rooftop solar energy and Home Area Network devices and systems such as thermostats, display units and other new technologies.

- Additionally, there are many Industries related to the utility sector whose business will be accelerated by the adoption of these devices. Job creation in these industries is not calculated as part of the Smart Grid jobs creation those jobs are often quoted under the heading of those industries. This would include:
  - Renewable Energy Source suppliers whose jobs would be stimulated and accelerated by the advancement of enabling technologies
  - Distributed Generation suppliers of products and services for which demand would increase as a result of increasing end-user demand for the products
  - Plug-in Electric Hybrid Vehicles (PHEV) providers whose products have a success dependency on supporting charging and billing systems

The jobs created are shown over time in Exhibit 2 below.

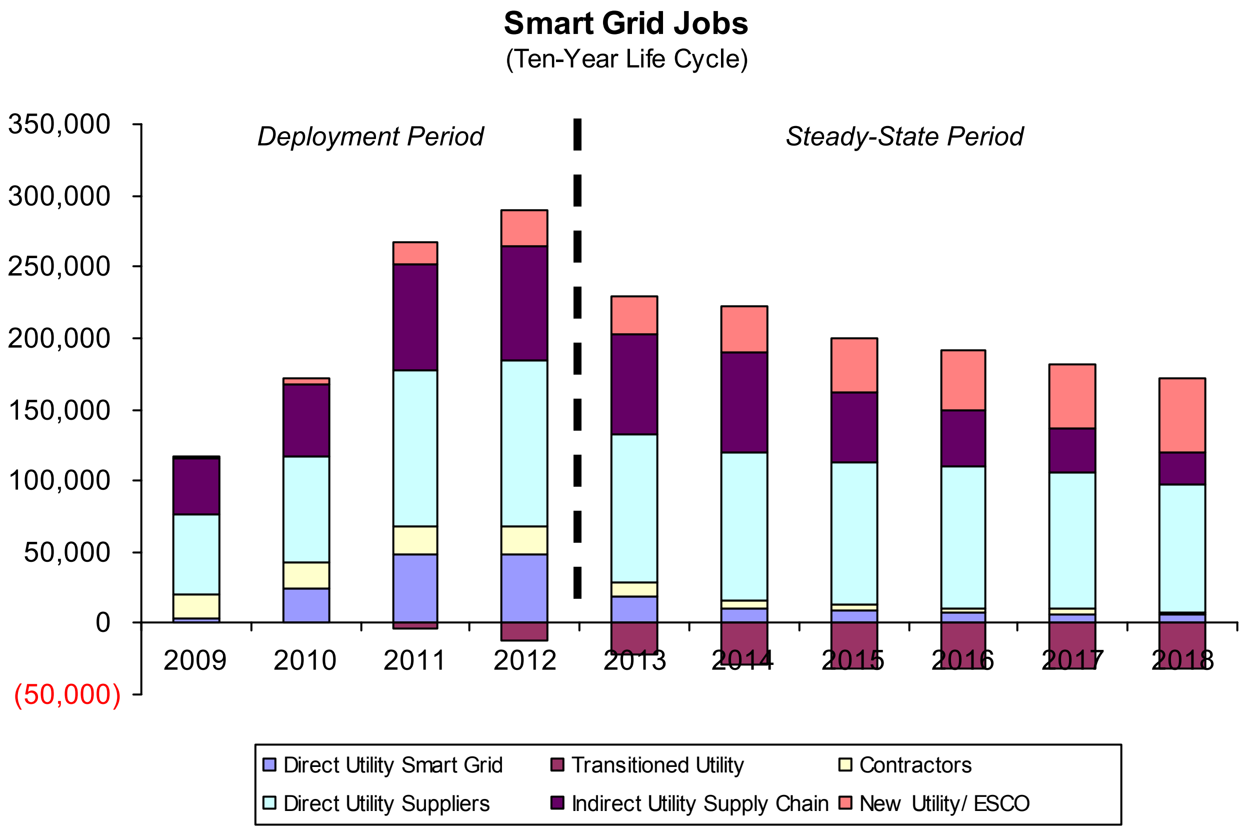


Exhibit 2: Smart Grid Jobs, Ten-Year Life Cycle

The remainder of this document provides further detail on how these projections were derived, including references to key data sources and key assumptions used in the analyses. Subsequent content is arranged as follows:

- Chapter 2 – provides further context and background regarding the Smart Grid revolution and expected impacts to related technology products and service industries.
- Chapter 3 – describes the methodology used to provide these employment projections.
- Chapter 4 – provides a summary and outlines a number of key recommendations for moving forward.

2. Background

Smart Grid is a vision for the electric delivery system of the future. The Smart Grid envisions an entirely transformed electrical infrastructure. It will embody a network of devices as vast, interconnected, automated, and interactive as the Internet. Utilities and consumers will accrue returns through the convergence of power delivery and information technologies to achieve improved reliability, reduced O&M costs, avoidance of new capacity, and increased customer satisfaction. Smart Grid includes advanced sensing, control, communications, and analytic technologies such as Advanced Metering and T&D Automation. The GridWise™ Alliance believes that Smart Grid will[3]:

- Utilize information technologies to revolutionize energy systems as they have revolutionized other aspects of U.S. business.
- Create value for all participants by developing and deploying technology solutions that cross enterprise and regulatory boundaries.
- Enhance security and reliability through an information-rich power grid that is flexible and adaptive.
- Empower consumers to benefit from their participation in the operation of the power grid.

This job creation analysis focuses in detail on the Advanced Metering and T&D automation aspects of Smart Grid, but also touches on the related new business opportunities around energy services, renewable installation and services, and home automation.

2.1 AMI Activity in the U.S.

The current Smart Grid activity in the United States mostly reflects activity undertaken to implement Advanced Metering Infrastructure (AMI). It is a generally accepted concept that AMI is often a precursor or foundational element to Smart Grid, or that the activity of Smart Grid efforts would incorporate levels of AMI.

Presently, Duke Energy is the only utility whose regulatory business case filing explicitly embodies both AMI and Smart Grid efforts in a full deployment scenario. Since the infrastructure that most utilities consider when they file their AMI plans supports Smart Grid, a foundational premise of this white paper is that the utilities who are filing their AMI business cases are also including elements of Smart Grid.

[3] GridWise Action Plan. (2008). A Joint Effort by the U.S. Department of Energy and the GridWise Alliance.

Presently, approximately 70 utilities have filed some form of AMI plan which also include pilots of this technology. Many have also filed business cases for implementation approval with their respective regulatory body. This activity represents progress in nearly 30 states.

Assuming a full-scale implementation for these AMI programs, the total number of electric meters that would be involved represents a potential of more than 70 million meters, though the total number of projects that are approved to-date represent a market size of approximately 30 million meters. Likewise, since many of these projects are in early stages of deployment or are in limited deployment pilots, fewer than 1 million AMI devices are actually deployed.

Exhibit 3 outlines major AMI projects and their respective deployment schedules. It is important to note that the most significant full-scale deployments have been approved in only two State jurisdictions: California and Texas. The programs in these states alone account for over 50% of the current deployment figures for AMI.

Typical AMI and Smart Grid regulatory filings present a business case with favorable benefit-to-cost ratios that may also include social benefits such as improved reliability and lower wholesale energy prices at peak. When these societal benefits are also factored in, the overall consumer benefit will further improve the financial attractiveness of AMI and Smart Grid as an investment.

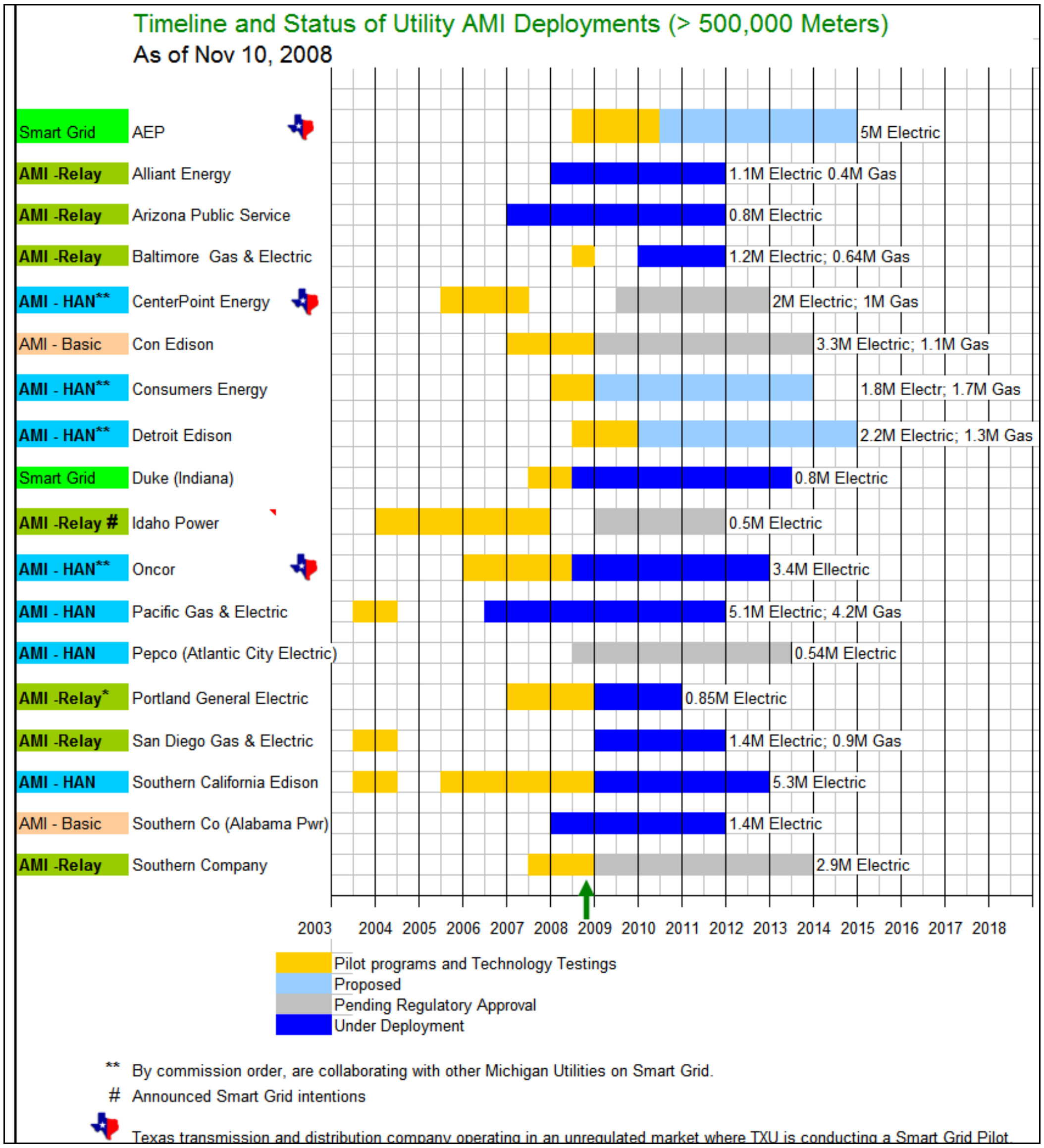


Exhibit 3: Current AMI Project Landscape

2.2 Smart Grid Activity in the U.S.

AMI is a preliminary technology to a Smart Grid development strategy. The incorporation of T&D monitoring and control adds an additional strategic aspect. Presently, only a handful of U.S. utilities have successfully embarked on wide-scale Distribution Automation independent of AMI. Based on our analysis, adding T&D automation to an AMI program to encompass more Smart Grid functionality adds approximately 30% to 40% to the total AMI costs of a full-scale meter program, while it significantly contributes to the economic benefits that would be attributed to improved T&D reliability, preventative maintenance, and asset-life extension.

Today, a typical U.S. utility plans a deployment period of 5 or more years for AMI or Smart Grid. Factors that limit the potential program acceleration are primarily attributed to capital spending constraints, workforce reduction issues, and supply chain barriers. While the customers that are first to receive advanced meters or be served by automated distribution circuits start to see direct benefits immediately, the broader social benefits and cost savings to the utility normally are not fully achieved until the deployment reaches a critical mass. Therefore, significant benefits would accrue to customers, utilities, and society in general by accelerating these programs.

If every major U.S. utility embarked on Smart Grid deployment today, the nation would be positioned with the majority of the end customer's part of a Smart Grid network. *The nations' energy infrastructure would be "renewable ready" and "electric vehicle ready" and would not be a limiting factor or obstacle to other key energy initiatives.* With a full deployment of Smart Grid, the nation's electric supply system would also achieve higher reliability and be more supportive of energy efficiency and customer choice endeavors.

2.3 Smart Grid Technologies

Exhibit 4 (adapted from the KEMA book, Utility of the Future[4]) illustrates the technology transitions that would occur at the current rate of progress by an aggressive utility. These tables outline technologies that are expected to be primarily developed in the United States and that are going through prolonged pilot and evaluation stages in the utility industry.

A major federal Smart Grid initiative would spur more rapid adoption of these selected Smart Grid technologies and could cement U.S. technological and industrial leadership in areas that are a marriage of the Information Technology and energy industries.

[4] ***Utility of the Future: Directions for Enhancing Sustainability, Reliability and Profitability, Volume 1***, Ralph Masiello, Hugo van Nispen, Robert Wilhite, and Ray Huizenga, ISBN 978-0-6152-7035-7.

Technology	2008	2012	2020
Advanced metering	Pilot Projects Filed	Pilots Being Deployed	Full Implementation
T&D Sensors	Substation based transducers	Feeder circuit transducers	Dynamic Radio Frequency Identification sensors everywhere
Distribution Protection Adaptive for DG	N/A	Fault Current Limiters, dynamic protection	Integration with Distributed Generation systems
Building Energy Management Systems Integration	Limited Functionality	Enhanced building automation	Agent Based Integration
Circuit and Substation Energy Storage	Handful of Pilots	Pilots routine and targeted deployment on problem circuits	Commonplace integrated in support of distributed renewables and EV
Centralized Renewable Generation supported by Flexible Alternating Current Transmission and Energy Storage	N/A	Piloted	Routine
High Temperature superconducting cable	A few short distance pilots planned	Technology is accepted	Routine in urban settings
Integration of Behind-the-Meter Systems	Hobbyist	Early adopter	Part of routine LEEDS standards and carbon neutral homes
Market Integration of Distributed Renewable Generation	N/A	Available in all markets	Routine
PHEV / EV Integration	N/A	Controlled charging	Vehicle-to-Grid applications and market integration
Six-sigma Integrated Micro-Grids	Piloted	Routine in new office parks and subdivisions	Being retrofitted on a widespread basis
Smart Asset Management Systems	Atypical; lack of data and data integration; lack of condition monitoring	Condition monitoring widespread	Extensive data bases and analytics deployed

Exhibit 4: Technology Transitions

The utility industry appears to be prepared to ramp-up production and delivery volumes if utilities can find the funding to move forward. Almost every U.S. T&D utility would likely be deploying Smart Grid at a faster pace if its regulatory approval and capital sourcing costs were more certain.

2.4 Renewable Portfolio Standards in the U.S.

Another growing trend, and an initiative worthy of note, is that over 30 states currently have established Renewable Portfolio Standards (RPS). These standards have established various targets that range from 10% to 30% of total generation provided by these sources of supply over the next few years and decades. Exhibit 5 shows the current status of the activity in the U.S.

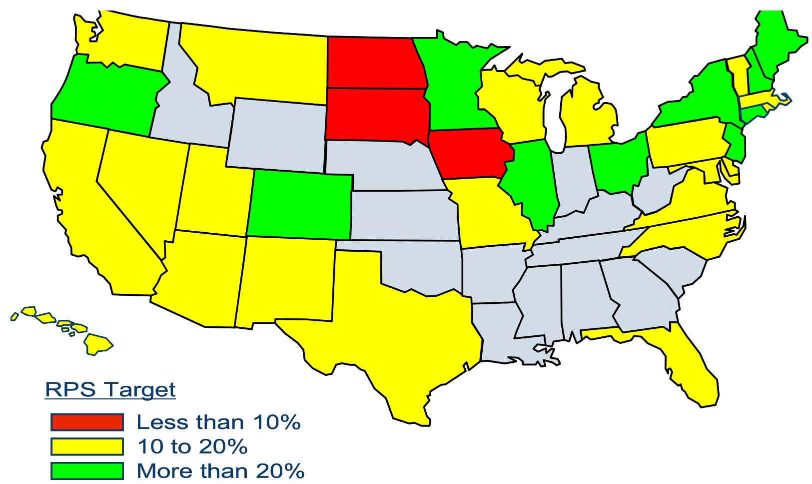


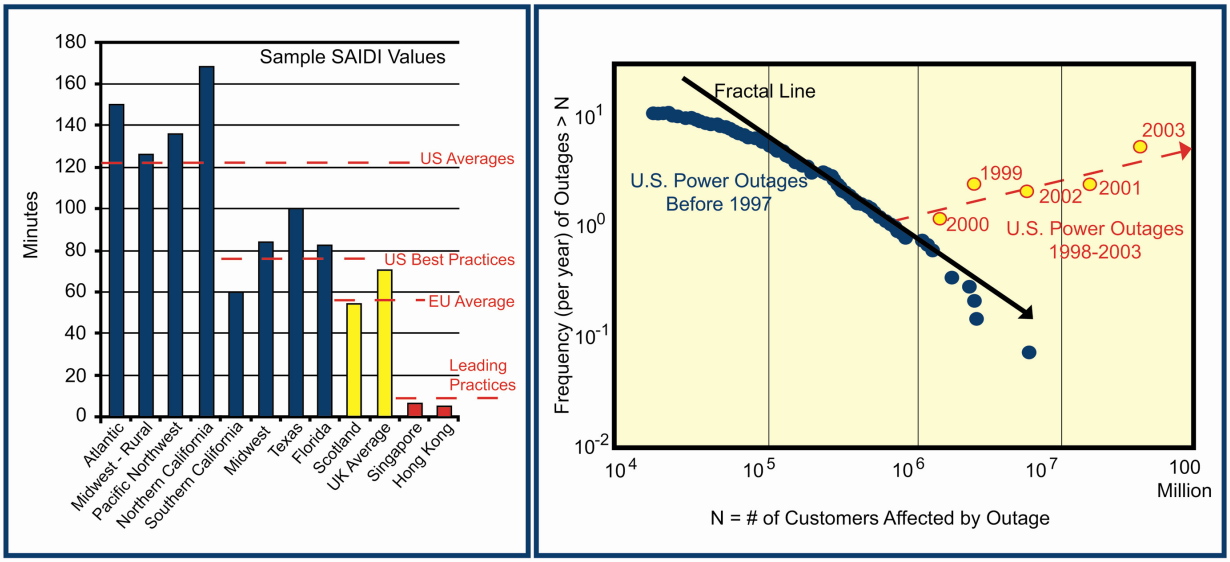
Exhibit 5: State Status of RPS (October 2008)

AMI and Smart Grid are essential to effectively integrate, manage and operate these resources. The intrinsic capability to provide net metering (separately monitoring and calculating power supplied to and from the grid) and conditioning and controlling the grid to support these resources is a core requirement to enable these programs.

2.5 Electric Service Reliability in the U.S.

System reliability in the U.S. is inadequate in comparison to the electric grid stability figures being achieved in other nations. This is not just a steady-state condition; the current trend indicates that our grid stability has actually been eroding in recent years. This condition can primarily be attributed to our aging electric infrastructure as shown in Exhibit 6.

The future of the every U.S. business is critically dependent on reliable and sustainable electric power. Reversing this current downward trend is critical to maintaining a world-leading economy in the 21st century.



Source: KEMA research, Roger N. Anderson - Columbia University

Exhibit 6: Leading Practices in Achieving SAIDI Values

Energy Storage is another dimension of the Smart Grid that has increased its technical and economic feasibility in just the past year. Advanced storage technologies are finding their way into small-scale generation (wind farm), T&D, and end-user applications. Storage can help with the variability / low capacity factor of renewable generation and is a "consumer-friendly" way to match generation to demand. Almost all the candidate storage technologies in pilot or early commercial deployment are developed in the United States. Support for energy storage as part of Smart Grid project will help develop and preserve a U.S. manufacturing base for this advanced technology, which is critical not only to Smart Grid and renewable resources but also to a future U.S. EV and PHEV industry.

2.6 Experiences of Other Industries

Other utility industries have generated considerable economic activity and job growth as they have incorporated new IT capabilities, with two examples being the cable industry and cellular telephone industry. These industries could be indicators of the job creation potential from investing in the Smart Grid.

2.6.1 Cable Industry

A 2008 study entitled "An Analysis of the Cable Industry's Impact on the U.S. Economy" [5] reports the following:

- Since 2002, direct and indirect employment attributable to the cable industry has increased by almost 367,000 jobs. This growth amounts to nearly five percent of all net new jobs created by the U.S. economy over this five-year period
- Even considering only those employment increases attributable directly to cable operators, growth since 2002 totals about 53,000 jobs – or 0.7 percent of net U.S. job growth
- Cable's economic impacts are spread throughout all major sectors of the U.S. economy. The largest impacts are in the information, services and manufacturing sectors, each of which are critical to both the growth and the overall health of the economy.

2.6.2 Cellular Telephone Industry

Wireless services are among the industries with the highest job growth. According to the Cellular Telephone Industry Association (CTIA)[6]:

- Direct Wireless Carrier employment has grown at a rate of 4.1% annually
- The total estimated direct employee count for June 2008 is nearly 268,000
- The employee to subscriber ratio has reached a plateau of approximately 1.1 direct employees per 1,000 customers. This has been relatively flat for the past 4 years, indicating a period of process optimization.

[5] Bortz Media & Sports Group, Inc. (2008). *An Analysis of the Cable Industry's Impact on the U.S. Economy.*
[6] CTIA. (2008). *Wireless Quick Facts, Mid-Year Figures*. Retrieved Dec. 22, 2008 from http://www.ctia.org/

3. Methodology and Calculations

3.1 Overview

The investment and installation of smart meters at the end of the energy supply chain (point-of-sale) will have a catalytic effect on other industries and aspects of the Smart Grid, as illustrated in Exhibit 7.

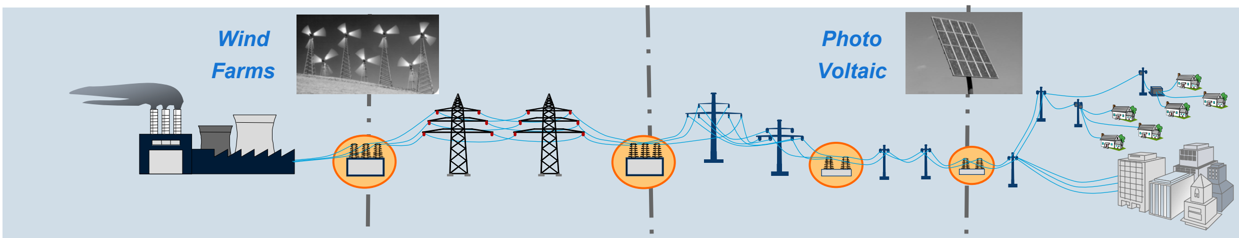


Exhibit 7: Energy Supply Chain

Some of these transformational aspects have already been outlined in the area of T&D, where the detailed point-of-sale data will result in greater reliability and efficiency, especially as the power grid transforms our work force into high-tech, industry leader roles. However the following “knock-on” effect of advance power supply and distribution of energy needs to be considered:

- Residential smart meter deployment is expected to stimulate home automation and the production of smart appliances for integration into the self energy-managed and programmable home.

- The smart meter is fundamentally a point-of-sale device and integrated with home automation and smart appliances will provide valuable buying / habit data which we have seen spur our economy in recent years when used in the food supply chain.

- Distributed generation, especially in the form of roof-top, photovoltaic units, can be more feasibly deployed with a Smart Grid deployment. Current utilities have a need to bring this resource under grid control for reliability and efficiency reasons. The deployment of this technology can result in a new industry base of suppliers, installers and software management developments at the domestic end of the energy supply chain.

- Industrial facilities such as automobile manufacturing, automobile retrofit, petrochemical, chemical, paper and pulp, packaging, glass and steel, and others, would benefit from a smart deployment of their “micro-grids” within their facilities, along with a smart coupling to the main grid, facilitating the optimization of inside–the-fence generation and power buying and selling transactions with the utility.

The analysis in this report focuses on the following four industry segments:

- Direct utility employees
- Contract utility employees
- Supply chain labor
- Related industry labor
- Broad industry labor

3.2 Direct Utility Employees Job Estimate

3.2.1 Overview

Implementing a Smart Grid represents an enterprise-wide initiative and impacts virtually the entire utility organization. Therefore, these projects will require a wide range of new skills, education, and talent. The following list describes the typical position types that will have full-time job allocations at some level. These jobs would be expected to be filled by a mix of existing utility employees and outside consultants.

Typically, utility jobs such as equipment installation and testing require specific training and experience. It normally takes several years to qualify to do this work. Given the level of training required for these jobs, the use of outside resources in this area would be limited to existing outside contractors that are already are under contract to utility companies. However, there could be more extensive use of outside resource for IT, communications, and other system integration and support services.

Smart Grid Position	During Implementation	Steady-State Position
Project Office Leadership		
o Project Manager	X	
o Executive Assistant	X	
o Lead Consultant	X	
Program Support		
o Scheduler(s)	X	
o Budget Analyst	X	
o Contacts Administrator	X	X
o Resource Manager	X	
o Communications Manager	X	
o Change Management Lead	X	
o Legal support	X	
Quality Assurance		
o Vendor Management	X	
o Test and Verification Supervisor	X	
o Performance Analysis	X	
Planning		
o Requirements Development Mgr.	X	
o Business Case Manager	X	
o Telecom/Communications	X	
o IT Interface (software, DB)	X	
o Grid Upgrades (e.g., Dist. Auto.)	X	
o Regulatory support for rate planning	X	
o Marketing and Outreach planning	X	
Functional Support		
o Rate Design Implementation	X	
o Marketing Implementation	X	
o Public Relations	X	
o Revenue Cycle services	X	
Implementation Operations & Support		
o Supply Chain and Inventory Mgmt.	X	X
o Logistics	X	X
o Meter Receipt Testing	X	X
o Meter disposal	X	X
o Meter Installation (incl. field testing)	X	X
o Grid Component Installation Mgmt.	X	
o Transformers	X	

Smart Grid Position	During Implementation	Steady-State Position
o Reclosers	X	
o Breakers	X	
o Sensors	X	
o Communications Installation Mgmt.	X	X
o IT software upgrades, replacement and new applications	X	X
o CIS	X	
o AMI	X	
o MDM	X	
o WAM	X	
o Net Metering Applications	X	
o OMS	X	
o DMS/SCADA	X	
o Demand Response	X	
o Asset Management	X	
o Customer Service (Call centers, account managers)	X	X
Functional Specialists		
o Special Metering	X	X
o Outage Management	X	X
o Net Metering (Solar, Wind, other DG)	X	X
o Prepaid Services	X	X
o Demand Response	X	X
o Special Billing	X	X
o Vehicle to Grid	X	X
o Theft prevention	X	X
o Field Technical support	X	X
o Distribution Automation	X	X
o System Planners & Engineers	X	X
o Asset Management	X	X
o Power Quality	X	X

3.2.2 Methodology

This analysis used the actual regulatory cost data from Duke Energy's recent filings of its Smart Grid deployment plans in both Indiana and Ohio. Duke Energy has a Smart Grid filing that has been used as a basis to in this analysis to project a nationwide level of job creation, based on the premise that similar Smart Grid projects would be implemented across the U.S. Duke Energy is the only major utility in the U.S. that has filed a business case with their regulator to install a complete Smart Grid (for part of their service territory). Duke also has over 800,000 electric meters for which they are proposing to implement a Smart Grid infrastructure, as well as roll out advanced metering.

Duke Energy is including Smart Grid elements to provide two-way communications and, where appropriate, remote control and automation features. This includes replacing outdoor oil circuit breakers, upgrading substations with Substation Automation systems and two-way communications, replacing the relays in circuit breakers, changing out the controls on capacitors and station load tap change transformers/regulators, providing sectionalization capabilities for the grid, and implementing self-healing technology.

Because the assumptions and methodology used to estimate the utility direct job creation is paralleled by those used for other job categories, we explain it in some detail. Exhibit 8 shows key assumptions used in the calculation.

Key Parameter and Assumption	Value
Total number of households	125,000,000
Total number of businesses	25,000,000
Total estimated number of meters	150,000,000
Percentage AMR	15%
Total non AMR	127,500,000
Total number of AMI meters installed in 2008	1,000,000
Total potential	126,500,000
Average cost of an AMI project per 1 million customers over 15 years	500,000,000
Total AMI project market estimate	$ 63,250,000,000
Eligible electric meters	128,000,000
Percent spent in start year	15% (75 M)
Percent spent in second year	25% (125 M)
Percent spent in third year	30% (150M)
Percent spent in fourth year	15% (75 M)
Percent spent in fifth thru end	15% (75 M)
% started in year 1	30%
% started in year 2	40%
% started in year 3	25%
% started in year 4	5%
Average number of years to deploy a Smart Grid system	3
% spend for labor	30%
Average annual labor cost per Full Time Equivalent employee	$75,000

Exhibit 8: Key Assumptions

We reviewed Duke Energy's regulatory filing in Indiana to determine the total projected labor costs. Their five-year capital cost estimate is $435 million or 870,000 meters, along with a total employee labor expense of $125 million, which represents close to 30% of the total cost projection.

To derive a national projection, we rounded the Duke Energy Indiana population to one million meters, increased the implementation cost to $500 million and then used a 30% ratio of labor to total cost, as a proxy consistent with the filing.

3.2.3 Calculation

There are an estimated 150 million meters in the U.S. This number has to be reduced by 10-15% to account for the deployments already underway in California and Texas and other utilities that are already in AMI deployment, and where many of the jobs are already being created. So we used 128 million meters as a remaining population. To facilitate the simplicity of the calculations, we also assumed that there would be approximately 128 Smart Grid projects at 1 million meters per project. We then used the $500 million dollar projected projects cost times 150 to get the estimated $64 billion Smart Grid spend.

We could project a "potential" Smart Grid jobs impact assuming that every eligible utility in the U.S. moved to full deployment immediately. However, we realize that some reduced percentage of implementation exists based on local power system economics, regulatory perspectives, public/private utility ownership, and the level of Smart Grid incentives. Additionally, there will be some limitations on the ability of the utilities and their suppliers to find and train some of the more demanding positions created by Smart Grid. We therefore used an estimate of the percentage of potential Smart Grid projects that start in each of the four years 2009-2012 (as shown in Exhibit 8) of 30%, 40%, 25%, and 5%, respectively. We also used the Duke Energy projected budget over a three to five year deployment period as a proxy for how labor and other costs are dispersed over time. The Duke filing has 30% of the total budget planned as utility labor; at an average cost of $75,000 per Full Time Equivalent (FTE), which we can then translate the budgeted spend over time into FTEs over time. This yields the utility direct labor jobs created as shown in the table on page 3-3. The projects started per year and the Smart Grid spending is shown in Exhibit 9.

Note: All figures in $M, except column one

No. of Programs Started	Budget	2009	2010	2011	2012	2013	2014	2015	2016
38	$19,200	$2,880	$4,800	$5,760	$2,880	$2,880			
51	$25,600		$3,840	$6,400	$7,680	$3,840	$3,840		
32	$16,000			$2,400	$4,000	$4,800	$2,400	$2,400	
6	$3,200				$480	$800	$960	$480	$480
Annual Spend	**$64,000**	**$2,880**	**$8,640**	**$14,560**	**$15,040**	**$12,320**	**$7,200**	**$2,880**	**$480**

Exhibit 9: Projected U.S. Smart Grid Projects and Spending

In addition, once a Smart Grid system is deployed, there will be several thousand utility jobs needed to maintain the Smart Gird. We estimated this number as just under 5,800 new positions. The on-going number is not expected to be higher due to the operational efficiencies gained.

3.3 Contract Utility Employee Job Estimate

3.3.1 Overview

Filings show that utilities generally subcontract the installation of meters and some of the communications equipment used for the infrastructure. Based on estimates of time and effort to complete these tasks we have projected the total number of jobs created. These jobs persist over a five-year deployment as a temporary condition, and then dissipate over time as the deployments ramp downward.

3.3.2 Methodology

A similar methodology to the utility jobs creation is used to extrapolate the 40 jobs per million meters to the 123 million meters to be installed going forward. This yields 19,000 contractor positions.

3.4 Supply Chain Job Estimate

3.4.1 Overview

Relevant Smart Grid sectors, as illustrated in Exhibit 10, outline the categories of vendors involved in supporting two-way communications on utility T&D lines and infrastructure. The illustration includes designers and manufacturers of intelligent devices capable of communicating information from customer premises or from the T&D circuits with utilities. A brief description of each sector is provided in the following paragraphs.

Exhibit 10: Relevant Smart Grid Sectors

In-home energy devices are energy management tools for customer use and control of consumption. These devices could include displays (e.g., energy usage, current kWh rate), showing programmable communicating thermostats and pre-payment terminals, as examples.

AMI meters measure time-differentiated energy consumption, and because of embedded two-way communications, facilitate customer participation in demand response programs, register customer generated energy (as in solar, wind, PHEV), measured and fed back to the electric grid (also known as net metering), signal power quality information to utilities, and provide other information that increases utility operational efficiencies.

Communications equipment transmits meter and other data between customer premises and the utility or retail energy provider, using a variety of technologies.

Distribution Automation includes two-way, intelligent communicating equipment (e.g., reclosers, circuit breakers, regulators) that enhance utility reliability and operational effectiveness.

A Meter Data Management (MDM) system is defined as the central repository for data that can be accessed by a large number of utility groups and systems. Data collected through the AMI communications backbone may be shared across the utility enterprise:

Back-office utility systems perform specific functions of collecting, storing, analyzing, and reporting information useful to the utility to improve system reliability, prepare accurate billing, enhance interaction with the customer service department, alert, manage and mitigate interruption because of outages. Examples of back-office systems include customer information systems (CIS), outage management systems (OMS), net metering applications (NMA), field work force management, asset management systems, etc.

3.4.2 Methodology

To facilitate the estimation of national jobs impact on applicable Smart Grid suppliers to utilities, the Duke Energy filing was rounded to one million meters.

If Smart Grid implementation were to take place nationally with all utilities participating concurrently, the number of jobs needed to supply the country with equipment would number 117,000. The useful life of this equipment may be as much as 10 to 15 years, after which there would be a need for replacement. Assuming manufacturing efficiencies over time, and accounting for equipment upgrades and failures more than 90,000 positions on an on-going basis would be needed. There would additionally be export market opportunities, which are not factored into this estimate.

In-home devices were not included in the Duke Energy regulatory filing. Because the vision of a Smart Grid includes customer communication, including demand response, price signaling and other data exchanges between customers and utilities, in-home devices were added. The assumption was that there were would be a minimum of two in-home devices per meter. Because of their longer useful life, there were no on-going jobs calculated for in-home devices. Those devices were identified in 3.4.1 as programmable communicating thermostats and in-home energy displays.

Naturally, there are other jobs that are supported or created by direct utility (Tier 1) supplier demand in the form of raw materials or sub-components, shipping, design, packaging, independent testing and consulting firms. This paper estimates the additional jobs created at the suppliers (Tier 2) of the direct suppliers in a consistent manner below.

Capital equipment expenditures of $686 million were calculated for a 1-million meter project, where 51% was derived from in-home devices. Meters and communications accounted for 39% and 10% for Distribution Automation and IT hardware.

For the categories of communications, IT and Distribution Automation, assumptions were that 24.5 cents of each dollar spent supported domestic jobs, where the blended cost of those jobs was estimated at $100,000 each include wages/ salaries, taxes and benefits for each full-time equivalent (FTE) position. Forty FTEs were estimated for each 1 million meters produced, and nearly 11 cents of each dollar spent for in-home displays was for domestic manufacturing related positions.

We assume that of the 75 cents of each dollar spent on purchased goods and imports; a similar 25% is spent on domestic jobs; i.e. (0.25 * 0.75) or another 75% of the tier 1 jobs created in tier 2 and upstream suppliers, or 79,250 additional jobs.

	Supply Chain Impact	
	Deployment	On-Going
In-home Devices (x2)	49,300	
AMI Meters	5,100	6,500
Communications Equipment	38,700	52,200
Distribution Automation Hardware	18,800	24,100
MDM Hardware	1,300	1,700
Back Office Hardware	4,500	6,100
Total Jobs	117,700	90,600

Exhibit 11: Jobs Needed to Support Smart Grid by Direct Suppliers

3.5 Related Industry Job Estimate

3.5.1 Overview

Utility and ESCO New Smart Grid Business Model Job Creation

Data collected from several existing competitive retailers and demand aggregators indicate an employee to customer ratio ranges from approximately 1:2, in the case of aggregators that are focused on large, complex Commercial and Industrial (C&I) customers, to 1:4,000, in the case of large utility affiliates serving major shares of residential customers in a large area. We believe that in a Smart Grid future the resulting Energy Services Company (ESCO) job situation will be a blend of the two models, but that employee customer ratios will decrease below these levels, due to better use of technology and Internet-based customer interaction, as well as due to competitive pressures. If we use a ratio of 5,000 residential customers to one employee and 500 C&I customers to one employee as conservative long term figures, we can project that utility and independent customer service employment in this new world would approach 50,000 positions as explained below.

Utility Share of Distributed Renewables Installation, Servicing, Operations

Other studies have projected from 100,000 to 300,000 new jobs to be created in the manufacturing, installation, servicing, and operations of renewable energy sources. While admittedly this is a "double count" to include any share of this figure in the Smart Grid job creation estimate, it is important to realize that long term utility employment may decrease slightly due to Smart Grid deployment; but new utility business activities would result in a net increase in utility employment. Utility shares of the ESCO job category above will be significant, especially in still-regulated jurisdictions. Utilities will also share in the business and job growth of renewables sales, installation, and service either directly or via contractors. Estimating this figure scientifically will require further work. Anecdotally, we observe that published employment advertising already is a sign that utilities with aggressive rooftop solar programs (e.g., SCE, PG&E). If we were to make a guess that the installation, servicing, and operations job content of the 100,000 renewables-derived jobs (low end of the scale) were 40% of the total, and that utilities will somehow be involved in 50% of that new market; then there are another 20,000 utility jobs to be created. These jobs are not included in the Smart Grids totals. The point of this discussion is that the utility sector is actually poised to *grow,* not to decrease, as a result of Smart Grid.

3.5.2 Methodology and Calculation

We use the same 128 million new meter figure for consistency. Twenty percent of these serve C&I customers and, at 2 meters / customer industry average, this yields 12.8 million customers. At 1 job per 500 C&I customers this would generate 25,600 positions.

The 122 million residential customers, at a typical industry ratio of 1 job per 5,000, would generate 25,800 positions.

These estimates are very conservative, given the potential for a new kind of consumer experience to generate jobs. The U.S. experience with the cellular and cable industries suggest that new job creation will be much larger. The far-from-concluded experience with the Internet suggests that the entire energy landscape will change as a result of Smart Grid and create additional businesses and jobs that cannot be foreseen today.

3.6 Broad Industry Job Estimates

Accelerated deployment of a Smart Grid would provide an incentive for accelerated development and deployment of new technologies, such as plug-in hybrid electric vehicles (PHEVs), smart appliances, home automation hardware and software, and distributed renewable energy resources (e.g., rooftop photovoltaic systems, small wind turbines, geothermal heat pumps).

By enabling accelerated deployment of these technologies, an investment in the Smart Grid has the potential to create additional jobs in these sectors. As these are emerging technologies in a sector of the economy with significant entrepreneurial activity, it is difficult to assess just how many jobs could be created in these sectors. One proxy for identifying the level of economic growth that could be anticipated is the interest from venture capital groups like Goldman Sachs and Kleiner Perkins Caufield & Byers (KPCB) and the commitment of funding from technology powerhouse Google.

In June 2007, Google announced the launch of the RechargeIT initiative to accelerate adoption of PHEVs. Google awarded $1 million in grants and promised another $10 million to fund development, adoption and commercialization of PHEVs and vehicle-to-grid technology.[7] In July 2008, Google awarded $5.8 million to ActaCell, to advance commercialization of its lithium-ion battery, and $2.5 million to Aptera, for market integration of its all-electric Typ-1 supercar.[8]

VentureBeat, an online portal that tracks venture capital funding, reported in May 2008 that funding in the Smart Grid space was "hot and heavy," with well over half a dozen large fundings in the months preceding the article.[9] Among the companies receiving funding were Optimal Technologies ($25 million from Goldman Sachs), a start-up company with technology to manage electricity allocation on local utility grids, and SmartSynch ($20 million from Credit Suisse), a company that supplies major meter manufactures with internal communication technology for their smart meters. In October 2008, KPCB announced that it was investing $75 million through its Green Growth Fund in Silver Spring Networks, a Smart Grid solution provider with technology to help consumers manage their energy use more efficiently.[10]

In addition to increasing venture capital investment in the "clean" technology sector, and Smart Grid in particular, electric utilities are investing in distributed renewable generation, for which the deployment of a Smart Grid is an enabling factor. In March 2008, Southern California Edison (SCE) announced an $875 million program to install 250 MW of solar photovoltaic (PV) systems

[7] Google Launches RechargeIT Plug-In Hybrid Car Initiative and Unveils Solar Installation, June 18, 2007. www.google.com, retrieved December 18, 2008.
[8] Google RechargeIT Fund Recipients Announced. July 24, 2008. www.pcmag.com, retrieved December 18, 2008.
[9] Smart grid investments come hot and heavy – SmartSynch gets another $20M for talkative electrical meters. May 22, 2008. http://venturebeat.com, retrieved December 18, 2008.
[10] Venture capital for smart grid technology expansion, October 9, 2008. www.metering.com, retrieved December 18, 2008.

on commercial rooftops throughout their service territory.[11] The 1 to 2 MW utility-owned PV systems will be installed on unused commercial rooftops and connected directly to the distribution system to meet the energy needs of the fastest growing areas in the region. The SCE program is intended to drive down the current cost of solar photovoltaic systems and to help California meet goals set forth in the Renewable Portfolio Standard and the California Solar Initiative ("Million Solar Roofs").

The SCE program has been a model for other electric utilities trying to achieve goals for renewable and distributed energy, including Duke Energy, which has proposed a $50 million program to install 16 MW of solar PV systems at up to 850 North Carolina sites, including homes, schools, and commercial and industrial facilities.[12] Smart Grid technologies, including smart meters with net metering capabilities, greatly facilitate the increasing penetration of distributed renewable energy technologies, which creates jobs for solar system manufacturers and installers.

[11] Application of Southern California Edison Company (U 338-E) for Authority to Implement and Recover in Rates the Cost of its Proposed Solar Photovoltaic (PV) Program (Application number A0803015). Filed with CPUC on March 27, 2008.
[12] Carr, Housley. Duke Energy plans to invest $100 million in solar projects to expand renewable portfolio. Global Power Report, June 12, 2008.

4. Summary and Recommendations

The GridWise Alliance endorses the Obama-Biden plan for Smart Grid incentives which would compensate qualifying Smart Grid projects for up to 25% of the initial investment cost. By reducing the utility investment by 25% this will make the cost benefit analysis that much more favorable.

In conclusion, Smart Grid incentives should focus on achieving the benefits of Smart Grid as outlined in Section 2 and reported in several DOE and other industry reports. The Grid Modernization Commission can be a vehicle for achieving best practices and comprehensive benefits from Smart Grid projects. Smart Grid investments have the potential to accomplish numerous benefits for the industry and the nation, including:

- Generate 280,000 new positions, many of which are high-value.
- Spur development of a domestic Smart Grid supplier's industry, which will create 140,000 ongoing high-value jobs.
- Position the U.S. as a global supplier of Smart Grid technologies, given the parallel rising interest in international Smart Grid efforts.