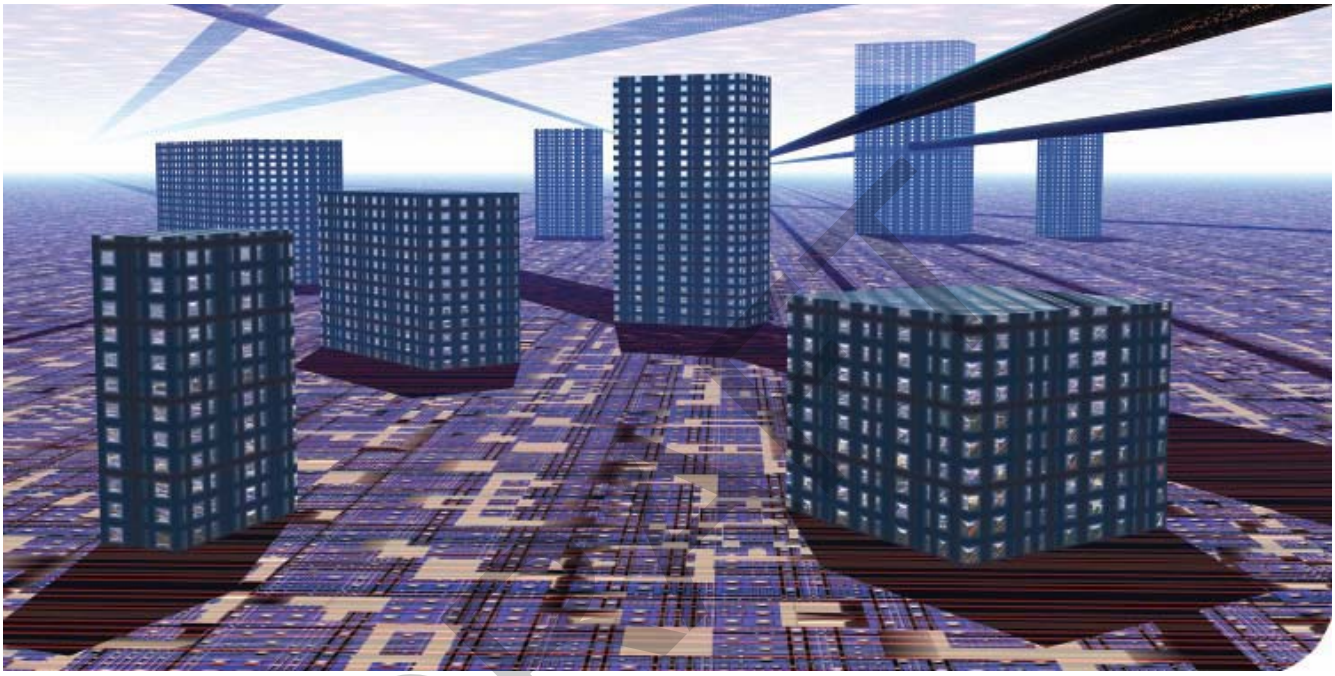
Smart Grid Project Evaluation Metrics



Prepared for the GridWise Alliance

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Table of Contents

Exhibits

1. Executive Summary

This paper was prepared by the GridWise Alliance in response to requests from the Department of Energy for suggestions and recommendations for the process of selecting Smart Grid Project Proposals to receive matching grants under the provisions of the American Recovery and Reinvestment Act of 2009 (referred to as the "Recovery Act"). The purpose of this paper is:

- To define the key metrics the DOE should use to assess Smart Grid proposals and projects under the Recovery Act.
- To describe a process for achieving stakeholder buy-in to the metrics and the weights to be used for each metric in a balanced scorecard approach to proposal evaluation.
- To suggest approaches to allocating funding to different categories of Smart Grid projects that cannot easily be compared to each other.
- To create a process to monitor and report on effective use of funding.

This work takes into account a number of key sources of information and instruction including prior DOE and National Laboratory Smart Grid work as well as the Recovery Act, Energy Independence & Security Act of 2007 (EISA), and the OMB Initial Implementing Guidelines (OMB Guidance).

2. Approach

The approach used for developing the suggested metrics is shown in Exhibit 2-1.

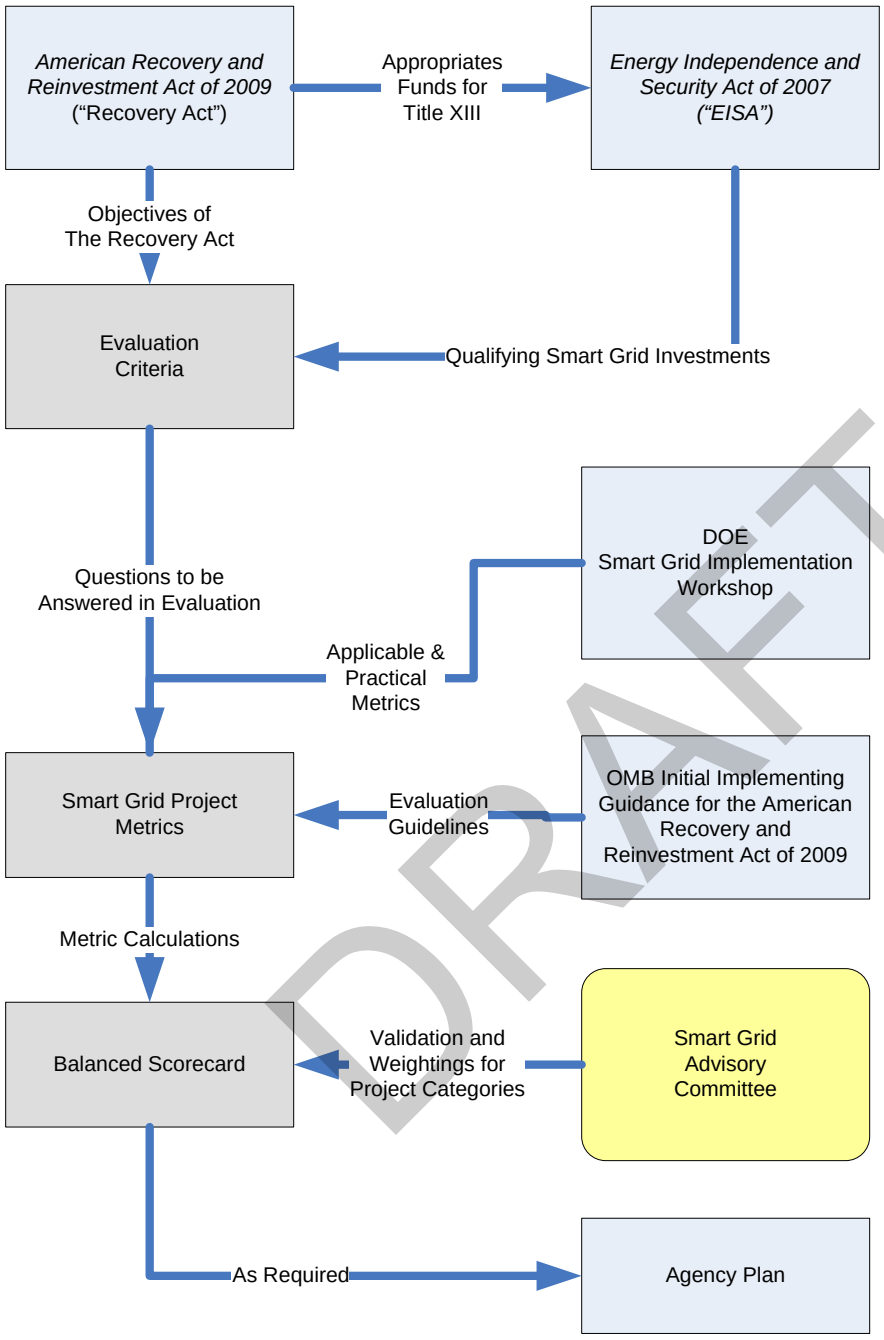


Exhibit 2-1: Metrics Development Approach

First, the Recovery Act was analyzed to identify requirements and objectives for Smart Grid project awards. Second, Title XIII Section 1306 of EISA was examined to further identify objectives and eligible projects. Third, the OMB Implementing Guidance was reviewed for critical elements to do with the overall process and the evaluation process. This led to an argument that DOE should allocate funding in tranches of solicitations over time, and that within each tranche a range of available funding is established as well as funding allocations are made to the different types of Smart Grid projects targeted by the DOE in light of the legislative and prior DOE descriptions of Smart Grid. The categories of Smart Grid project types are established, broadly, and a case made for the use of different metric weightings for competitive proposals within each category.

The Recovery Act objectives are translated into simple evaluation criteria – questions which must be answered in the submittal and evaluation of each proposal. These are used to organize the identification of specific technical and economic metrics for use in a balanced scorecard methodology.

The metrics that arose from the DOE Smart Grid workshops on Smart Grid success factors were analyzed for applicability and practicality for this purpose. Those that were applicable and capable of implementation are mapped to the evaluation criteria developed from the Recovery Act objectives. Additional metrics are identified to address the Recovery Act objectives which are not addressed by the workshop metrics. The metrics developed were also compared to those typically used in Smart Grid business case development, regulatory filings, or other ongoing utility performance reporting.

Because some of the metrics are non-fungible, a set of weightings in a balanced scorecard approach is required to perform comparative evaluations. Rather than suggest weightings, this paper suggests a well-proven methodology for developing weightings when complex metrics are in use and when different stakeholders have different perceptions of the relative importance of each metric. A mechanism to execute this process expeditiously using an existing DOE stakeholder organization, the Electricity Advisory Committee Smart Grid subcommittee, as the basis for the Smart Grid Committee stipulated in Title XIII of EISA.

A process for publishing the metrics and scorecard weightings; applying them to proposals; and disseminating results is described at a high level. Finally, a summary of which metrics can be monitored and reported by project contractors and grantees, and how these can be reported by DOE is described.

3. Recovery Act Smart Grid Provisions

The Recovery Act provides $4.5 billion for “Electricity Delivery and Energy Reliability” and instructs the Secretary of Energy to establish procedures for awarding grant money within 60 days from enactment of the legislation. The Recovery Act specifies the allocation of only $190 million of the $4.5 billion, with $100 million for worker training, $80 million for the Office of Electricity Delivery and Energy Reliability (OEDER) to conduct a resource assessment and analysis of future demand and transmission requirements, and $10 million for the National Institute of Standards and Technology (NIST) to develop a Smart Grid interoperability framework.

The remaining $4.31 billion is made available for “expenses necessary for electricity delivery and energy reliability activities to modernize the electric grid, to include demand responsive equipment, enhance security and reliability of the energy infrastructure, energy storage research, development, demonstration and deployment, and facilitate recovery from disruptions to the energy supply, and for implementation of programs authorized under title XIII of the Energy Independence and Security Act of 2007.”

The Recovery Act makes several changes to title XIII of EISA, including removing limitations on the number of Smart Grid demonstration projects and the available funding for those projects, and increasing the federal matching grants from 20 percent to 50 percent for qualifying smart grid investments. Some of the conditions for receiving funding are clearly spelled out, while others are left to the discretion of the Secretary. The purpose of this paper is to suggest clear and transparent screening criteria to facilitate the grant making process for the DOE and for those seeking funding for smart grid projects.

In the paper, we propose factors to consider when reviewing proposals for funding under the Federal Matching Fund for Smart Grid Investment Costs (EISA, Title XIII, Section 1306). Some of the factors are explicitly laid out in the text of the legislation. Others are set out as overriding goals for the Recovery Act.

3.1 Purpose of the Recovery Act

In the introduction to the Recovery Act, the heads of federal agencies are instructed to commence expenditures and activities as quickly as possible consistent with prudent management to achieve the following purposes:

1. To preserve and create jobs and promote economic recovery.
2. To assist those most impacted by the recession.
3. To provide investments needed to increase economic efficiency by spurring technological growth in science and health.
4. To invest in transportation, environmental protection, and other infrastructure that will provide long-term economic benefits.
5. To stabilize State and local government budgets, in order to minimize and avoid reductions in essential services and counterproductive state and local tax increases.

Exhibit 3-1 presents, at a high level, those key evaluation factors that should be applied to each purpose. These factors are descriptive and qualitative at this step – they are not metrics at this stage in development.

Exhibit 3-1: Recovery Act Goals and Related Metrics

Purpose	Evaluation Factor(s)
To preserve and create jobs and promote economic recovery.	Assessment of the total number of direct created or preserved (see below) jobs by specific programs and project, and a fact-based estimate of the secondary jobs that would be created or preserved through the execution of these programs or projects.
To assist those most impacted by the recession.	Determination of impact to those jobs tied to electric infrastructure value chain which are at risk due to housing and commercial construction downturns; Assessment of the number of jobs or contracts that would be made available to businesses at risk.
To provide investments needed to increase economic efficiency by spurring technological growth in science and health.	Evaluation of the impact of Smart Grid investments that provide a platform for new technologies and solutions conducive to energy efficiency, use of renewables, and improvements in reliability.
To invest in transportation, environmental protection, and other infrastructure that will provide long-term economic benefits.	Smart Grid investments should promote energy efficiency, the use of renewables, more economic energy delivery, and improve energy delivery reliability, including lowering Greenhouse Gas (GHG) emissions, and carbon footprints, improving system reliability through distributed generation and smart control, and providing for consumer options to readily participate in conservation programs.
To stabilize State and local government budgets, in order to minimize and avoid reductions in essential services and counterproductive state and local tax increases.	Grants and loan guarantees to state and municipal power agencies may assist in stabilizing state and local government budgets.

3.2 Federal Matching Fund for Smart Grid Investment Costs

EISA Title XIII includes two important sections: 1304b, Demonstration Projects and 1306, Matching Funds.

While the Recovery Act and EISA do not specify the relative allocation of funding to section 1304b and section 1306, we argue that the bulk of the approximately $4.3 billion available should be allocated to the latter on the basis that there are many more projects, more shovel-ready projects, and a stronger linkage to the Recovery Act objectives.

Section 1306 enumerates nine categories of expenditures that are authorized and eligible for matching funds as reproduced in Appendix C. It is safe to say that seven of the categories cover virtually any Smart Grid technology that a utility, a regional operator, or a utility customer might procure and install. The remaining categories are for manufacturers making an investment to enable appliances and machinery to engage in Smart Grid functions.

4. Allocation of Funding to Technological Subsets of Smart Grid Initiatives

Implicit in the act and prior DOE work on Smart Grid is a recognition of different categories of Smart Grid technologies and applications ranging from new transmission apparatus and controls to smart meters and integration with Home Automation. The different technological categories focus on achieving different objectives of the Recovery Act to varying degrees; that is, not all technologies address all objectives in a comparable fashion. How then can DOE ensure that the funding is suficiently and fairly allocated so as to appropriately cover the broad universe of Smart Grid technologies?

One mechanism to consider is to explicitly allocate funding targets or ranges of funding to different technology subsets and then to match or adust those targets within those allocated ranges as awards are made. This approach has the advantage that it clearly identifies funding levels by category/subset at the beginning of the process and this identification should spur proposals by entities falling within the various categories.

Another mechanism that would seek to address the equity issue is to allocate the funding in "tranches" or blocks of awards over defined time periods. This approach has the advantage that DOE can evaluate the diversity of technologies, geographies, and entities receiving funding over time and adjust the targets of successive tranches, as appropriate. It may also enable the

subsequent inclusion and introduction of new technologies that are not necessarily ready for commercial application today, but may instead be adopted over the course of the next 12 to 18 months. .

Both mechanisms have been used by state energy research agencies as well as DOE in the past. We recommend that DOE apply a combination of the two methodologies. DOE can announce early in the process that there are minimum target allocations of funding to different types of Smart Grid projects and transparently announce ranges of funding for each. DOE can be clear in its intentions and allocation and adjustment approach in its agency plan submitted to OMB and its publication of that plan and progress towards it on public communications such as the doe.gov/recovery web site and grants.gov.

Another advantage of the tranche approach is that there may not be sufficient shovel-ready projects to have a competitive award process at high levels in the first few months of the program. OMB is clear that grants under the Recovery Act should be competitive – thus by allocating funds in competitive tranches DOE increases the probability of having sufficient proposals to conduct a competitive selection at any moment. It also ensures that DOE can reserve some funding until a larger set of applicants can develop plans and applications.

5. Categorization of Smart Grid Projects

In order to develop and exemplify the development of evaluation metrics we make the following definitions of Smart Grid project categories (in terms of technology and applications); taking into account the ways that Smart Grid projects, demonstrations, and pilots have been constructed to date.

- Transmission apparatus with Smart Grid capabilities
- Transmission monitoring, control, and optimization
- Smart Grid Technologies focused on Renewables facilitation
- Distribution Systems
- Advanced Metering
- Microgrids capable of high reliability/resiliency and islanded operation
- Integration of Distribution Automation (DA), Feeder Automation (FA)

- Consumer integration into energy markets and grid operations

6. Evaluation Metrics

6.1 Relationship of Smart Grid Technologies to Evaluation Factors

We can generally assess each Smart Grid category defined above against the categories of evaluation factors to see how different technologies and applications map to the different factors. For instance, Smart Grid projects around transmission apparatus inherently do not "impact" the Recovery Act's objectives with respect to consumer participation and energy savings to the same degree as those around distribution and consumer systems. But if we consider the ability of new transmission technology to enable future transmission systems with enhanced performance across the metrics, an investment in these types of projects is worthwhile

6.2 Metrics Development

The recommended metrics for guiding smart grid funding allocations were developed using the results of the Smart Grid Workshop report on national smart grid metrics, which were assessed for applicability to this initiative and categorized within the evaluation criteria from the legislation. Included in these recommendations were considerations for the practicality of applying quantitative metrics to track, assess, and report. Many of the workshop criteria (e.g., venture capital funding, development of companies exceeding $100M in market capitalization) were intended to measure success levels of the penetration and development of Smart Grid on a regional or national scale and are not applicable to a single project. Others are clearly measures of Smart Grid impacts (such as improvement in System Average Interruption Duration Index (SAIDI) and can be translated to one or both of "projected benefits of a project" and "project evaluation metric post implementation." Also considered was whether the particular metric was already included in Smart Grid business case development and/or regulatory filings. Metrics that are familiar to the Smart Grid community and already calculated in an intensive review process for large-scale projects are more likely to be successfully applied and submitted with proposals in a timely . Those which have too many "issues" identified in the workshop report and which are not typical today are likely to delay project proposals and evaluations. An assessment of the workshop metrics for this purpose is shown in Appendix D.

Finally, some of the legislative objectives in the Recovery Act are simply not in the workshop results or, in some cases, in typical business case and filings. However, these are also likely among the most critical of the Recovery Act's objectives – particularly job creation, environmental impact (in terms of renewables facilitation), and sometimes the engagement and participation of the consumer. With these metrics, it is important that DOE provide guidance as to their definition and direction as to how to apply them in developing and measuring a project.

Using this process, we have developed a suggested list of metrics under each objective. This is shown in Exhibit 6-1 and the detailed explanation of each metric development is shown in Appendix E.

Exhibit 6-1: Results

Evaluation Criteria	Metric
Economic Stimulus Effect	
Job creation plans and estimates	
Timing of job creation	Direct jobs and wages created; #jobs/$000 of project cost
	Indirect supply chain jobs and wages as above
Impact on local economy	Wages and purchases spent in local economy times multiplier effect
Stimulation of a Smart Grid business ecosystem	Quantitative but subjective
Impact on regulated electric rates and energy costs to consumers	% and $ decrease in rates
	Consumer savings- average $ and % change in consumer annual bill by class
Number or extent of new programs/services being offered	Qualitative
Number of existing smart grid implementations in the state (to encourage geographic dispersion)	Qualitative
Other	As proposed
Energy Independence and Security	
Facilitation of renewable energy	Additional capacity for accomdating incrmental renewables - MW and % peak MW and & energy

Evaluation Criteria	Metric
	% of DG / renewables that can be sensed and controlled
	Facilitation of distributed renewables - projection - MW, % peak MW; % energy
	MW and % increase in maximum remote renewable resource capacity the system can accommodate
Electric Vehicle / Plug-in Hybrid Electric Vehicle integration	Qualitative
	# PHEV charging connected to V2G services
	Projected impact in terms of # of PHEV added
Demand Response management	# customers and coincident peak MW participating
	MWH saved at coincident peak
	MW reduction at coincident peak
	Market price impact
System Efficiency	% improvement in losses
	$ and % improvement in costs of failed equipment
Forecast of customer participation in demand response and conservation programs	# of customers and MW
Greenhouse gas emissions reduction potential	Tons GHG and per MWH; also tons GHG / customer
Power System reliability impacts	SAIDI improvement
	Reduced restoration time from major disruptions
	Reduction in major outages
	Improvement in Loss of Load Probability
Amount of distribution and substation automation in project	Increase in IED penetration integrated to SA and control systems
	# / % of feeders and stations to be automated
Integration and Interoperability	

Evaluation Criteria	Metric
Links to the state energy assurance plan (required of all governors)	% fulfillment
Integration with state/local energy efficiency and conservation programs	Qualitative
Plans for measurement of customer participation and adoption	Qualitative
Interoperability of smart grid technologies	Qualitative
Use of Open Protocols	Qualitative
	% improvement in # of IEDs and controllable apparatus using open protocols
	Compliance to Security needs
Business Plan Robustness	
Degree to which direct consumer participation is encouraged	Attractiveness of customer value proposition
	Open protocols and open business model to 3rd party products / services
Completeness of technology plan and maturity of chosen technologies	Qualitative
Outcome of cost-benefit analysis which includes qualitative factors such as benefits to society	Qualitative
Plans for interim reporting on progress	Not a metric; specified by DOE
Implementation plan	Assess per FAR
	Risks - cost, schedule

7. Evaluation Process

In order to apply these metrics to a proposed project and arrive at a balanced scorecard result suitable for comparing project proposals, DOE will need to develop weightings for each metric appropriate to the Smart Grid category being proposed.

One approach to developing the weightings (and gaining some acceptance of the metrics) for DOE to consider is the "Analytical Hierarchical Process" or AHP. AHP is a process for developing weightings of multi-factor metrics that are not fungible and where different stakeholders have different perceptions of the importance and value of each metric. AHP has an accepted theoretical background, is widely used in project evaluations in a number of domains, and has been applied to Smart Grid and related project assessment criteria development in the past. It is supported by a number of commercially available software tools. It is a transparent process wherein stakeholders interact to develop relative comparative pairwise weightings and then which rationalizes those weightings in a logical and mathematical framework. We recommend that DOE make use of the existing Electricity Advisory Committee (EAC) which (a) is familiar with the issues especially Smart Grid; (b) was chosen to broadly represent stakeholders across a wide spectrum and to contain necessary expertise; and (c) is accustomed to working as a team to resolve differences. The EAC Smart Grid subcommittee could be the basis for the formation of the Smart Grid Advisory Committee stipulated in EISA. An experienced facilitator can guide the Smart Grid Advisory Committee through the metrics and weightings development in a few days of workshops resulting in a final product with expected credibility and value to DOE.

DOE could then publish the metrics and weightings on www.doe.gov/recovery as well as link it to grants.gov so that the process would be transparent to grant applicants.

By publishing the criteria and guidance on definitions and methodology, DOE can require grant applications to provide the basis of calculations of metrics which DOE can then audit and adjust as part of the evaluation process. DOE would also apply its own metrics which cannot be prepared by the applicant – the metrics that judge the risk of the project, the capabilities of the project team, the financial strength of the team, and so on as prescribed by OMB in the Guidance.

8. Reporting

The OMB Guidance spells out periodic agency reporting requirements on agency programs under the Recovery Act. The Guidance also points to existing Federal regulations and procedures for monthly cost and progress analysis and reporting by contractors and grantees. This paper does not attempt to amplify on these well-understood processes.

We do, however, suggest that on a periodic basis the entity executing an awarded project (contractor, utility, government / non profit organization) report on project performance against

the evaluation criteria. The evaluation metrics that are calculated in the original project proposal and audited/modified/accepted by DOE should be derived from a set of calculations and assumptions that were transparent in the proposal and consistent with accepted definitions and DOE guidance. As such, they are subject to change as inputs to those calculations change. The DOE should require the project entity to update and report on changes to the metrics calculation on a periodic basis. Once the demonstration project is deployed, the project entity should assess the system performance metrics (reliability, costs, consumer participation, etc) that were derived and report on the development of those observed metrics vs. the proposal/project implementation calculations. A final report should include a reconciliation of all proposed and observed metrics and scorecard results.

DOE can establish a database of proposed and awarded metrics and scorecard results plus the evolution of those through the project and as finally reported. This database can be used to accomplish a number of beneficial results:

- Publication of it allows the likely future proposing entities to fine tune their proposed metrics and scorecards and to understand where the assumptions and calculations have changed with events.
- Publication during implementation will also allow follow-on projects to learn from the earlier ones.
- DOE will ultimately possess a database of calculations, observations, and reconciliations that will be useful to the industry in future Smart Grid project planning on a commercial basis. This will also be useful in future regulatory processes.
- DOE will have a basis for periodic agency reporting of the expected and updated metrics and scorecards on an overall basis for analysis.

9. Summary

A set of metrics have been developed logically from the results of recent DOE workshops with industry stakeholders that developed broad Smart Grid success factors, adapting these to the needs of proposal evaluation and scoring. Typical technical and economic metrics already well understood and developed in Smart Grid business case development and regulatory filings are used and mapped to the relevant workshop metrics. Additional metrics are simply defined to satisfy the needs of evaluating proposals against the Recovery Act objectives and evaluation

criteria where the prior work and industry practice is silent, and guidance to proposers for these metrics is suggested.

A process of ratifying the metrics and developing balanced scorecard weightings for them is described that would take advantage of the Electricity Advisory Committee and would make use of an accepted scorecard development methodology, the Analytical Hierarchical Process.

The way in which DOE could apply these metrics to tranches of proposal requests and submittals with allocated funding ranges is described, along with simple processes to allocate funding and tranches to technical project categories.

10. References

The American Recovery and Reinvestment Act of 2009, Public Law No: 111-005

The Energy Independence and Security Act of 2007,

Initial Implementing Guidance for the American Recovery and Reinvestment Act of 2009, Executive Office of the President, Office of Management and Budget, 2/18/2009. Retrieved from www.recovery.gov.

"Smart Grid: Enabler of the New Energy Economy," A Report by the Electricity Advisory Committee to the U.S. Department of Energy, December 2008.

Smart Grid Workshop results for Smart Grid measures of success

Analytical Hierarchical Process

Appendix A – Energy Independence and Security Act of 2007, Title XIII – Smart Grid

Section 1304(b) – Smart Grid Regional Demonstration Initiative

(1) IN GENERAL.—The Secretary shall establish a smart grid regional demonstration initiative (referred to in this subsection as the ‘‘Initiative’’) composed of demonstration projects specifically focused on advanced technologies for use in power grid sensing, communications, analysis, and power flow control. The Secretary shall seek to leverage existing smart grid deployments.

(2) GOALS.—The goals of the Initiative shall be—

(A) to demonstrate the potential benefits of concentrated investments in advanced grid technologies on a regional grid;

(B) to facilitate the commercial transition from the current power transmission and distribution system technologies to advanced technologies;

(C) to facilitate the integration of advanced technologies in existing electric networks to improve system performance, power flow control, and reliability;

(D) to demonstrate protocols and standards that allow for the measurement and validation of the energy savings and fossil fuel emission reductions associated with the installation and use of energy efficiency and demand response technologies and practices; and

(E) to investigate differences in each region and regulatory environment regarding best practices in implementing smart grid technologies.

(3) DEMONSTRATION PROJECTS.—

‘(A) IN GENERAL.—In carrying out the initiative, the Secretary shall provide financial support to smart grid demonstration projects in urban, suburban, tribal, and rural areas, including areas where electric system assets are controlled by nonprofit entities and areas where electric system assets are controlled by investor-owned utilities.’

(B) COOPERATION.—A demonstration project under subparagraph (A) shall be carried out in cooperation with the electric utility that owns the grid facilities in the electricity control area in which the demonstration project is carried out.

(C) FEDERAL SHARE OF COST OF TECHNOLOGY INVESTMENTS.—The Secretary shall provide to an electric utility described in subparagraph (B) or to other parties financial assistance for use in paying an amount equal to not more than 50 percent of the cost of qualifying advanced grid technology investments made by the electric utility or other party to carry out a demonstration project.'

(D) INELIGIBILITY FOR GRANTS.—No person or entity participating in any demonstration project conducted under this subsection shall be eligible for grants under section 1306 for otherwise qualifying investments made as part of that demonstration project.

(E) AVAILABILITY OF DATA.—The Secretary shall establish and maintain a smart grid information clearinghouse in a timely manner which will make data from smart grid demonstration projects and other sources available to the public. As a condition of receiving financial assistance under this subsection, a utility or other participant in a smart grid demonstration project shall provide such information as the Secretary may require to become available through the smart grid information clearinghouse in the form and within the timeframes as directed by the Secretary. The Secretary shall assure that business proprietary information and individual customer information is not included in the information made available through the clearinghouse.

(F) OPEN PROTOCOLS AND STANDARDS.—The Secretary shall require as a condition of receiving funding under this subsection that demonstration projects utilize open protocols and standards (including Internet-based protocols and standards) if available and appropriate.

(c) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated—

(1) to carry out subsection (a), such sums as are necessary for each of fiscal years 2008 through 2012; and

(2) to carry out subsection (b), such sums as may be necessary.

Section 1306 – Federal Matching Fund for Smart Grid Investment Costs

Section 1306 Provisions are summarized in the table below

What Qualifies?	Who Qualifies?
Appliances Devices that allow appliances to engage in Smart Grid functions (note: Appliances must be covered under part B of title III of the Energy Policy and Conservation Act of 1975, which established energy conservation standards)	**Appliance Manufacturers** The documented expenditures incurred by a manufacturer of such appliances associated with purchasing or designing, creating the ability to manufacture, and manufacturing and installing for one calendar year
Specialized Electricity-Using Equipment Devices or modifications that allow specialized electricity-using equipment (e.g., motors and drivers) to engage in Smart Grid functions	**Equipment Owner or Manufacturer** The documented expenditures incurred by its owner or its manufacturer of installing devices or modifying that equipment to engage in Smart Grid functions
Monitoring And Communications Devices T&D equipment fitted with monitoring and communications devices to enable smart grid functions	**Electric Utility** The documented expenditures incurred by the electric utility to purchase and install such monitoring and communications devices
Metering and Control Devices Metering devices, sensors, control devices, other devices integrated with and attached to an electric utility system or retail distributor or marketer of electricity capable of engaging in Smart Grid functions	**Electric Utility or Retail Distributor or Marketer and its Customers** The documented expenditures incurred to purchase and install such devices
Software Software that enables devices or computers to engage in Smart Grid functions	**Software Purchaser** Documented purchase costs of software
System Operation Equipment Equipment that allows Smart Grid functions to operate and be combined or coordinated among multiple electric utilities and between that region and other regions	**System Operators** Entities that operate or coordinate operations of regional electric grids, the documented expenditures for purchasing and installing such equipment
Distributed Generation Expenditures of enabling a distributed electricity generator to be monitored, controlled, or otherwise integrated into grid operations and electricity grid utilizing smart grid functions	**Non-Utility Distributed Generation Owners** The documented expenditures of persons or entities other than electric utilities of such investments
Electric and Hybrid-Electric Vehicles Devices that allow the vehicle to engage in Smart Grid functions (but not the costs of electricity storage for the vehicle)	**Unspecified Investor** The documented expenses for such investments

Section 1306 language as amended is replicated below.

(a) MATCHING FUND.—The Secretary shall establish a Smart Grid Investment Matching Grant Program to provide grants of up to one-half (50 percent) of qualifying Smart Grid investments.

(b) QUALIFYING INVESTMENTS.—Qualifying Smart Grid investments may include any of the following made on or after the date of enactment of this Act:

(1) In the case of appliances covered for purposes of establishing energy conservation standards under part B of title III of the Energy Policy and Conservation Act of 1975 (42 U.S.C. 6291 et seq.), the documented expenditures incurred by a manufacturer of such appliances associated with purchasing or designing, creating the ability to manufacture, and manufacturing and installing for one calendar year, internal devices that allow the appliance to engage in Smart Grid functions.

(2) In the case of specialized electricity-using equipment, including motors and drivers, installed in industrial or commercial applications, the documented expenditures incurred by its owner or its manufacturer of installing devices or modifying that equipment to engage in Smart Grid functions.

(3) In the case of transmission and distribution equipment fitted with monitoring and communications devices to enable smart grid functions, the documented expenditures incurred by the electric utility to purchase and install such monitoring and communications devices.

(4) In the case of metering devices, sensors, control devices, and other devices integrated with and attached to an electric utility system or retail distributor or marketer of electricity that are capable of engaging in Smart Grid functions, the documented expenditures incurred by the electric utility, distributor, or marketer and its customers to purchase and install such devices.

(5) In the case of software that enables devices or computers to engage in Smart Grid functions, the documented purchase costs of the software.

(6) In the case of entities that operate or coordinate operations of regional electric grids, the documented expenditures for purchasing and installing such equipment that allows Smart Grid functions to operate and be combined or coordinated among multiple electric utilities and between that region and other regions.

(7) In the case of persons or entities other than electric utilities owning and operating a distributed electricity generator, the documented expenditures of enabling that generator to be monitored, controlled, or otherwise integrated into grid operations and electricity flows on the grid utilizing Smart Grid functions.

(8) In the case of electric or hybrid-electric vehicles, the documented expenses for devices that allow the vehicle to engage in Smart Grid functions (but not the costs of electricity storage for the vehicle).

(9) The documented expenditures related to purchasing and implementing Smart Grid functions in such other cases as the Secretary shall identify.

(c) INVESTMENTS NOT INCLUDED.—Qualifying Smart Grid investments do not include any of the following:

(1) Investments or expenditures for Smart Grid technologies, devices, or equipment that utilize specific tax credits or deductions under the Internal Revenue Code, as amended.

(2) Expenditures for electricity generation, transmission, or distribution infrastructure or equipment not directly related to enabling Smart Grid functions.

(3) After the final date for State consideration of the Smart Grid Information Standard under section 1307 (paragraph (17) of section 111(d) of the Public Utility Regulatory Policies Act of 1978), an investment that is not in compliance with such standard.

(4) After the development and publication by the Institute of protocols and model standards for interoperability of smart grid devices and technologies, an investment that fails to incorporate any of such protocols or model standards.

(5) Expenditures for physical interconnection of generators or other devices to the grid except those that are directly related to enabling Smart Grid functions.

(6) Expenditures for ongoing salaries, benefits, or personnel costs not incurred in the initial installation, training, or start up of smart grid functions.

(7) Expenditures for travel, lodging, meals or other personal costs.

(8) Ongoing or routine operation, billing, customer relations, security, and maintenance expenditures.

(9) Such other expenditures that the Secretary determines not to be Qualifying Smart Grid Investments by reason of the lack of the ability to perform Smart Grid functions or lack of direct relationship to Smart Grid functions.

(d) SMART GRID FUNCTIONS.—The term ‘‘smart grid functions’’ means any of the following:

(1) The ability to develop, store, send and receive digital information concerning electricity use, costs, prices, time of use, nature of use, storage, or other information relevant to device, grid, or utility operations, to or from or by means of the electric utility system, through one or a combination of devices and technologies.

(2) The ability to develop, store, send and receive digital information concerning electricity use, costs, prices, time of use, nature of use, storage, or other information relevant to device, grid, or utility operations to or from a computer or other control device.

(3) The ability to measure or monitor electricity use as a function of time of day, power quality characteristics such as voltage level, current, cycles per second, or source or type of generation and to store, synthesize or report that information by digital means.

(4) The ability to sense and localize disruptions or changes in power flows on the grid and communicate such information instantaneously and automatically for purposes of enabling automatic protective responses to sustain reliability and security of grid operations.

(5) The ability to detect, prevent, communicate with regard to, respond to, or recover from system security threats, including cyber-security threats and terrorism, using digital information, media, and devices.

(6) The ability of any appliance or machine to respond to such signals, measurements, or communications automatically or in a manner programmed by its owner or operator without independent human intervention.

(7) The ability to use digital information to operate functionalities on the electric utility grid that were previously electro-mechanical or manual.

(8) The ability to use digital controls to manage and modify electricity demand, enable congestion management, assist in voltage control, provide operating reserves, and provide frequency regulation.

(9) Such other functions as the Secretary may identify as being necessary or useful to the operation of a Smart Grid.

(e) PROCEDURES AND RULES.—(1) The Secretary shall, within 60 days after the enactment of the American Recovery and Reinvestment Act of 2009, by means of a notice of intent and subsequent solicitation of grant proposals—

(A) establish procedures by which applicants can obtain grants of not more than one-half of their documented costs;

(B) require as a condition of receiving funding under this subsection that demonstration projects utilize open protocols and standards (including Internet-based protocols and standards) if available and appropriate;

(C) establish procedures to ensure that there is no duplication or multiple payment for the same investment or costs, that the grant goes to the party making the actual expenditures for the qualifying Smart Grid investments, and that the grants made have a significant effect in encouraging and facilitating the development of a smart grid;

(D) establish procedures to ensure there will be public records of grants made, recipients, and qualifying Smart Grid investments which have received grants; and

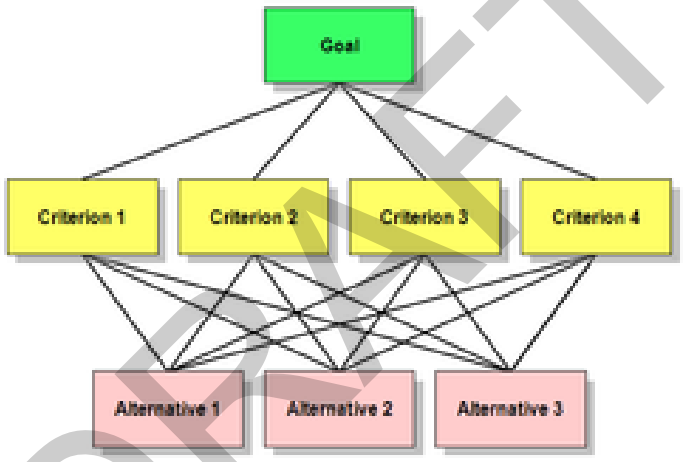
(E) establish procedures to provide advance payment of moneys up to the full amount of the grant award.

(2) The Secretary shall have discretion and exercise reasonable judgment to deny grants for investments that do not qualify.

(f) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the Secretary such sums as are necessary for the administration of this section and the grants to be made pursuant to this section for fiscal years 2008 through 2012.

Appendix B – Analytical Hierarchical Process

The Analytic Hierarchy Process (AHP) is a structured technique for helping people deal with complex decisions. Rather than prescribing a "correct" decision, the AHP helps people to determine one that suits their needs and wants. Based on mathematics and psychology, it was developed by Thomas L. Saaty in the 1970s and has been extensively studied and refined since then. The AHP provides a comprehensive and rational framework for structuring a problem, for representing and quantifying its elements, for relating those elements to overall goals, and for evaluating alternative solutions. It is used throughout the world in a wide variety of decision situations, in fields such as government, business, industry, healthcare, and education.



A simple AHP hierarchy.

Several firms supply computer software to assist in using the process.

Users of the AHP first decompose their decision problem into a hierarchy of more easily comprehended sub-problems, each of which can be analyzed independently. The elements of the hierarchy can relate to any aspect of the decision problem—tangible or intangible, carefully measured or roughly estimated, well- or poorly-understood—anything at all that applies to the decision at hand.

Once the hierarchy is built, the decision makers systematically evaluate its various elements, comparing them to one another in pairs. In making the comparisons, the decision makers can

use concrete data about the elements, or they can use their judgments about the elements' relative meaning and importance. It is the essence of the AHP that human judgments, and not just the underlying information, can be used in performing the evaluations.[1]

The AHP converts these evaluations to numerical values that can be processed and compared over the entire range of the problem. A numerical weight or priority is derived for each element of the hierarchy, allowing diverse and often incommensurable elements to be compared to one another in a rational and consistent way. This capability distinguishes the AHP from other decision making techniques.

In the final step of the process, numerical priorities are derived for each of the decision alternatives. Since these numbers represent the alternatives' relative ability to achieve the decision goal, they allow a straightforward consideration of the various courses of action.

Appendix C – Smart Grid Project Categories Definitions

- **Transmission apparatus with Smart Grid capabilities**: flexible AC transmission technologies; high-efficiency technologies (e.g., low-loss or superconducting technologies); high-speed switchgear; new voltage transient suppression technologies; environmentally-friendly technologies (lower profile transmission towers, oil-free or gas-free apparatus) new technologies targeted at renewables integration (e.g., novel undersea cables for offshore wind). Storage is explicitly called out in the Recovery Act and is both a technology that can be applied as a generation, transmission, distribution, or customer resource.

- **Transmission monitoring, control, and optimization**: sensors, communications, automation systems, asset-condition monitoring systems, planning and control room applications.

- **Smart Grid Technologies focused on Renewables facilitation**: there are a number of technology "gaps" associated with support for high levels of renewable resources ranging from apparatus (inverters capable of providing voltage var support, governor response, and power system stabilization) to protection/automation systems (specific wide-area protection schemes aimed at high RP levels); feeder and station protection and automation systems developed for high local renewables penetration, and protection systems developed for high behind the meter or distributed renewables on distribution circuits), and analytic applications (forecasting, scheduling, and optimization tools which are developed for the high levels of uncertainty associated with some renewable portfolio projections).

- **Distribution Systems**: feeder and substation automation with particular provisions for integrating high renewables levels, integrating consumer-side resources and demand response; improving reliability; reducing losses; improving resiliency against major disturbances – physical and cyber, natural, accidental, and deliberate. Also apparatus with new controllability, efficiency, or environmental-direct benefits.

- **Advanced Metering**: two-way metering capable of a variety of functionality including real-time pricing; remote connect/disconnect; integration of electric vehicles (EVs) and home area networks (HAN) at some level; power quality sensing and communications.

- **Microgrids capable of high reliability/resiliency and islanded operation**: Advanced microgrids integrated with distributed generation and storage, bridge distribution systems, and consumer technologies.

- **Integration of Distribution Automation (DA), Feeder Automation (FA), Advanced Metering Initiatives (AMI), and microgrid technologies**: Microgrids which are integrated operationally with utility Smart Grid systems.

- **Consumer integration into energy markets and grid operations**: Systems which communicate market information to customers and enable them to make decisions which impact markets as well as facilitating integration of grid operations with consumer decision making. Systems for integrating EVs with Smart Grid fall under this category

Appendix D – Smart Grid Workshop

Smart Grid Workshop Metric	Rating	Issues In Workshop	Factor In AMI / SG Filings Today	Issue For DOE SG Metrics	DOE Stimulus Scorecard Basis
Enables Informed Participation by Customers					
% of customers capable of receiving information from the grid	H	Communications infrastructure acknowledgement of signals customer actual response technical penetration and standards	Yes	Yes	High
% of customers opting "in" or delegating authority	H	Definition, sources, demographics	Forecast as part of Benefit Cost Analysis (BCA)	Maybe	Medium
# of comms enabled behind the meter devices	H	Definition, product life cycles, what to include	Not under utility control at all	No	No
# of customer side devices interacting with the grid	H		Could be forecast for renewables and Electrtic Vehicle (EV)	Maybe	Medium/High
Amount of load managed	M	vs. business as usual, impact of information availability, measurement	Forecast as part of BCA	Yes	Yes
Measurable energy savings by customers	H	Definitions, load growth, EE vs SG savings	Forecast as part of BCA	Yes	Yes
% of customers on 2-way TOU metering (actual)	M		Yes	Yes	Yes
# of participation options available to customers	M		Tariff issue often not addressed in SG filings	Yes	Yes
AMI Mkt penetration	M		Not relevant	No	No

Smart Grid Workshop Metric	Rating	Issues In Workshop	Factor In AMI / SG Filings Today	Issue For DOE SG Metrics	DOE Stimulus Scorecard Basis
MW of demand response / # of customers with DR	L		Forecast as part of BCA	Yes	Yes
% of successful rate recovery on smart grid investments	L		No	No but PUC endorsement needed	Yes as PUC endorsement
MW of DG / # of customers with DG	L		Forecast as part of BCA	Yes	Yes
Elasticity of demand in regional markets	L		Not Usually Today	Maybe	???
Reduction in CO2	L		Not Usually Today	Yes	Yes
ASCI point improvement	L		No	No	No
Accommodates all Generation and Storage Options					
% of grid networked to standards	M	Standards, FERC involvement, non-IOU DER	No	Yes	Yes
% of Real Time (RT) DG & storage that can be controlled	M	Standards, data definition, needed R&D	No	Yes	Yes
% of load (energy) served by DG/renewables	M	Defining baseline, data management, validation	No	Yes	Yes
# of days to process DG applications	M	Single data base, many procedural issues	No	No	No
% of off system renewables served by storage	H	Visibility of Renewable; operational status of storage			
Improvement in load factors	M	Metering, multiple impacts, data validation	Usually Part of BCA	Yes	Yes
% completion of comms infrastructure to support DG and storage	M		Yes	Yes	Yes

Smart Grid Workshop Metric	Rating	Issues In Workshop	Factor In AMI / SG Filings Today	Issue For DOE SG Metrics	DOE Stimulus Scorecard Basis
Ability for scheduling and forecasting	L		No	Not for SG projects	No
Ability to accommodate 50% non-dispatchable generation by 2020	L		Not Usually	Link to any National RPS Goal	Maybe
Capacity of fossil gen retired	L				
Ability to sense DG presence	L		No	Yes	Yes
Ability to sense and measure DG physical effects	L		No	Yes	Yes
Address intermittency	L		No	No	No
Enables New Products, Markets, Services					
Degree of Regulatory Recovery for Alternative Solutions	H	Data base and funding, definition, non IOU,	No	PUC Endorsement	Yes - PUC Endorsement
Number of New SG related $100M enterprises	M	SG as sole driver; definitions; sources of data; proprietary data	No Applicable	No	No
# of products with end to end interoperability certification	M	Who certifies; scope of standards; validation; source of data	Not Applicable	No	No
Amount of VC funding for SG startups	M	Source and validity of data; what to count	Not Applicable	No	No
# of New Residential products vs 2 yrs prior	M	Definitions; who tracks;	Not Applicable	No	No
Expected availability of service	M		No	No	Yes
Venture Capital (VC) funding	M		Not Applicable	No	No
# households with Home	M		No	No	No

Smart Grid Workshop Metric	Rating	Issues In Workshop	Factor In AMI / SG Filings Today	Issue For DOE SG Metrics	DOE Stimulus Scorecard Basis
Atuomation Network (HAN)					
# consumer owned generation types	L		Yes	Yes	Yes
n# of MW saved and business models capitalizing on savings	L		Usually in BCA	Yes	Yes
Per capita electricity use	L		No	No	No
BCA and NPV of project	L		Yes	Yes	Yes
# of EV charging off peak	L		No	Maybe	Maybe
Optionality value of savings	L		No	No	No
Consumption efficiency by users	L		Yes	No	No
# new standards	L		Not Applicable	No	No
# of title 13 related generization plans	L		Not Applicable	No	No
Per capita avoidance of GHG	M		No	Yes	Yes
Provides Power Quality Needs for Digital Economy					
#Devices/Reliability Improvement	H	Definitions and determination	Yes	Could be in BCA	Maybe
# Power Quality Measurements per customer	H	What is actually useful	Yes	No	No
# Power Quality Incidents that can be anticipated and identified	H	Definition; cause, standards	Yes	No	No
# States with Power Quality performance rates	M		Not Applicable	No	No
# customer complaints re Power Quality	H	Definition, attribution to SG	Yes	No	No
# PQ devices sold and installed	M		No	No	No

Smart Grid Workshop Metric	Rating	Issues In Workshop	Factor In AMI / SG Filings Today	Issue For DOE SG Metrics	DOE Stimulus Scorecard Basis
Open architecture of devices	L		No	No	No
$ of sensitive loads with immunity	M		No	No	No
# customer choices for PQ levels	M		No	No	No
DG level where VR is economic	L		No	??	??
Cost to economy of PQ	L		No	??	??
Optimizes Asset Utilization and Operating Efficiency					
Transmission					
# assets deferred and timing	H	Tracking; must maintain performance	Sometimes in BCA	Yes	Yes
# of MW involving V / VAR control	M	Definitions, what technologies	No	Yes	Yes
# assets with condition monitoring an diagnostics	H	Tracking by category; definitions	No	Yes	Yes
# lines with dynamic ratings	M		No	Yes	Yes
3 miles of line with advanced materials and devices increasing capacity	M	Definitions, better metrics	No	Yes	Yes
Distribution					
MW of DG as dispatchable assets	H		Yes	Yes	Yes
% SG enabled apparatus	H		No Usually	Yes	Yes
# MW with V VAR controls	M		Not Usually	Yes	Yes

Smart Grid Workshop Metric	Rating	Issues In Workshop	Factor In AMI / SG Filings Today	Issue For DOE SG Metrics	DOE Stimulus Scorecard Basis
# customers connected per automated segment	M		No	Maybe	Maybe
Consumer					
# smart meters	H	% two way; openness; functionality	Yes	Yes	Yes
# customers with TOU rates	L	Link to meter deployment; available vs utilized	Yes	Yes	yes
MW dispatchable demand response	M	Available vs utilized	Yes	Yes	Yes
General					
# IEDs deployed	M	Definitions; track by assets monitored	No	Yes	Yes
# IEDs with full communications	M		No	Yes	Yes
# IT applications integrated	M		No	No	No
# of Phase Measurement Units (PMUs) deployed	M		No	Yes	Yes
Addresses Disturbances via Automated Prevention, Containment, and Control					
% of assets that are monitored, controlled, or automated	H	Variations; definitions; standards	Yes	Yes	Yes
% of nodes and customer interfaces that are monitored	H	What assets qualify; definitions; standards; variations	Yes	Yes	Yes
Level of deployment of common communications infrastructure	H	Definitions; standards development; current state	Yes	Yes	Yes
% of system that can be fed from alternative sources	H	Variations; not always a valid approach	No	Yes	Yes

Smart Grid Workshop Metric	Rating	Issues In Workshop	Factor In AMI / SG Filings Today	Issue For DOE SG Metrics	DOE Stimulus Scorecard Basis
geographic coverage, numbers, MW covered by PMU	H	Definitions; actual usage	No	Yes	Yes
Amount of focused disturbance location	M		Yes	Yes	Yes
Extent of cbm	L		No	Yes	Yes
Db lvl of 5th & 7th harmonics	L		No	No	No
MW in RTP and DSM	L		Yes	Yes	Yes
# of automated grid operations	L		Can be in BCA	No	No
Amount of system visibility	M		Not Explicit	Yes	Yes
extent of data exchange/interoperability	L		No	Yes	Yes
(N-X) reliability	M		No	No	No
% of load /MW of storage	M		No	Yes	Yes
Amount of networked distribution	L		No	No	No
Smart Grid roadmap	L		No	Yes	Yes
# breaker cycle faults/yr	L		No	No	No
% of circuits > 1 switch	L		No	No	No
# sections w dist loc	L		No	No	No
Restoration time	M		No	No	No
# prevented disturbances	L		No	No	No
# outages/duration	M		Usually in BCA	Yes	Yes
Customer sat	L		No	No	No
# regional outages	L		No	No	No
Operational errors (disconnects)	L		No	No	No
System efficiency	L		Loss reduction in BCA	Yes	Yes

Smart Grid Workshop Metric	Rating	Issues In Workshop	Factor In AMI / SG Filings Today	Issue For DOE SG Metrics	DOE Stimulus Scorecard Basis
Feeder lvl quality metrics	L		No	No	No
Maintenance cost per unit availability	L		Sometimes in BCA	Yes	Yes
Resilient against all hazards					
% operating entities that exhibit progressively mature resiliency behavior	H	Specificity; willingness to respond; who actually owns/maintains affected systems;	No	No	No
Measure of # alternative paths of supply	H	Data availability and validity; baseline;	Sometimes in BCA	Yes	Yes
Qualified operating margin that is needed to ensure resiliency	H	Knowing ultimate capacities; knowing real time state; information sharing	No	No	No
Adjusting standard metrics to capture physical/cyber attacks	H	Agreement re new codes; privacy and reporting issues;	No	No	No
DOD cyber system metrics	L				
Training	L				
# interconnected urban substations	L				
# successful cyber attacks	M				
# domains penetration tested	M				
# CIP standards addressing SG	L				
NERC CIP compliance	L				
# devices meeting CIP	L				
Cyber security issue repair time	L				

Smart Grid Workshop Metric	Rating	Issues In Workshop	Factor In AMI / SG Filings Today	Issue For DOE SG Metrics	DOE Stimulus Scorecard Basis
Physical threat identification time	L				
# physical threat attempts	L				
# physically hardened distribution facilities	L				
Reduction in critical load outages	L				
% of DG/DR automation	L				
Failures to conflicting procedures	L				
# hazard events detected	L				
System availability	M				
Enhanced recoveries via SG	M				
Event impact reduction	L				
# of assets for which risk assessment is done	H				
Dollar loss per unit time	L				
# secondary assets affected	L				
Additional Stimulus SG Metrics					
Stimulus Effects					
Utility jobs lost/created	H		Yes	Yes	Yes
Contractor jobs	H		Yes	Yes	Yes
Supplier jobs	M		No	Yes	Yes
Expense timing	H		Yes	Yes	Yes
Retraining	M		Sometimes	Yes	Yes
Facilitation of Renewables	H				

Smart Grid Workshop Metric	Rating	Issues In Workshop	Factor In AMI / SG Filings Today	Issue For DOE SG Metrics	DOE Stimulus Scorecard Basis
Facilitation of EV/PHEV	H				

Appendix E – Recommended Metrics

Evaluation Criteria	Metric	Description	Proposal Scorecard	DOE Scorecard	"NEW"	Monitored and Reported
Economic Stimulus Effect						
Job creation plans and estimates						
Timing of job creation	Direct jobs and wages created; #jobs/$000 of project cost	Net new jobs and wages of utility and project contractor employees, linked to project tasks and durations. Example: installation of 200,000 meters at 4 hrs/meter over 6 months results in 800 installers and 40 supervisors. Result should be in # of jobs and # of jobs / project cost. Profile of jobs and wages over time to be provided.	X		Done but not typical	X
	Indirect supply chain jobs and wages as above	Suppliers certify that project will result in XX incremental jobs over a time period incrementally greater than if project had not gone forward. Example: manufacturing, test, and delivery of 200,000 meters at 0.25 hours /meter over 6 months results in 100 jobs and 10 supervisors. Jobs are net of avoided layoffs and new hires/ contractors.	X		Atypical	X
Impact on local economy	Wages and purchases spent in local economy times multiplier effect	DOE should publish Federally accepted multipliers for local regions. Proposing entities should use these for utility, contractor, and supplier jobs and	X		Typical in economic projections	

Evaluation Criteria	Metric	Description	Proposal Scorecard	DOE Scorecard	"NEW"	Monitored and Reported
		wages to estimate additional regional jobs.				
Stimulation of a Smart Grid business ecosystem	Quantitative but subjective	If the project is expected to create / sustain direct and indirect supplier businesses, this should be described and quantified where possible. Examples could include factors such as % increase of revenues of Smart Grid technology/product supplier (jobs already counted above, note) or stimulation of NN local business enterprises / franchises installing consumer side products (PV, example). This latter may or may not be already counted in the local economic multiplier effect based on uniqueness of procurement and business opportunity. DOE will have to develop a process for scoring these claimed impacts.		X	New	Qualitatively
Impact on regulated electric rates and energy costs to consumers	% and $ decrease in rates	Should be weighted more heavily if a proposed tariff than if a projected change. Also, rate increases are negative factors.	X		Typical	X
	Consumer savings-average $ and % change in consumer annual bill by class	Projected on a per consumer basis by class as is typical in regulatory filings today	X		Typical	X
Number or extent of new programs/services being offered	Qualitative	Proposal should describe new services offered and an estimate of the consumer		X	Not typical	Qualitatively

Evaluation Criteria	Metric	Description	Proposal Scorecard	DOE Scorecard	"NEW"	Monitored and Reported
		acceptance/participation. DOE will develop a methodology for scoring such				
Number of existing smart grid implementations in the state (to encourage geographic dispersion)	Qualitative	From DOE data base. DOE must determine and publish definitions,	X		New	By DOE
Other	As proposed	Freedom for proposer to identify other economic benefits. Example: improved reliability reduces exodus of high technology firms. Reduced rates attract additional business.		X	Typical	Not valuable
Energy Independence and Security						
Facilitation of renewable energy	Additional capacity for accomdating incrmental renewables - MW and % peak MW and & energy	Could be as a result of increased transmission capacity (or reduced stability limit derating); could be as a result of peak reduction on distribution feeder; whatever rationale and calculation that can be supported	X		Done but not typical	X
	% of DG / renewables that can be sensed and controlled	Renewables and DG need to be integrated with Smart Grid and system operations via sensing, communications, control, and integration with system computer systems	X		New	X
	Facilitation of distributed renewables - projection - MW, %	Calculation/estimate of additional distributed renewables as a result of technical support, integration technologies,	X		Done but not typical	X

Evaluation Criteria	Metric	Description	Proposal Scorecard	DOE Scorecard	"NEW"	Monitored and Reported
	peak MW; % energy	consumer business propositions and value. Also fossil fuel offset				
	MW and % increase in maximum remote renewable resource capacity the system can accommodate	Increased transmission capacity to access remote renewables due to Smart Grid technologies. (this metric will only be applicable in selected instances)			New	X
Electric Vehicle / Plug-in Hybrid Electric Vehicle integration	Qualitative	Description of specific programs / customer participation offerings to attract PHEV		x	New	X
	# PHEV charging connected to V2G services	Projection of how many PHEV will be connected to Vehicle to Grid functionality for managed charging	X		New	X
	Projected impact in terms of # of PHEV added	Programs to support / enable projected # of PHEV where projection source is regional, auto industry, governmental	X		New	X
Demand Response management	# customers and coincident peak MW participating	Per existing program filings. Calculated by revenue class	X		Typical	X
	MWH saved at coincident peak	Per existing filing methodologies, calculated by revenue class	X		Typical	X
	MW reduction at coincident peak	Per existing filing methodologies, calculated by revenue class	X		Typical	X
	Market price impact	Per market simulations using accepted methodologies	X		Typical	X
System Efficiency	% improvement in	Reduction in losses via voltage	X		Typical	X

Evaluation Criteria	Metric	Description	Proposal Scorecard	DOE Scorecard	"NEW"	Monitored and Reported
	losses	control, peak reduction, use of storage, etc.				
	$ and % improvement in costs of failed equipment	This metric summarizes the economic impacts of condition monitoring, condition based maintenance, asset management, and other operational techniques relying on sensors, systems integration, and advanced applications software				
Forecast of customer participation in demand response and conservation programs	# of customers and MW	As per today's typical filings	X			X
Greenhouse gas emissions reduction potential	Tons GHG and per MWH; also tons GHG / customer	Weighted per GHG norms; includes loss reduction, renewables increase, effect of conservation, and secondary effects such as reduced utility truck mileage	X		Typical	X
Power System reliability impacts	SAIDI improvement	Per filings today	X		Typical	X
	Reduced restoration time from major disruptions	Projected from utility applicant experience and/or benchmark data; expressed as % reduction in the total major disruption customer outage hours (area under duration curve)	X		Atypical	X
	Reduction in major outages	Not quantifiable today as incidents are too infrequent. Description of how outages will	X	X	Done but not typical	Already done

Evaluation Criteria	Metric	Description	Proposal Scorecard	DOE Scorecard	"NEW"	Monitored and Reported
		be avoided and why; relation to historical where possible; projected additional threat due to load growth, renewables growth, etc				
	Improvement in Loss of Load Probability	Calculated improvement in system reliability due to Smart Grid technologies at the transmission level, including synchrophasors, FACTS and other technologies, advanced software systems, asset management, and other technologies				
Amount of distribution and substation automation in project	Increase in IED penetration integrated to SA and control systems	Increase in digital vs analog/electromechanical technology and full utilization via comms and integration per Smart Grid workshop discussions	X		Atypical	X
	# / % of feeders and stations to be automated	Comment: projects that deploy IEDs w/o substation, comms, and back office systems do not qualify	X		Atypical	X
Integration and Interoperability						
Links to the state energy assurance plan (required of all governors)	% fulfillment	Exposition of contribution of renewables, demand management, and reliability projections to state plan. Could measure extent to which project fulfills state objectives but is not a comparable metric	X		Typical of resource projects today	X

Evaluation Criteria	Metric	Description	Proposal Scorecard	DOE Scorecard	"NEW"	Monitored and Reported
Integration with state/local energy efficiency and conservation programs	Qualitative	Exposition of how project fulfills state objectives. And how to avoid double counting	X		Typical for conservation projects today	X
Plans for measurement of customer participation and adoption	Qualitative	Description of plans for end use consumption measurement; total household/business measurement; and statistical analysis of same	X		typical in end use surveys today	X
Interoperability of smart grid technologies	Qualitative	Description of standards to be employed; justification of any standards not embraced; plans to validate the interoperability; description of any new integration points or techniques. Decision not to use standards should weigh very negatively	X		Atypical	X
Use of Open Protocols	Qualitative	Binary yes / no; need a commitment to future open standards when available	X		Atypical	X
	% improvement in # of IEDs and controllable apparatus using open protocols	The relative % of system IEDs and controllable apparatus that are integrated via open protocols			New	X
	Compliance to Security needs	Assurance of levels of security consistent with industry practices and emerging standards	X		New	X
Business Plan Robustness						
Degree to which direct	Attractiveness of	Financial value to customer;		X	New	Measure via

Evaluation Criteria	Metric	Description	Proposal Scorecard	DOE Scorecard	"NEW"	Monitored and Reported
consumer participation is encouraged	customer value proposition	extent to which is market tested; extent of hurdles to customer participation				participation
	Open protocols and open business model to 3rd party products / services	Qualitative description of provisions for 3rd party products and services (also part of ecosystem above)	X	X	New	Measure via amount of 3rd party engagement
Completeness of technology plan and maturity of chosen technologies	Qualitative	An accepted Technology / Capability Maturity model should be used in this assessment	X		Typical	No
Outcome of cost-benefit analysis which includes qualitative factors such as benefits to society	Qualitative	BCA per filings. Include description of benefits, avoided costs, and costs borne by stakeholders to achieve benefits	X		Typical	X
Plans for interim reporting on progress	Not a metric; specified by DOE					
Implementation plan	Assess per FAR					
	Risks - cost, schedule					