

126 FERC ¶ 61,253  
UNITED STATES OF AMERICA  
FEDERAL ENERGY REGULATORY COMMISSION

18 CFR Part Chapter I

[Docket No. PL09-4-000]

SMART GRID POLICY

(Issued March 19, 2009)

AGENCY: Federal Energy Regulatory Commission.

ACTION: Proposed Policy Statement and Action Plan.

SUMMARY: This proposed policy statement and action plan provides guidance to inform the development of a smarter grid for the Nation's electric transmission system focusing on the development of key standards to achieve interoperability of smart grid devices and systems. The Commission also proposes a rate policy for the interim period until interoperability standards are adopted. Smart grid investments that demonstrate system security and compliance with Commission-approved Reliability Standards, the ability to be upgraded, and other specified criteria will be eligible for timely rate recovery and other rate treatments. This rate policy will encourage development of smart grid systems.

DATES: Comments on the proposed policy statement and action plan are due

[Insert\_Date 45 days after publication in the **FEDERAL REGISTER**]

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SUPPLEMENTARY INFORMATION:

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Before Commissioners: Jon Wellinghoff, Acting Chairman;  
Sudeen G. Kelly, Marc Spitzer,  
and Philip D. Moeller.

Smart Grid Policy

Docket No. PL09-4-000

PROPOSED POLICY STATEMENT AND ACTION PLAN

(Issued March 19, 2009)

1. The Commission is issuing this proposed policy statement to articulate its policies and near-term priorities to help achieve the modernization of the Nation's electric transmission system, one aspect of which is "Smart Grid" development. Smart Grid advancements will apply digital technologies to the grid, and enable real-time coordination of information from generation supply resources, demand resources,<sup>1</sup> and distributed energy resources (DER).<sup>2</sup> This will bring new efficiencies to the electric system through improved communication and coordination between utilities and with the grid, which will translate into savings in the provision of electric service. Ultimately the

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<sup>1</sup> For purposes of this proposed policy statement, "demand resources" refers to the set of demand response resources and energy efficiency resources and programs that can be used to reduce demand or reduce electricity demand growth.

<sup>2</sup> DER comprises dispersed generation devices and dispersed storage devices, including reciprocating engines, fuel cells, microturbines, photovoltaics, combined heat and power, and energy storage. See International Electrotechnical Commission, International Standards IEC 61850-7-420.

smart grid will facilitate consumer transactions and allow consumers to better manage their electric energy costs. These technologies will also enhance the ability to ensure the reliability of the bulk-power system. The Commission's interest and responsibilities in this area derive from its authority over the rates, terms and conditions of transmission and wholesale sales in interstate commerce, its responsibility for approving and enforcing mandatory reliability standards for the bulk-power system in the United States, and a recently enacted law<sup>3</sup> requiring the Commission to adopt interoperability standards and protocols necessary to ensure smart-grid functionality and interoperability in the interstate transmission of electric power and in regional and wholesale electricity markets. The development and implementation of these interoperability standards is a challenging task, which requires the efforts of industry, the states and other federal agencies, in addition to the Commission. The Commission intends to use its authority, in coordination and cooperation with other governmental entities, to help achieve interoperability in a timely manner. Achievement of interoperability will not only increase the efficiency of the bulk-power system, with the goal of achieving long-term consumer savings, but will also enable demand response and other consumer transactions and activities that give consumers the tools to better control their electric energy costs. Reaching this goal will also help promote the integration of significant new renewable

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<sup>3</sup> Energy Independence and Security Act of 2007, Pub. L. No. 110-140, 121 Stat. 1492 (2007) (EISA).

power into the transmission system and help state and federal initiatives to promote greater reliance on renewable power and meet future demand growth to satisfy the Nation's energy needs.

2. The purpose of the policy statement the Commission ultimately adopts will be to prioritize the development of key interoperability standards, provide guidance to the electric industry regarding the need for full cybersecurity for Smart Grid projects, and provide an interim rate policy under which jurisdictional public utilities may seek to recover the costs of Smart Grid deployments before relevant standards are adopted through a Commission rulemaking. Specifically, development of interoperability standards for inter-system communication, system security, wide-area situational awareness, demand response, electric storage, and electric transportation should be prioritized and accelerated. The work done on certain standards will provide a foundation for development of many other standards.

3. In addition, as further explained below, for the near term we propose certain rate treatments to encourage investment in Smart Grid technologies that advance efficiency, security, reliability and interoperability in order to address potential challenges to the bulk-power system. We recognize that a key consideration of public utilities in deciding whether to invest in Smart Grid technologies may involve the potential for stranded costs associated with legacy systems that are replaced by Smart Grid equipment. Additionally, as the electric system may require several of the new capabilities of the Smart Grid

before interoperability standards have been developed, we recognize the need for guidance for jurisdictional entities. Thus, to offer some rate certainty and guidance regarding cost recovery issues, the Commission is proposing a rate policy for the interim period until final interoperability standards are adopted. The Commission also proposes that smart grid investments that demonstrate system security and compliance with Commission-approved Reliability Standards, the ability to be upgraded, and other specified criteria will be eligible for timely rate recovery and other rate treatments. For now, we propose as an interim rate policy to accept single-issue rate filings submitted under FPA section 205 by public utilities to recover the costs of Smart Grid deployments involving jurisdictional facilities provided that certain showings are made. In other words, we propose to consider Smart Grid devices and equipment, including those used in a Smart Grid pilot program or demonstration project, to be used and useful for purposes of cost recovery if an applicant makes the certain showings, as described below.

4. We seek comments from the industry on these and other steps the Commission can take to encourage and expedite the development of interoperability standards and implementation of Smart Grid projects. In the near future, we may convene a technical conference for further public input on these issues.

#### **I. Background**

5. Under the Federal Power Act (FPA), the Commission has jurisdiction over the transmission of electric energy in interstate commerce by public utilities, and over the

reliable operation of the bulk-power system in most of the Nation.<sup>4</sup> The Commission also was given a new responsibility under the EISA, discussed further below, to issue a rulemaking to adopt standards and protocols to ensure Smart Grid functionality and interoperability in interstate transmission of electric power and in regional and wholesale electric markets.

6. Section 1301 of the EISA states that it is the policy of the United States to support the modernization of the Nation's electricity transmission and distribution system to maintain a reliable and secure electricity infrastructure that can meet future demand growth and to achieve each of several goals and characteristics, which together characterize a Smart Grid.<sup>5</sup> These goals and characteristics are:

(1) Increased use of digital information and controls technology to improve reliability, security, and efficiency of the electric grid. (2) Dynamic optimization of grid operations and resources, with full cyber-security. (3) Deployment and integration of distributed resources and generation, including renewable resources. (4) Development and incorporation of demand response, demand-side resources, and energy efficiency resources. (5) Deployment of "smart" technologies (real-time, automated, interactive technologies that optimize the physical operation of appliances and consumer devices) for metering, communications concerning grid operations and status, and distribution automation. (6) Integration of "smart" appliances and consumer devices. (7) Deployment and integration of advanced electricity storage and peak-shaving

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<sup>4</sup> 16 U.S.C. 824, 824o.

<sup>5</sup> EISA sec. 1301, to be codified at 15 U.S.C. 17381.

technologies, including plug-in electric and hybrid electric vehicles, and thermal storage air conditioning. (8) Provision to consumers of timely information and control options. (9) Development of standards for communication and interoperability of appliances and equipment connected to the electric grid, including the infrastructure serving the grid. (10) Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices, and services.<sup>[6]</sup>

7. Section 1305(a) of EISA directs the National Institute of Standards and Technology (the Institute) “. . . to coordinate the development of a framework that includes protocols and model standards for information management to achieve interoperability of smart grid devices and systems.”<sup>7</sup> A helpful description of interoperability is “the ability of a system or a product to work with other systems or products without special effort on the part of the customer . . .”<sup>8</sup> In order to achieve the

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<sup>6</sup> Id.

<sup>7</sup> EISA sec. 1305(a), to be codified at 15 U.S.C. 17385(a).

<sup>8</sup> Testimony of Patrick D. Gallagher, Ph.D., Deputy Director, National Institute of Standards and Technology, before the Committee on Energy and Natural Resources, United States Senate, March 3, 2009, available at: <http://www.nist.gov/director/ocla/nist%20pgallagher%20smart%20grid%20testimony%20senate%20e&nr%203-3-09.pdf>. According to the GridWise Architecture Council, the term "interoperability" refers to the ability to: (1) exchange meaningful, actionable information between two or more systems across organizational boundaries; (2) assure a shared meaning of the exchanged information; (3) achieve an agreed expectation for the response to the information exchange; and (4) maintain the requisite quality of service in information exchange (i.e., reliability, accuracy, security). See GridWise Architecture Council, Interoperability Path Forward Whitepaper at 1-2, 2005, available at: [http://www.gridwiseac.org/pdfs/interoperability\\_path\\_whitepaper\\_v1\\_0.pdf](http://www.gridwiseac.org/pdfs/interoperability_path_whitepaper_v1_0.pdf). The GridWise Architecture Council was formed by the U.S. Department of Energy to

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Smart Grid characteristics and functions listed in EISA section 1301, interoperability of Smart Grid equipment will be essential.

8. Finally, pursuant to the EISA, once the Commission is satisfied that the Institute's work has led to "sufficient consensus" on interoperability standards, we are directed to "institute a rulemaking proceeding to adopt such standards and protocols as may be necessary to insure smart-grid functionality and interoperability in interstate transmission of electric power, and regional and wholesale electricity markets."<sup>9</sup>

9. The Commission appreciates the Institute's work to assess current Smart Grid standards and infrastructure to identify gaps, and is aware of its plans to create a knowledge base to enable effective communication among stakeholders and a roadmap to lay out a recommended course toward a highly interoperable grid.<sup>10</sup> In general, we expect that the Institute will recommend standards to the Commission that have resulted from the Institute's coordination with standards development organizations and technical experts. The Commission will initiate rulemakings as individual or suites of standards<sup>11</sup> achieve sufficient consensus. The Commission will consider the most effective and

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promote and enable interoperability among the many entities that interact with the Nation's electric power system. See <http://www.gridwiseac.org/about/mission.aspx>.

<sup>9</sup> EISA sec. 1305(d), to be codified at 15 U.S.C. 17385(d).

<sup>10</sup> See Testimony of Patrick D. Gallagher, Ph.D., infra n.8.

<sup>11</sup> A suite of standards would consist of a group of related standards.

efficient ways to interact with the Institute and standards development organizations between the issuance of a notice of proposed rulemaking on submitted standards and a final rule adopting standards. We invite comment on this proposed approach.

10. The Commission will continue to take an active role in helping to ensure that the participants in the Institute's process effectively prioritize and sequence future standards development efforts. We invite comments on what factors the Commission should consider in determining when the Institute's work has led to "sufficient consensus" on interoperability standards to warrant instituting a rulemaking proceeding. We also seek comment and ideas on how to identify and stage the adoption of successive waves of interoperability standards. Finally, we seek comment as to whether there should be some formal process for parties to seek Commission guidance if negotiations on certain interoperability standards reach an impasse.

## **II. Discussion**

### **A. Urgency of Achieving Certain Smart Grid Functionalities**

11. As noted above, rather than directing the Institute to develop interoperability standards of its own, Congress charged the Institute with coordinating such development. The EISA specifically requires the Institute to solicit input from, among others, a range of

existing standards development organizations that rely on extensive negotiation in order to achieve broad industry consensus on proposed standards.<sup>12</sup>

12. The EISA contains no specific deadline for the creation of interoperability standards; instead, it provides for a consensus-based process. However, there is a sense of urgency within industry and government for the development of standards for and deployment of smart grid technologies generally. The Commission is particularly interested in the development of Smart Grid functions and characteristics that can help address challenges to the Commission-jurisdictional bulk-power system. These include the cross cutting issues of cybersecurity and the further development of common information models to allow useful exchange of electric system information (e.g., standard definitions). Broad policy goals also need to be addressed such as optimizing the transmission system to reduce congestion and improve reliability, security and efficiency; encouraging increased reliance on demand response; state and possibly national climate change initiatives such as Renewable Portfolio Standards and other efforts that result in increased reliance on variable renewable resources; and the potential

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<sup>12</sup> The EISA specifically names the IEEE (formerly known as the Institute of Electrical and Electronics Engineers), and the National Electrical Manufacturers Association. Other relevant existing standards development organizations could include the International Electrotechnical Commission (IEC), the American National Standards Institute (ANSI), the German Standards Institute (actually Deutsches Institut für Normung), the International Organization for Standardization, and the International Telecommunication Union.

for increased and variable electricity loads from the transportation sector. We discuss in turn the importance of each of these in driving the need for Smart Grid capabilities and the standards to achieve interoperability of smart grid devices with the electric grid and its associated users and infrastructure.

#### Cybersecurity and reliability

13. Absent any consideration of the Smart Grid concept, other activities and events currently taking place in various regions raise physical and cybersecurity concerns for the electric industry. For example, utilities have already taken advantage of the existing communications infrastructure and capabilities of the Internet to aid their marketing operations. While typically not connecting their more sensitive control center systems directly to the Internet, many entities have nevertheless upgraded those systems to use Internet-based protocols and technologies. This, coupled with the fact that the non-Internet-connected control center operations may be connected to the same corporate network as the Internet-connected marketing systems, means that there may be an indirect Internet vulnerability to those sensitive control systems. Accordingly, without adequate protections, these preexisting utility efforts potentially increase the exposure of the bulk-power system to cybersecurity threats. Cybersecurity and physical security have been ongoing concerns for the Commission and the electric industry with the advent of the mandatory and enforceable federal bulk-power system reliability regime in place in most of the United States under the oversight of the Commission pursuant to FPA section

215.<sup>13</sup> Pursuant to this section 215 authority, the Commission recently approved eight cyber and physical protection related reliability standards.<sup>14</sup>

14. The fact that a smarter grid would permit two-way communication between the electric system and a much larger number of devices located outside of controlled utility environments commands that even more attention be given to the development of cybersecurity standards. Therefore, the Commission proposes to advise the Institute to undertake the necessary steps to assure that each standard and protocol that is developed as part of the Institute's interoperability framework is consistent with the overarching cybersecurity and reliability mandates of the EISA as well as existing reliability standards approved by the Commission pursuant to section 215 of the FPA. The Commission proposes to make consistency with cybersecurity and reliability standards a precondition to its adoption of Smart Grid standards. We seek comment on these proposals.

15. In order to fully incorporate measures to protect against cyber and physical security threats, we also propose to advise the Institute to take the necessary steps to assure that its process for the development of any interoperability standards and protocols

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<sup>13</sup> 16 U.S.C. 824o.

<sup>14</sup> See Mandatory Reliability Standards for Critical Infrastructure Protection, Order No. 706, 73 FR 7368 (Feb. 7, 2008), 122 FERC ¶ 61,040, reh'g denied and clarification granted, Order No. 706-A, 123 FERC ¶ 61,174 (2008). Notably, section 215(a) of the FPA, 16 U.S.C. 824o(a), defines the terms "reliability standard," "reliable operation," and "cybersecurity incident."

leaves no gaps in cyber or physical security unfilled. We are concerned that this could be a particular problem where separate groups of interested industry members independently develop and advocate select standards or protocols for the Institute's consideration. We seek comment on this proposal.

#### Inter-system communication and coordination

16. There is an urgent need to further develop a common semantic framework (i.e., agreement as to meaning) and software models for enabling effective communication and coordination across inter-system interfaces. Such standards could play an important role in the movement to a smarter grid that is capable of addressing challenges to the operation of the bulk-power system. The bulk-power system can be thought of as a system of systems.<sup>15</sup> In order to enable a smarter grid, particularly one capable of addressing the bulk-power system challenges discussed below, effective interfaces must be developed between and among all of these systems (i.e., inter-system interfaces) and common information model standards appear to be powerful tools to enable such inter-system interfaces. The Commission proposes to identify standards for common information models for inter-system interfaces as a high priority for accelerated development. We seek comment on this proposal.

#### Integrating renewable resources into the electric grid

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<sup>15</sup> See Appendix A for a graphic representation of the various systems.

17. Several groups of states have been working on aggressive regional carbon control measures,<sup>16</sup> and one regional effort has already begun operation in the form of the Regional Greenhouse Gas Initiative.<sup>17</sup> Federal legislation addressing carbon control and other environmental and climate related matters may follow. These initiatives point toward a shift in the mix of fuels that will be used to generate electricity, and an associated shift in where new generation resources are located. Additional transmission capacity to ensure deliverability of those new generating resources will be needed in the form of new transmission lines and more efficient use of existing infrastructure. Also, additional demand resources, generation resources, and DER will be needed to reliably integrate variable generation into the electric grid. Efforts to address these challenges could benefit from the enhanced capabilities associated with certain aspects of the Smart Grid; among them, the ability to maximize the capability and use of existing and new transmission capacity,<sup>18</sup> and foster the deployment and integration of demand resources, generation resources and DER.

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<sup>16</sup> See, e.g., the Western Climate Initiative (<http://www.westernclimateinitiative.org/>) and the Midwestern Greenhouse Gas Reduction Accord (<http://www.midwesternaccord.org/>).

<sup>17</sup> See <http://www.rggi.org/home>.

<sup>18</sup> For example, a smarter grid could enable an increase in transmission capacity through a switch from static to dynamic transmission line ratings enabled by the advanced sensor, communications, and information technology capabilities associated with a smarter grid.

18. As of December 2008, the Nation had 25,170 MW of wind generation based on nameplate capacity.<sup>19</sup> According to the 2008 Long-Term Reliability Assessment by the North American Electric Reliability Corporation (NERC), an additional 145,000 MW of wind power projects are planned or proposed over the next ten years.<sup>20</sup> Accordingly, it is evident that in a relatively short period of time, some parts of the bulk-power system may face the need to effectively integrate unprecedented amounts of variable generation resources. This is significant because operators of variable generation have less control over when the resource is available to produce electricity, in contrast with more conventional fossil and nuclear generation.

19. Large amounts of variable generation raise several important operational and planning issues, including: (1) resource adequacy (potential loss and unavailability of variable resources at peak periods and other critical times such as loss of other generators or transmission lines); (2) resource management (potential for over-generation by variable resources during off-peak periods when there is insufficient load to accommodate such generation); and (3) reduced system inertia (potential loss of system

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<sup>19</sup> Source, American Wind Energy Association's website:  
<http://www.awea.org/projects/>.

<sup>20</sup> North American Electric Reliability Corporation, 2008 Long-Term Reliability Assessment at 12.



stability due to the high penetration of variable resources with low inertia properties).<sup>21</sup>

Given sufficient time and resources, a variety of solutions to these concerns may be feasible. For example, investment in large amounts of electricity storage could ultimately address both the resource adequacy and resource management concerns,<sup>22</sup> although technical and economic issues remain to be addressed before such investment is likely to become significant. In the meantime, Smart Grid-enabled demand response capabilities<sup>23</sup>

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<sup>21</sup> Inertia is the physical property which allows an object in motion to continue to stay in motion, absent other forces. Traditional dispatchable generating units (such as thermal and hydro power plants) utilize large rotary generators which have large amounts of inertia. This property has a tendency to stabilize the bulk-power system with an output response in the event of a disturbance. Variable resources, such as wind and solar, have less or no inertia and, as such, cut back more quickly in response to disturbances (e.g., frequency excursions), which may contribute to power system instabilities.

<sup>22</sup> The Electricity Advisory Committee, which was formed by the Department of Energy to provide it with advice on a number of electricity issues, recently issued a report, Bottling Electricity: Storage as a Strategic Tool for Managing Variability and Capacity Concerns in the Modern Grid, December 2008. This report asserts that there are many benefits to deploying energy storage technologies into the Nation's grid: (1) a means to improve grid optimization for bulk power production; (2) a way to facilitate power system balancing in systems that have variable renewable energy sources; (3) facilitation of integration of plug-in hybrid electric vehicle power demands with the grid; (4) a way to defer investments in transmission and distribution infrastructure to meet peak loads (especially during outage conditions) for a time; and (5) a resource providing ancillary services directly to grid/market operators.

<sup>23</sup> The Smart Grid concept envisions a power system architecture that permits two-way communication between the grid and essentially all devices that connect to it, ultimately all the way down to large consumer appliances. Efforts at realizing this concept focus on standardization to enable all of this new equipment to be manufactured economically in support of widespread adoption by consumers. Once that is achieved, a significant proportion of electric load could become an important resource to the electric  
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could add important new tools to deal with both resource adequacy and resource management concerns.<sup>24</sup> Demand response reductions in load can help address the resource adequacy concerns surrounding unexpected loss of variable generation, and EISA envisions, among other things, the development of large new pools of demand response resources.<sup>25</sup>

20. With respect to the resource management concerns surrounding potential over-generation, this situation tends to arise during off-peak periods when load is at its lowest and system operators have already turned off all traditional generation except their large conventional units that, for primarily operational reasons, must be operated in a nearly steady state around the clock.<sup>26</sup> If large amounts of variable generation begin producing

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system, able to respond automatically to customer-selected price or dispatch signals delivered over the Smart Grid infrastructure without significant degradation of service quality. For purposes of this proposed policy statement we will refer to such new demand response capability as Smart Grid-enabled demand response capability.

<sup>24</sup> A recent NERC Draft Special Report recognizes that “[d]emand response has already been shown in some balancing areas to be a flexible tool for operators to use with wind generation [footnote omitted] and is a potential source of flexibility equal to supply-side options.” NERC, Special Report Accommodating High Levels of Variable Generation at 45; available at [http://www.nerc.com/docs/pc/ivgtf/IVGTF\\_Reporta\\_17Nov08.pdf](http://www.nerc.com/docs/pc/ivgtf/IVGTF_Reporta_17Nov08.pdf).

<sup>25</sup> See, e.g., EISA sec. 1301(4), (5), (6), (8), and (9), to be codified at 15 U.S.C. 17381(4), (5), (6), (8), and (9).

<sup>26</sup> There can also be an economic justification for around-the-clock operation because large conventional units tend to have relatively higher capital costs and lower running costs. However, their generally slow and difficult start-up and cool-down sequences are the main reason why they cannot be started and stopped easily to address

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power during such periods, then the supply of electricity would exceed the demand for electricity and risk unbalancing the bulk-power system. In order to bring the system back into balance in a situation where easily dispatchable generation or demand resources are not available, system operators may have to require variable generation to reduce output. However, at such times this variable generation may be producing the lowest priced energy on the system, so reducing or eliminating its output would not be economically efficient. If a system existed whereby entities<sup>27</sup> could receive a timely signal to temporarily shift their demand from peak to off-peak, and if such load shifts could be controlled by the system operator, then such “dispatchable” demand response could alleviate to some degree the resource management concerns associated with over-generation from the other side of the supply/demand equation. Again, the urgency to develop and implement those aspects of a smarter grid that can enable such demand response capability is clear.<sup>28</sup>

21. The future potential for a large and variable new class of electric load, specifically electricity-powered vehicles, also presents challenges that may deserve special attention and priority in the consensus-based interoperability process being coordinated by the

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over-generation situations.

<sup>27</sup> Such entities would need to have invested in the equipment necessary to reliably measure and control either their own load or the load of clients that they manage under contract.

<sup>28</sup> See, e.g., EISA sec. 1301(4), (5), (6), (8), and (9).

Institute. In addition to the plans of major automobile manufacturers to roll out plug-in hybrid vehicles starting in 2010, it is possible that large numbers of pure electric vehicles, sometimes known as neighborhood electric vehicles, could be purchased as second cars for short-haul daily commuting or for other purposes.<sup>29</sup> Judging by the observed intensity of electric utility and state government interest in this area,<sup>30</sup> the potential for a significant shift in personal transportation technology to electric power in the near future cannot be discounted.

22. The timing of vehicle charging activities is an illustration of the effect electric vehicles can have on the operation of the electric grid. If charging takes place during peak periods it could require a large investment in new generation, demand response resources and/or transmission capacity to meet the resulting higher peak loads. However, charging off-peak could actually improve the operation of the electric system, for example by improving existing generation asset utilization or by providing an electricity storage solution to address the potential for over-generation by variable resources in off-

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<sup>29</sup> See, e.g., Kris Osborn, Services Plan to Buy Electric Cars, Federal Times, November 17, 2008, at 3 (noting that Army, Navy, and Air Force plan to purchase a total of 30,000 neighborhood electric vehicles for use on military bases).

<sup>30</sup> See, e.g., John S. Adams, Bill benefits 'medium-speed' electric cars, Great Falls Tribune, January 9, 2009 (reporting on efforts in the Montana legislature to ease restrictions and ownership and use requirements on “medium speed” electric vehicles, which could include electric vehicles of up to 5,000 pounds gross vehicle weight), available at <http://www.greatfallstribune.com/article/20090109/NEWS01/901090337>.

peak periods. Ultimately, large numbers of plug-in electric vehicles have the potential to provide some ancillary services like distributed energy storage or, when aggregated, regulation service. In all cases, however, the enhanced information processing and high-speed communications and control capabilities of the Smart Grid would be extremely helpful, perhaps necessary, in dealing with the challenges and opportunities associated with large numbers of new electric vehicles on the bulk-power system.

23. Additionally, these and other changing patterns of electricity generation and use are increasing the frequency with which congestion on transmission facilities becomes binding and raises costs for consumers. The Smart Grid concept includes the deployment of advanced sensors and controls throughout the electric system that should maximize the capability and use of existing and new transmission capacity.

24. For all of the reasons discussed above, which may represent direct challenges to the reliable operation of the bulk-power system and wholesale power markets, the fact that many utilities are already beginning to deploy Smart Grid related systems, and the substantial funding for Smart Grid in the American Recovery and Reinvestment Act,<sup>31</sup>

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<sup>31</sup> See American Recovery and Reinvestment Act, Pub. L. No. 111-5, Title IV, Subpart A, \_\_ Stat. \_\_, \_\_ (2009) (ARRA).

the Commission herein proposes a targeted acceleration of certain aspects of the interoperability standards process as described further below.<sup>32</sup>

**B. Development of Key Interoperability Standards**

25. As discussed above, several important trends indicate a strong national interest in expediting the development and deployment of the types of technologies and capabilities associated with a smarter grid. To achieve these types of capabilities, Smart Grid technologies must be interoperable.<sup>33</sup> The Commission understands that a consensus-based interoperability standards development process typically requires time to reach consensus, but also recognizes that recent efforts by the Institute and several industry groups, including the OpenSG Subcommittee of the Utility Communication Architecture International User Group (OpenSG Subcommittee) and the GridWise Architecture Council, have developed concepts to prioritize the large set of potential standards, and have suggested principles for expediting development of a set of transmission and distribution systems standards that will facilitate many other important standards development activities. The Commission is committed to identifying these key transmission and distribution standards and working with the Institute to expedite their

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<sup>32</sup> This is consistent with the Institute's approach of prioritizing standards and functionalities that may impact reliability. See NIST Smart Grid Issues Summary, March 10, 2009, available at: <http://www.nist.gov/smartgrid/> (in case link is temporarily unavailable at this website, please request it via e-mail at: [smartgrid@nist.gov](mailto:smartgrid@nist.gov) ).

<sup>33</sup> See Gridwise Architecture Council, Interoperability Path Forward Whitepaper, infra n.8.

adoption. The Commission believes that focusing on the priorities identified below will help to remove uncertainty for developers of standards applicable to all levels of the grid.

26. The Institute has issued for comment a “Smart Grid Issues Summary” that will act as an interim roadmap, starting with high priority standards that are largely based on existing broadly accepted standards.<sup>34</sup> Leveraging existing standards to the greatest extent practical should shorten the time required to finalize needed interoperability standards.

27. The Commission proposes to prioritize the development of standards for two cross-cutting issues and four key grid functionalities involving interfaces between utilities (e.g., regional transmission organizations (RTO) to utilities outside the RTO), utilities and customers, and utilities and other systems (e.g., energy management systems). These cross-cutting issues and key functionalities are proposed as the first level of work to be accomplished in the interoperability standards-setting process. Swift progress on adopting standards for these cross-cutting issues and key functionalities is necessary for the transmission operator/RTO to address the bulk-power system challenges identified above.

28. The two cross cutting issues are first, cybersecurity (and physical security to protect equipment that can give access to Smart Grid operations) and second, a common

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<sup>34</sup> See infra n.32.

semantic framework and software models for enabling effective communication and coordination at the boundaries of utility systems where these interface with customer and other systems (and hence provide “inter-system” functionality).<sup>35</sup> The four key grid functionalities are wide-area situational awareness, demand response, electric storage, and electric transportation.

### System Security

29. We propose two initial overarching principles regarding security that Smart Grid applications must address in order to comply with the need for full cybersecurity and with the Commission’s bulk-power system concerns, consistent with our authority under section 215 of the FPA.<sup>36</sup> First, we believe that a responsible entity subject to Commission-approved reliability standards, such as the Critical Infrastructure Protection Reliability Standards, must ensure that it maintains compliance with those standards during and after the installation of Smart Grid technologies. Indeed, many Smart Grid installations will need to be included on a responsible entity’s list of critical assets to be

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<sup>35</sup>The concept of the Smart Grid as a “system of systems” and the importance of the need of first focusing on the inter-system interfaces are presented in a paper by the OpenSG Subcommittee and Smart Grid Executive Working Group entitled Smart Grid Standards Adoption: Utility Industry Perspective (Utility Perspective Paper), available at: <http://osgug.ucaiug.org/Shared%20Documents/Forms/AllItems.aspx>. A graphic that illustrates these concepts is found in Appendix A.

<sup>36</sup> 16 U.S.C 824o.



protected under the Commission-approved NERC Critical Infrastructure Protection Reliability Standards.

30. Second, to the extent that they could affect the reliability of the bulk-power system, Smart Grid technologies must address, the following considerations: (1) the integrity of data communicated (whether the data is correct); (2) the authentication of the communications (whether the communication is between the intended Smart Grid device and an authorized device or person); (3) the prevention of unauthorized modifications to Smart Grid devices and the logging of all modifications made; (4) the physical protection of Smart Grid devices; and (5) the potential impact of unauthorized use of these Smart Grid devices on the bulk-power system.

31. To the extent that any of the new Smart Grid standards or extensions to relevant existing standards require adaptation or extension in order to address these security-related concerns, such considerations should be given the highest priority. The Institute has suggested that beyond the NERC Critical Infrastructure Protection Reliability Standards, additional security standards to be investigated include ISA99/IEC 62443, NIST Special Publication (SP) 800-53, and the work of AMI-SEC.<sup>37</sup> The Institute also

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<sup>37</sup> ISA99/IEC 62443 represents a suite of standards for industrial automation and control system security. NIST Special Publication (SP) 800-53 involves security controls for federal agencies, including those who are part of the bulk-power system (e.g., Tennessee Valley Authority, Bonneville Power Authority). The Advanced Metering Infrastructure (AMI) Security Task Force (AMI-SEC), is defining common requirements and standardized specifications for securing AMI system elements.

suggests examining harmonization of several of these standards in order to provide additional protection to the bulk-power system. Commission staff will monitor Institute activities with respect to Smart Grid cybersecurity and physical security in order to fully coordinate the Commission's regulatory objectives and responsibilities in this arena. The Commission seeks comments on this proposed approach to maintaining bulk-power system reliability and security as smart grid technologies are deployed and integrated.

### Communication

32. The second cross-cutting issue is the need for a common semantic framework (i.e., agreement as to meaning) and software models for enabling effective communication and coordination across inter-system interfaces. An interface is a point where two systems need to exchange data with each other; effective communication and coordination occurs when each of the systems understands and can respond to the data provided by the other system, even if the internal workings of each system are quite different. A core group of standards initiated by the Electric Power Research Institute provide the basis for addressing this issue - these standards are IEC 61970 and IEC 61968 (together often referred to as the "Common Information Model" standards) and IEC 61850. These standards have been cited by both the Utility Perspective Paper, as well as the Institute's recent Smart Grid Issues Summary.<sup>38</sup> This group of standards was designed to allow

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<sup>38</sup> See infra n.32.

different systems to talk to one another as well as to provide software development tools for more efficient system integration. This suite of standards is already in use by a number of utilities for enterprise system integration (enabling integration across “intra-system” interfaces). Indeed, while additional work on these standards will also help intra-system communication and coordination, we agree with the OpenSG Subcommittee and the Institute that inter-system interfaces should be a priority.

33. The Commission is not mandating that these particular standards be further developed. Rather, we identify them here to establish priorities for further development by the Institute and industry. The group of standards initiated by the Electric Power Research Institute serves as a foundation for developing a complete set of communications standards. These standards require some level of harmonization with one another and other standards, and extensions to these standards will be required for additional interoperability and functionality. Efforts to coordinate and/or harmonize these standards with others intended to promote interoperability should be encouraged. For example, ongoing efforts to coordinate IEC 61968 with “MultiSpeak” developed by the National Rural Electrical Cooperative Association should be continued. But these standards represent the best work to date and will be an essential building block in realizing the most significant early benefits for the bulk-power system. These standards are also key to the attainment of renewable power and climate policy goals and can help

enable customers to manage their energy usage and cost. The Commission seeks comments on this proposed approach.

#### **Four Priority Functionalities**

34. In addition to the cross-cutting issues discussed above, the Commission seeks comments on the four Smart Grid functionalities that the Commission's preliminary analysis indicates will be most helpful in addressing the bulk-power system challenges and should be given priority in the standards development process.

#### **Wide-area situational awareness**

35. Wide-area situational awareness is the visual display of interconnection-wide system conditions in near real time at the reliability coordinator level and above. The wide-area situational awareness efforts, with appropriate cybersecurity protections, can rely on the NASPInet work undertaken by the North American SynchroPhasor Initiative (NASPI) and will require substantial communications and coordination across the RTO and utility interfaces. We encourage the RTOs to take a leadership role in coordinating the NASPI work with the member transmission operators.

36. Regarding the potential Smart Grid role in addressing transmission congestion and optimization of the system, increased deployment of advanced sensors like Phasor Measurement Units will give bulk-power system operators access to large volumes of high-quality information about the actual state of the electric system that should enable a more efficient use of the electric grid, for example through a switch from static to

dynamic line ratings. However, such large volumes of data present challenges in the form of information processing and management. Advanced software and systems will be needed to manage, process, and render this data into a form suitable for human operators and automated control systems. The Institute's process should strive to identify the core requirements for such software and systems that would be most useful to system operators in addressing transmission congestion and reliability.

#### Demand response

37. Smart Grid-enabled demand response is a priority because of its potential to help address several of the bulk-power system challenges identified above. Further development of key standards would enhance interoperability and communications between system operators, demand response resources, and the systems that support them. In order to achieve an appropriate level of standardizations, a series of demand response "use cases" should be developed using readily available tools.<sup>39</sup> In this regard, we encourage a particular focus on use cases for the key demand response activities discussed earlier: dispatchable demand response load reductions to address loss or unavailability of variable resources and the potential for dispatchable demand response to increase power consumption during over-generation situations.

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<sup>39</sup> The "use case" is a concept from the software and systems engineering communities whereby a developer, usually in concert with the end user, attempts to identify all of the functional requirements of a system. Each "use case" essentially describes how a user will interact with a system to achieve a specific goal.

38. It also appears that achieving such demand response capabilities will require additional standardization of the interfaces between systems on the customer premises and utility systems, including addressing data confidentiality issues. The Institute notes that considerable work has been done to develop demand response standards. One standard, Open Automated Demand Response (OpenADR) (developed for the interface between the utility and large commercial customers) has already been referred to the Organization for the Advancement of Structured Information Systems (OASIS). OpenADR has been developed by the Lawrence Berkeley National Laboratory, and is now going through a formal standards development process being coordinated between OASIS and the Utility Communication Architecture International User Group.<sup>40</sup> Accordingly, we would encourage a focus in this area as well.

39. Specifications for customer meters are within the jurisdiction of the States, but it is clear that communication and coordination across the interfaces between the utility and its customers can have a significant impact on the bulk-power system, particularly as new renewable power and climate policy initiatives introduce the need for more flexibility in the electricity grid, which creates the need for increased reliance on demand response and

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<sup>40</sup> The Utility Communication Architecture International User Group has also been developing OpenHAN, a specification for the energy services interface between the home area network (HAN) and the utility. Both OpenHan and OpenADR will benefit from the planned extensions of IEC 61850 and the common information model standards described above.

electricity storage. A large portion of electricity storage may ultimately be located on customer premises. As noted in the Institute's Smart Grid Issues Summary, an appropriate starting point for further standards development would be the harmonization of IEC Standard 61850 and several meter standards, namely ANSI C12.19 and C12.22, and we encourage the Institute and industry to work together on this suggestion. The Commission seeks comment from States and other parties on the optimal approach to develop standards in this area, and we will pursue direct communications with the States on this topic through the NARUC-FERC Smart Grid Collaborative and other NARUC Committees.

#### Electric storage

40. The third key grid functionality is electric storage. If electricity storage technologies could be more widely deployed, they would present another important means of addressing some of the difficult issues facing the electric industry. To date, the only significant bulk electricity storage technology has been pumped storage hydroelectric technology. However, we are aware that new types of storage technologies are under development and in some cases are being deployed, and could also potentially provide substantial value to the electric grid. While further research and development appears necessary before any widespread deployment of such newer technologies can take place, it may nevertheless be appropriate to encourage the identification and standardization of all possible electricity storage use cases at an early stage. There are

existing standards that can be the starting point for interoperability standards development for DER. IEC 61850 addresses communications for DER, and IEEE 1547 has been designated as a federal standard for interconnection.<sup>41</sup>

#### Electric transportation

41. The fourth key grid functionality is electric transportation. As indicated above, to the extent that new electric transportation options become widely adopted in the near future, maintaining the reliable operation of the bulk-power system will require some level of control over when and how electric cars draw electricity off of the system. At the most basic level, this could be accomplished by providing an ability for distribution utilities to facilitate vehicle charging during off-peak periods so that this new electric load would not increase peak loads and require the development of new peak generation, demand response and/or more transmission to urban load centers that are being targeted for these vehicles. A more advanced implementation could offer vehicle owners the option to voluntarily limit their charging to times when variable renewable generation is producing power or to permit utilities the limited use of the aggregated capabilities of these vehicles for various grid-related purposes such as bulk power storage or ancillary services.

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<sup>41</sup> See Energy Policy Act of 2005, Pub. L. No. 109-58, sec. 1254, 110 Stat. 594, 970 (2005), adding a new subsection 111(d)(15) to the Public Utility Regulatory Policies Act of 1978 (16 U.S.C. 2621(d)).



42. Ultimately we would hope for a smarter grid to accommodate a wide array of advanced options for electric vehicle interaction with the grid, including full vehicle-to-grid capabilities. However, assuming full vehicle-to-grid capabilities cannot be achieved immediately, we would encourage the Institute's process to focus on the development of appropriate standards, or extensions to relevant existing standards, to provide at least the minimum communications and interoperability requirements that are necessary to permit some ability for distribution utilities to facilitate vehicle charging during off-peak load periods. The Institute's Smart Grid Issues Summary notes that the Society of Automotive Engineers (SAE) has developed two draft standards, SAE J2836 and SAE J2847, which address communications and price signals/demand response respectively. These standards are on the SAE 2009 Ballot. Looking forward to the potential provision of ancillary services to the grid by electric vehicles, electrical interconnection issues must be dealt with along with potential expansion of communications ability. To this end, we urge the SAE and the automobile industry to plan data communications systems between electric vehicles and the grid that are able to be upgraded. We also urge the Institute to include electric vehicles in its DER standards development.

43. Several of the preceding paragraphs discuss the development of use cases or other standards that appear similar to business practice standards development, in order to help shape and identify the functional needs that the Institute's technical interoperability standards development process will address. Since the North American Energy

Standards Board (NAESB) has a great deal of experience in helping the electric and natural gas industries successfully negotiate business practice standards, it may be helpful to the Institute to engage NAESB resources in the development of these use cases and other business practice-like standards. We seek comment as to whether the Institute would be helped by the incorporation of resources from other organizations such as NAESB into the development of these various business practice-like standards.

44. The Commission seeks comment on whether the priorities and reliability principles articulated above are appropriate, and whether there are other priorities or reliability principles that should be included in order to address potential challenges to the operation of the bulk-power system.

**C. Interim Rate Policy: Guidance for Smart Grid-Related Filings by Jurisdictional Entities**

45. Given the trends discussed above, Smart Grid policies should encourage utilities to deploy systems in the near term that advance efficiency, security, and interoperability in order to address potential challenges to the bulk-power system. A key consideration for utilities when determining whether to adopt such systems will be whether they are able to recover the costs of these deployments in regulated rates. Another key consideration may involve the potential for stranded costs associated with legacy systems that are replaced by Smart Grid equipment. Additionally, as the electric system may require several of the new capabilities of the Smart Grid before interoperability standards have been developed, we recognize the need for guidance for jurisdictional entities. Thus, to offer some rate

certainty and guidance regarding cost recovery issues, the Commission is proposing a rate policy for the interim period until final interoperability standards are adopted.

46. FPA section 205 requires that all rates for the transmission or sale of electric energy subject to the Commission's jurisdiction be just and reasonable.<sup>42</sup> In evaluating expenses for which cost recovery is appropriate, one of the criteria the Commission relies on is whether the facilities are "used and useful."<sup>43</sup> Once interoperability standards are completed, the Commission will consider making compliance with those standards a mandatory condition for rate recovery of jurisdictional Smart Grid investments. For now, we propose as an interim rate policy to accept rate filings, including single issue rate filings, submitted under FPA section 205 by public utilities to recover the costs of Smart Grid deployments involving jurisdictional facilities provided that certain showings are made. In other words, we propose to consider Smart Grid devices and equipment, including those used in a Smart Grid pilot program or demonstration project, to be used and useful for purposes of cost recovery if an applicant makes the following showings.

47. We propose that an applicant must show that the reliability and security of the bulk-power system will not be adversely affected by the deployment at issue. Second,

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<sup>42</sup> 16 U.S.C. 824d.

<sup>43</sup> The general rate-making principle is that expenditures for an item may be included in a public utility's rate base only when the item is "used and useful" in providing service. See NEPCO Municipal Rate Committee v. FERC, 668 F.2d 1327, 1333 (D.C. Cir. 1981).

the filing must show that the applicant has minimized the possibility of stranded investment in Smart Grid equipment by designing for the ability to be upgraded, in light of the fact that such filings will predate adoption of interoperability standards. Finally because it will be important for early Smart Grid deployments, particularly pilot and demonstration projects, to provide feedback useful to the interoperability standards development process, we propose to direct the applicant to share information with the Department of Energy Smart Grid Clearinghouse, provided for in the ARRA.<sup>44</sup>

48. In order to satisfy our first concern about reliability and security, we propose that applicants will be required to address the security concerns discussed in the previous section on the development of key standards. Accordingly, an applicant must show how its proposed deployment of smart grid equipment will maintain compliance with Commission-approved reliability standards, such as the Critical Infrastructure Protection Reliability Standards, during and after the installation and activation of Smart Grid technologies so the reliability and security of the bulk-power system will not be jeopardized. An applicant must also address: (1) the integrity of data communicated (whether the data is correct); (2) the authentication of the communications (whether the communication is between the intended Smart Grid device and an authorized device or person); (3) the prevention of unauthorized modifications to Smart Grid devices and the

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<sup>44</sup> ARRA sec. 405(3).

logging of all modifications made; (4) the physical protection of Smart Grid devices; and (5) the potential impact of unauthorized use of these Smart Grid devices on the bulk-power system.

49. Regarding the second concern about stranded smart grid investment, we propose to require a showing that the applicants have made good faith efforts to adhere to the vision of a Smart Grid described in Title XIII of the EISA, including optimizing asset utilization and operating efficiency. In general, applicants should attempt to adhere to the principles of the Gridwise Architecture Council Decision-Maker's Interoperability Checklist.<sup>45</sup> In practice, we will place the most weight on an applicant's adherence to the following principles: (1) reliance to the greatest extent practical on existing, widely adopted and open<sup>46</sup> interoperability standards; and (2) where feasible, reliance on systems

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<sup>45</sup> See Gridwise Architecture Council Decision-Maker's Interoperability Checklist Draft Version 1.0, available at [http://www.gridwiseac.org/pdfs/gwac\\_decisionmakerchecklist.pdf](http://www.gridwiseac.org/pdfs/gwac_decisionmakerchecklist.pdf) (Interoperability Checklist).

<sup>46</sup> An open architecture is publicly known, so any and all vendors can build hardware or software that fits within that architecture, and the architecture stands outside the control of any single individual or group of vendors. In contrast, a closed architecture is vendor-specific and proprietary, and blocks other vendors from adoption. An open architecture encourages multi-vendor competition because every vendor has the opportunity to build interchangeable hardware or software that works with other elements within the system. See Gridwise Architecture Council Decision-Maker's Interoperability Checklist Draft Version 1.0, available at [http://www.gridwiseac.org/pdfs/gwac\\_decisionmakerchecklist.pdf](http://www.gridwiseac.org/pdfs/gwac_decisionmakerchecklist.pdf). We note that Congress recently made utilization of open protocols and standards, if available and appropriate, a condition of receiving funding from the Department of Energy for

(continued...)

and firmware that can be securely upgraded readily and quickly. Adherence to these two key principles should minimize the possibility of stranded smart grid investment by making it less likely that equipment replacement will be required once final standards are approved.

50. Regarding the information sharing concern, the following information should be shared with the Department of Energy Smart Grid Clearinghouse: (1) any internal or third party evaluations, ratings, and/or reviews including all primary source material used in the evaluation; (2) detailed data and documentation explaining any improvement in the accurate measurement of demand response resources; (3) detailed data and documentation explaining the expansion of the quantity of demand response resources that resulted from the project and the resulting economic effects; (4) detailed data and documentation for any improvements in the ability to integrate variable renewable generation resources; (5) detailed data and documentation that shows any achievement of greater system efficiency through a reduction of transmission congestion and loop flow; (6) detailed data and documentation showing how the information infrastructure supports DER such as plug-in electric vehicles; and (7) detailed data and documentation that shows how the project resulted in enhanced utilization of energy storage. To the extent

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demonstration projects and grants pursuant to EISA sections 1304 and 1306. See American Recovery and Reinvestment Act, Pub. L. No. 111-5, sec. 405(3) and 405(8), \_\_\_ Stat. \_\_\_, \_\_\_ (2009).

that the Department of Energy specifies additional criteria for making grants under the ARRA for Smart Grid demonstration and pilot projects, the Applicant should agree to share information relevant to those criteria as well.

51. Finally, consistent with the policy of supporting the modernization of the Nation's electric system announced in EISA section 1301, the Commission also proposes to permit applicants to file for recovery of the otherwise stranded costs of legacy systems that are to be replaced by smart grid equipment. However, an appropriate plan for the staged deployment of smart grid equipment, which could include appropriate upgrades to legacy systems where technically feasible and cost-effective, could help minimize the stranding of unamortized costs of legacy systems. Accordingly, we propose that any filing for the recovery of stranded legacy system costs must demonstrate that such a migration plan has been developed.

52. The Commission will also entertain requests for rate treatments such as accelerated depreciation and abandonment authority (whereby an applicant is assured of recovery of abandoned plant costs if the project is abandoned for reasons outside the control of the public utility) specifically tied to Smart Grid deployments under our FPA section 205 authority. Any requests for such rate treatments for Smart Grid deployments will need to address all of the concerns discussed above for rate recovery and make the same showings described in that section. We would also consider applying these rate treatments to the portion of a smart grid pilot or demonstration project's cost that is not

already paid for by Department of Energy funds, such as those authorized by EISA sections 1304 and 1306.<sup>47</sup> To the extent that such showings are made, we propose to consider permitting abandonment authority to apply to any Smart Grid investments that, despite reasonable efforts, could not be made upgradeable and must ultimately be replaced if found to conflict with the final standards to be approved under the Institute's standards development process.

53. The Commission invites comments on all aspects of this proposed interim rate policy.

### **III. Comment Procedures**

54. The Commission invites comments on this proposed policy statement [Insert\_Date 45 days after publication in the **FEDERAL REGISTER**].

### **IV. Document Availability**

55. In addition to publishing the full text of this document in the Federal Register, the Commission provides all interested persons an opportunity to view and/or print the contents of this document via the Internet through FERC's Home Page (<http://www.ferc.gov>) and in FERC's Public Reference Room during normal business hours (8:30 a.m. to 5:00 p.m. Eastern time) at 888 First Street, N.E., Room 2A, Washington D.C. 20426.

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<sup>47</sup> To be codified at 42 U.S.C. 17384, 17386.



56. From FERC's Home Page on the Internet, this information is available on eLibrary. The full text of this document is available on eLibrary in PDF and Microsoft Word format for viewing, printing, and/or downloading. To access this document in eLibrary, type the docket number excluding the last three digits of this document in the docket number field.

57. User assistance is available for eLibrary and the FERC's website during normal business hours from FERC Online Support at 202-502-6652 (toll free at 1-866-208-3676) or email at [ferconlinesupport@ferc.gov](mailto:ferconlinesupport@ferc.gov), or the Public Reference Room at (202) 502-8371, TTY (202)502-8659. E-mail the Public Reference Room at [public.referenceroom@ferc.gov](mailto:public.referenceroom@ferc.gov).

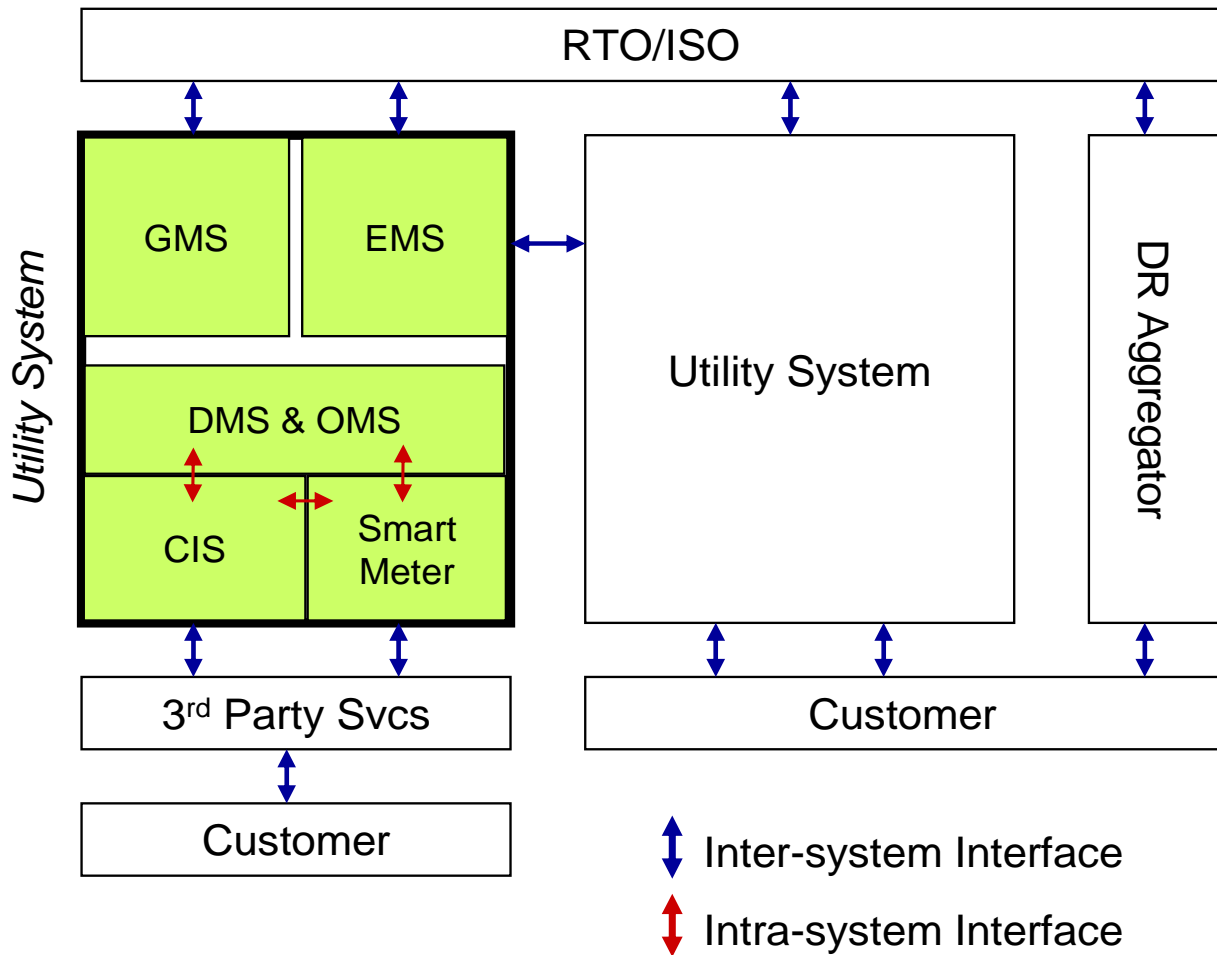
By the Commission.

( S E A L )

Nathaniel J. Davis, Sr.,  
Deputy Secretary.

Appendix A

**System of Systems**



Source: Smart Grid Standards Adoption: Utility Industry Perspective, OpenSG Subcommittee of the Utility Communication Architecture International User Group, and Smart Grid Executive Working Group.