Pace Law Review

Volume 32
Issue 3 *Summer 2012*

Article 2

June 2012

Standards, Patents, and the National Smart Grid

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Standards, Patents, and the National Smart Grid

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I. Introduction

Since the 1970s, energy independence, conservation, and environmental preservation in the United States have been recognized as urgent national priorities. In recent years, this concern has only increased. In 2003 the Department of Energy warned that "[u]nprecedented levels of risk and uncertainty about future conditions in the electric industry have raised concerns about the ability of the system to meet future needs."[1] Responding to this call for action, Congress enacted the Energy Independence and Security Act of 2007 (EISA),[2] implementing a sweeping new national energy policy.[3] EISA mandates the modernization of the century-old national power grid that is "aging, inefficient, and congested."[4] To do this, it calls for the creation of a "Smart Grid" that will dramatically improve the reliability, efficiency, security, and cost-effectiveness of the national electric grid.[5] Among the key provisions of EISA is a requirement that standards be developed to enable

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1. OFFICE OF ELEC. TRANSMISSION & DISTRIB., U.S. DEPT. OF ENERGY, "GRID 2030": A NATIONAL VISION FOR ELECTRICITY'S SECOND 100 YEARS, iv (2003) [hereinafter GRID 2030 REPORT], *available at* http://www.ferc.gov/eventcalendar/files/20050608125055-grid-2030.pdf.

2. Energy Independence and Security Act of 2007, Pub. L. No. 110-140, 121 Stat. 1492.

3. For example, in addition to the electrical grid, EISA addresses issues ranging from vehicle fuel economy to home appliance and lighting efficiency, to oil and gas industry tax subsidies. *Id.*

4. GRID 2030 REPORT, *supra* note 1, at iii.

5. Energy Independence and Security Act § 1301, 121 Stat. at 1783-84.

interoperability among the many different components that will be necessary to implement the Smart Grid infrastructure.[6]

The National Institute of Standards and Technology (NIST) is charged with overseeing the identification and selection of the hundreds of standards that will be required to implement the massive Smart Grid project.[7] This critical work has begun, and the first standards have already been selected for inclusion in NIST's Smart Grid catalog.[8] However, the benefits that could be realized from Smart Grid standardization could be threatened by a growing number of patents that cover Smart Grid architecture and technologies.[9] If patents that cover standardized Smart Grid elements are not revealed until technology is broadly distributed throughout the network ("locked-in"), significant disruption could occur if patent holders sought to collect unanticipated rents from large segments of the market.[10] Moreover, even if patents are revealed early in the standardization process, there is currently no efficient way for market participants to assess the cost of implementing the standardized technologies covered by these patents before those technologies and associated costs are locked-in to the system.[11] As a result, costs to consumers could increase, competitors could be shut out from the market, and the standardization process itself could be subverted. And far from being hypothetical, each of these scenarios has arguably *already occurred* in industries that rely heavily on standardization, such as computer memory and

6. § 1305, 121 Stat. at 1787-88.

7. NAT'L INST. OF STANDARDS & TECH., U.S. DEPT. OF COMMERCE, NIST SPECIAL PUBL'N NO. 1108, NIST FRAMEWORK AND ROADMAP FOR SMART GRID INTEROPERABILITY STANDARDS RELEASE 1.0, 7 (2010) [hereinafter NIST FRAMEWORK 1.0].

8. Press Release, Nat'l Inst. Standards & Tech., Smart Grid Panel Approves Six Standards for Catalog (Jul. 26, 2011), *available at* http://www.nist.gov/smartgrid/sgip-072611.cfm.

9. Jorge L. Contreras, *Standards and Related Intellectual Property Issues for Climate Change Technology* 13-14 (Wash. Univ. in St. Louis Sch. of Law Legal Studies Research Paper Series, Working Paper No. 11-02-05, 2011), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1756283.

10. *Id.* at 16.

11. *See id.* at 16-17, 20-21.

telecommunications.[12] In the case of the Smart Grid, however, the risk is even greater, as Smart Grid standards are mandated by law and have the potential to be adopted into both federal and state regulation, making lock-in nearly impossible to avoid and providing even greater leverage to opportunistic patent holders.

The U.S. federal government has in recent years adopted a relatively hands-off approach to the development of technical standards, deferring in large part to the efforts of privately-organized standardization efforts.[13] Such deference has characterized both federal procurement and agency rulemaking activity.[14] By the same token, the federal government has recognized a number of key technology areas in which the federal government should take a "convening and/or active-engagement role" to "ensure a rapid, coherent response to national challenges."[15] One of these areas is the Smart Grid.

Given the critical importance of the Smart Grid, it is imperative that the governmental agencies overseeing the identification and development of Smart Grid standards take appropriate measures to ensure that broad, national

12. *See* Joseph Farrell et al., *Standard Setting, Patents, and Hold-up,* 74 ANTITRUST L.J. 603, 644-47 (2007); *see generally* Mark A. Lemley, *Ten Things to Do About Patent Holdup of Standards (and One Not to)*, 48 B.C. L. REV. 149 (2007).

13. *See* Memorandum from Aneesh Chopra, Miriam Sapiro & Carl Shapiro to the Heads of Executive Departments and Agencies (Jan. 17, 2012) [hereinafter OSTP Principles for Federal Engagment], *available at* http://www.whitehouse.gov/sites/default/files/omb/memoranda/2012/m-12-08_1.pdf (noting that "reliance on private sector leadership, supplemented by Federal Government contributions to discrete standardization processes . . . remains the primary strategy for government engagement in standards development" and that "all standards activities should involve the private sector"). As observed in a 1992 report by the Congressional Office of Technology Assessment (OTA), "The U.S. standards setting process reflects a strong political and cultural bias in favor of the marketplace, a preference that has its origins deep in American history." OFFICE OF TECH. ASSESSMENT, CONGRESS OF THE UNITED STATES, TCT-512, GLOBAL STANDARDS: BUILDING BLOCKS FOR THE FUTURE 14 (1992), *available at* http://www.fas.org/ota/reports/9220.pdf.

14. *See* OFFICE OF MGMT. AND BUDGET, CIRCULAR NO. A-119 REVISED, FEDERAL PARTICIPATION IN THE DEVELOPMENT AND USE OF VOLUNTARY CONSENSUS STANDARDS AND IN CONFORMITY ASSESSMENT ACTIVITIES (1998), *available at* http://standards.gov/a119.cfm.

15. OSTP Principles for Federal Engagement, *supra* note 13, at 3.

implementation of standardized Smart Grid technology is not hindered either by undue economic burdens or the threat of costly and disruptive litigation.[16] To this end, in this Article I lay out a number of legal options available to the U.S. federal government for addressing potential patent encumbrances on Smart Grid standards. These range from relatively modest measures such as priority-setting within existing regulatory frameworks to more interventionist approaches, such as federal march-in rights, compulsory licensing, legislative exclusions of injunctive relief and the formation of patent pools. It is hoped that this brief catalog of options will offer useful assistance to federal policy makers seeking to preserve this strategic national resource.

II. The U.S. Electrical Power Grid and the Need for a Smart(er) Grid

A. *The Grid Today*.

The electrical power that is available for public use in the United States[17] is produced by a decentralized network of more than nine thousand generating facilities that are interconnected in a national power transmission "grid."[18]

16. This Article makes recommendations with respect to patents affecting standards for the Smart Grid, a system critical to the national energy infrastructure. I do not claim that the same considerations apply in commercial contexts, such as mobile telephony, computing, or semiconductor standards. While these technologies are economically important, they do not implicate the same national health, safety, and security priorities as electrical power transmission. A different set of considerations is called for with respect to technologies that are primarily commercial in nature, and a full discussion of these considerations is beyond the scope of this Article. *Cf.* Daniel R. Cahoy, *Inverse Enclosure: Abdicating the Green Technology Landscape*, AM. BUS. L.J. (forthcoming 2012) (drawing similar conclusions in the related areas of renewal energy and other "green" technologies).

17. Public electrical power is distinguished from power that is privately generated by diesel, wind, solar, or other local facilities operated by private parties, generally for their own benefit.

18. *See Effectively Transforming our Electric Delivery System to a Smart Grid: Hearing Before the Subcomm. on Energy and Env't of the H. Comm. on Sci. and Tech.*, 111th Cong. 4 (2009) [hereinafter *2009 House Smart Grid Hearing*]. For a general-interest history of the evolution of the U.S. electrical power grid, from Edison and Westinghouse to the present, see generally

Whether these facilities use coal, petrochemicals, nuclear fission, hydroelectric energy, solar energy, wind power, or other generating means, the electricity that they produce flows into the grid on an undifferentiated basis and is distributed across the country via a complex network of transmission stations and three hundred thousand miles of power lines.[19]

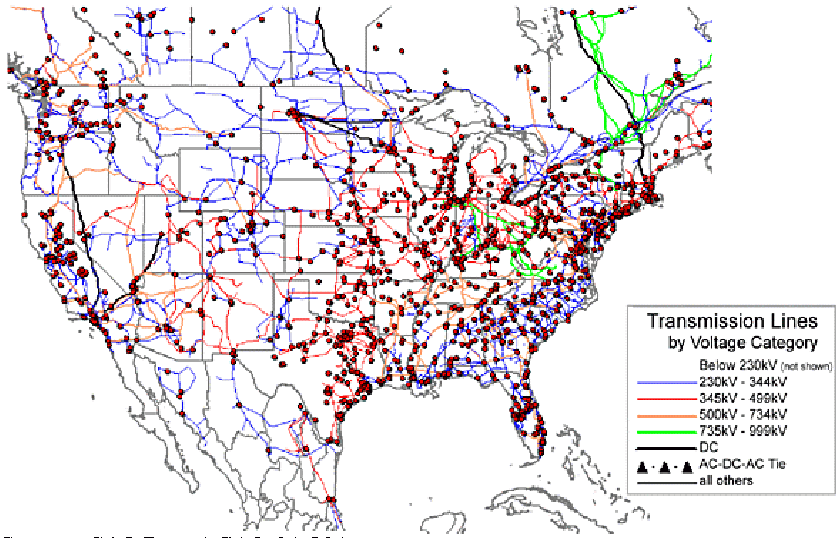
The grid operates on a real-time basis. That is, electricity must be used at the moment it is generated and cannot, using today's technology, be stored for future use.[20] Thus, during hot summer days when tens of millions of air conditioning units are running simultaneously, power generation is at its peak, and during the cooler evenings and winter months it is lower.[21] The grid must always have the capacity to meet peak demand, though much of its generating capacity remains unutilized most of the time.[22]

PHILLIP F. SCHEWE, THE GRID: A JOURNEY THROUGH THE HEART OF OUR ELECTRIFIED WORLD (2007).

19. *2009 House Smart Grid Hearing, supra* note 18, at 4.
20. *Id.*
21. *See id.*
22. *Id.*

Figure 1

U.S. Electric Transmission Network[23]



Source: GAO Report GAO-04-204

B. *Intelligence in the Grid.*

The U.S. power distribution system is in many ways technologically advanced.[24] Energy consumption is monitored in real time and generation capacity is adjusted to meet rising and falling demand on a minute-by-minute basis.[25] Outages are isolated and repaired with remarkable swiftness, and back-up systems enable rapid recovery from damage and faults.[26] Nevertheless, there are some ways in which the national power grid remains a relic of the past. Many of these manifest themselves in the interface between the grid and the end

23. U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-04-204, ELECTRICITY RESTRUCTURING: 2003 BLACKOUT IDENTIFIES CRISIS AND OPPORTUNITY FOR ELECTRICITY SECTOR 12 (2003).

24. *See, e.g.*, *2009 House Smart Grid Hearing, supra* note 18, at 35-36 (statement of Paul De Martini, Vice President, Advanced Technology, Southern California Edison).

25. *Id.* at 54.

26. *But see* SCHEWE, *supra* note 18, at 6-9, 134-56 (describing the widespread New York blackouts of 1965 and 2003).

consumer. For example, electricity meters in many homes date to the 1960s and are still read manually by technicians, homes, and businesses that generate their own electricity through solar panels, wind turbines, or other means have no way to share this power with others when they are not using it, and consumers have no way to notify the utility of their projected energy needs (such as lower consumption during vacations).[27]

C. *A "Smart" Grid?*

These shortcomings and others have led to calls for the development of a national "Smart Grid" that utilizes advanced communications and network properties to dramatically improve the efficiency of power generation and consumption in the United States.[28] Such a Smart Grid, it is hoped, will ease grid congestion and increase transmission capacity, network reliability, and pricing transparency, as well as enable a host of consumer-producer interactive transactions.[29]

The implementation of the Smart Grid will be a massive, multi-decade technological undertaking, and will require the engagement not only of electrical utilities and operators, but also a wide array of technology vendors in areas including power metering, computer networking, and telecommunications.[30] The alternative is continuing reliance on a power transmission architecture that is obsolete, inefficient and unable to deliver the energy-efficient solutions that are desperately needed in today's economy. Figure 2 illustrates the complex set of interrelated network elements that would comprise the Smart Grid architecture.

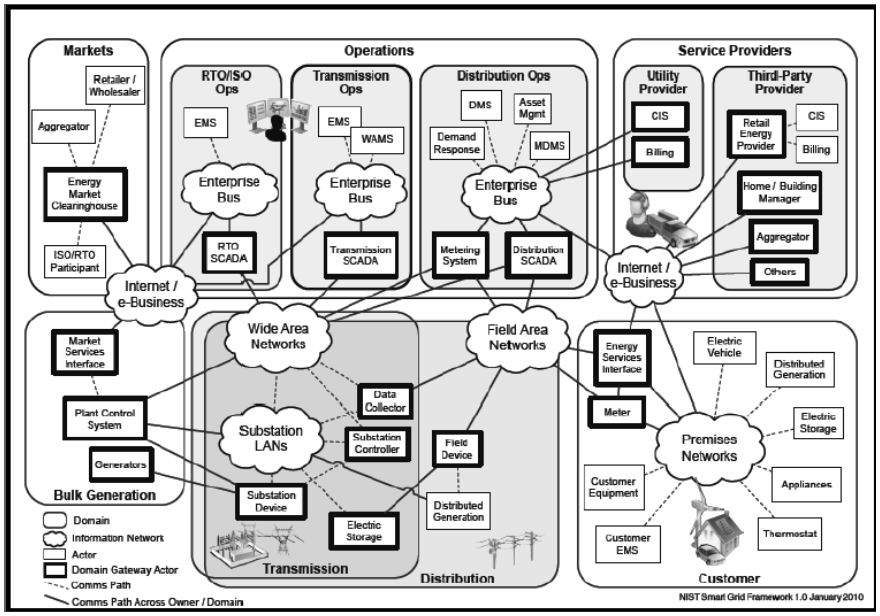
27. *See 2009 House Smart Grid Hearing*, *supra* note 18, at 54-55; GRID 2030 REPORT, *supra* note 1, at 3-5.

28. *See generally* GRID 2030 REPORT, *supra* note 1.

29. *Id.* at iv-v.

30. *See 2009 House Smart Grid Hearing, supra* note 18, at 33-34 (statement of Paul De Martini, Vice President, Advanced Technology, Southern California Edison).

Figure 2
Smart Grid Conceptual Reference Diagram[31]



III. Electrical Power Regulation and the Smart Grid

A. *The U.S. Electrical Power Regulatory Landscape*.

Electrical power generation and transmission in the United States is regulated by a combination of federal and state authorities. The Federal Electrical Regulatory Commission (FERC), an independent federal agency, has authority under the Federal Power Act,[32] among other things, to regulate interstate electricity transmission and to oversee the rates and tariffs for wholesale electricity sales in the U.S.[33] The federal Nuclear Regulatory Commission (NRC) oversees

31. NIST FRAMEWORK 1.0, *supra* note 7, at 35 (fig.3-2).
32. 16 U.S.C. §§ 791a-828c (2006).
33. To a large degree, the transmission and sale of wholesale electricity in the U.S. has been deregulated, and a market for independent power and market-based energy trading exists. *See generally* SCHEWE, *supra* note 18, at 171-80 (discussing the 1978 Public Utility Regulatory Policy Act (PURPA) and the 1992 Energy Policy Act).

the siting, construction, operation, and decommissioning of nuclear power facilities and the disposal of radioactive waste.[34] At the state level, public utility commissions (PUCs) regulate retail electricity sales and the commissioning of electrical generation facilities.[35]

B. *EISA and the Smart Grid Mandate.*

In 2007, Congress enacted EISA to address numerous areas of domestic energy policy and regulation. Title XIII of EISA designates the modernization of the national electricity transmission and distribution system as a national priority, both for meeting future energy demand and maintaining a "reliable and secure energy infrastructure."[36] EISA identifies the following characteristics of a national "Smart Grid" necessary to achieve these results:

> (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.

34. *About NRC,* U.S. NUCLEAR REGULATORY COMM'N, http://www.nrc.gov/about-nrc.html (last visited Mar. 4, 2012).

35. *See* NIST FRAMEWORK 1.0, *supra* note 7, at 33.

36. Energy Independence and Security Act of 2007, Pub. L. No. 110-140, § 1301, 121 Stat. 1492, 1783-84.

> (6) Integration of "smart" appliances and consumer devices.
> (7) Deployment and integration of advanced electricity storage and peak-shaving 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.[37]

EISA also calls for public utilities to make Smart Grid pricing, usage and source information available to consumers via the Internet or other electronic means.[38]

IV. Standards and the Smart Grid

One of the impediments to the implementation of a national Smart Grid system is the lack of uniform standards and protocols through which the many components of the grid system can communicate and interact. Most power and transmissions systems today can communicate only with equipment offered by the same vendor, but the Smart Grid will depend on real-time interaction among components supplied by a myriad of vendors.[39]

A. *FERC and the EISA Interoperability Requirements*.

In Clause 9 of the EISA Smart Grid mandate, Congress identifies communication and interoperability standards as key

37. *Id.* (emphasis added).
38. § 1307(a)(17), 121 Stat. at 1792.
39. *2009 House Smart Grid Hearing*, *supra* note 18, at 6.

components of the national Smart Grid.[40] In enacting this mandate, Congress recognized that technologies offered by a wide range of vendors would need to interoperate seamlessly in order to realize the promise of the Smart Grid.[41] Thus, just as computers, printers, headsets, and countless other peripheral devices sold by different manufacturers communicate with one another using common industry standards such as USB, WiFi, and Bluetooth, the diverse components of the Smart Grid network require uniform standards for communication and interoperability. Accordingly, EISA calls for a Smart Grid interoperability framework that is "flexible, uniform and technology-neutral"[42] and directs FERC to adopt standards and protocols "as may be necessary to insure smart-grid functionality and interoperability in interstate transmission of electric power . . . ."[43]

B. *National Institute of Standards and Technology (NIST).*

While EISA grants FERC the authority to adopt standards and protocols for the implementation of the Smart Grid, the responsibility for developing the Smart Grid interoperability framework falls to the National Institute of Standards and Technology (NIST).[44] NIST is authorized under EISA "to coordinate development of a framework that includes protocols and model standards for information management to achieve

40. § 1301(9), 121 Stat. at 1784.

41. *2009 House Smart Grid Hearing, supra* note 18, at 3-8.

42. § 1305(b), 121 Stat. at 1788.

43. § 1305(d), 121 Stat. at 1788.

44. Founded in 1901, NIST is a non-regulatory federal agency within the U.S. Department of Commerce's Technology Administration whose mission is to develop and promote measurement, standards, and technology to enhance productivity, facilitate trade, and improve the quality of life. Under the National Technology Transfer Advancement Act of 1995 (NTTAA), NIST is also charged to "coordinate Federal, State, and local technical standards activities and conformity assessment activities with private sector technical standards activities and conformity assessment activities with the goal of eliminating unnecessary duplication and complexity in the development and promulgation of conformity assessment requirements and measures." National Technology Transfer Advancement Act of 1995, Pub. L. No. 104-113, 110 Stat. 775.

interoperability of smart grid devices and systems."[45] In developing this framework, NIST is directed to solicit input and cooperation from various federal agencies and private entities, including electricity industry trade associations.[46] NIST released the initial version of a comprehensive framework and roadmap for Smart Grid interoperability standards in January 2010.[47] Release 2.0 of this framework document was published in February 2012 after an open public comment period.[48]

C. *The Smart Grid Interoperability Panel (SGIP).*

In order to carry out its responsibilities under EISA, in 2009 NIST formed the Smart Grid Interoperability Panel (SGIP), as an independent, consensus-based organization comprising representatives of interested stakeholders (utilities, vendors, service providers, and the public).[49] As of the writing of this Article, the SGIP comprised 740 member organizations represented by more than two thousand individuals.[50] Each

45. § 1305(a), 121 Stat. at 1787. The Smart Grid standards mandated by EISA relate to the *interoperability* of different components of the Smart Grid. Other types of standards, such as those relating to the safety of electrical equipment, power line emissions, nuclear safety, and the like are addressed elsewhere and are beyond the scope of this Article.

46. § 1305(a)(2), 121 Stat. at 1788.

47. NIST FRAMEWORK 1.0, *supra* note 7.

48. NAT'L INST. OF STANDARDS AND TECH., U.S. DEP'T OF COMMERCE, DRAFT NIST FRAMEWORK AND ROADMAP FOR SMART GRID INTEROPERABILITY STANDARDS, RELEASE 2.0 (2011) [hereinafter NIST FRAMEWORK RELEASE 2.0], *available at* http://collaborate.nist.gov/twiki-sggrid/pub/SmartGrid/IKBFramework/Draft_NIST_Framework_Release_2-0_10-17-2011.pdf.

49. SGIP has recently announced plans to transform into a self-sustaining independent entity that is legally separate from NIST. *See* Dr. George Arnold, National Coordinator for Smart Grid Interoperability, Nat'l Inst. of Standards and Tech., Power Point Presentation at SGIP Governing Board January 2012 Meeting 10 (Jan. 12, 2012), http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/SGIPGBMeetingsAndMinutes.

50. *NIST Smart Grid Collaboration Wiki Smart Grid Interoperability Panel Site, What is the Smart Grid Interoperability Panel?*, NAT'L INST. OF STANDARDS AND TECH., http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/WebHome#What_is_the_Smart_Grid_Interoper (last visited Feb. 24, 2012).

technical area within SGIP is addressed by a Priority Action Plan (PAP), of which there are currently nineteen.[51]

Though SGIP evaluates and recommends standards, it does not currently develop standards itself (though it is not precluded from doing so). That work has been left to a host of external standards development organizations (SDOs) ranging from large formal organizations that work in multiple technical areas to small consortia that focus on one or two specialized applications. Among the many organizations that have developed standards under consideration by SGIP are the Internet Engineering Task Force (IETF), Institute of Electrical and Electronics Engineers (IEEE), International Electrotechnical Commission (IEC), the European Telecommunications Standards Institute (ETSI), OASIS, the WIMAX Forum, and ZigBee Alliance. Each of these organizations develops standards according to its own internal procedures independently of SGIP and NIST. However, if such an organization has developed (or is developing) a standard that SGIP deems to be of potential interest for Smart Grid, it may initiate consideration of the standard for inclusion in the SGIP "Catalog of Standards" and recommendation to FERC.

In July 2011 NIST added the first six standards to the SGIP Catalog of Standards covering technologies such as Internet protocols, energy usage information, electric vehicle plugs, and upgrading household electric meters to smart meters.[52] Release 2.0 of NIST's Smart Grid interoperability framework adds twenty-two additional standards to the framework.[53] Additionally, NIST and the Smart Grid Co-Ordination Group of the European Union jointly published a white paper expressing their intent to collaborate to ensure a consistent set of Smart Grid standards.[54] Among the many

51. *Smart Grid Interoperability Panel (SGIP),* NAT'L INST. OF STANDARDS AND TECH. (Nov. 15, 2010), http://www.nist.gov/smartgrid/priority-actions.cfm.

52. Press Release, Nat'l Inst. of Standards and Tech., Smart Grid Panel Approves Six Standards for Catalog (July 26, 2011), *available at* http://www.nist.gov/smartgrid/sgip-072611.cfm.

53. NIST FRAMEWORK RELEASE 2.0, *supra* note 48.

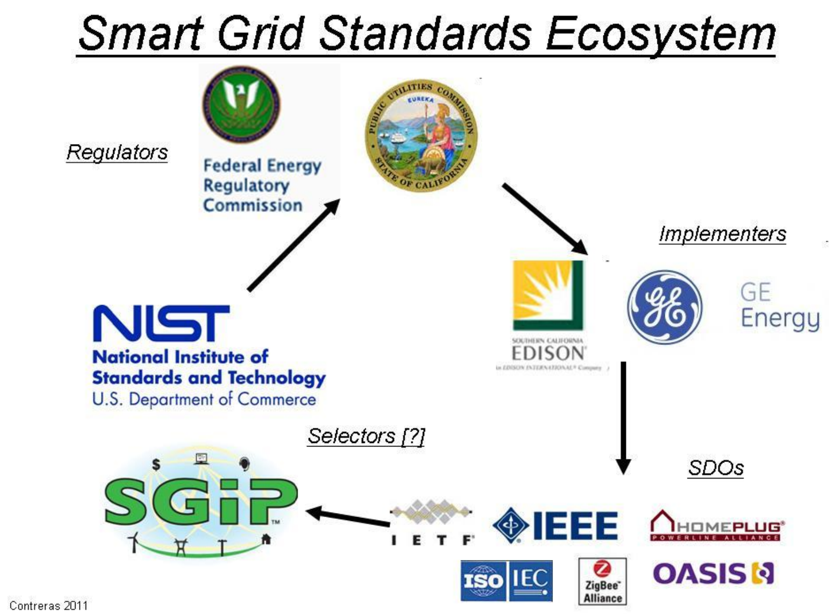
54. NAT'L INST. OF STANDARDS AND TECH. & SMART GRID CO-ORD. GRP., WHITE PAPER ON STANDARDIZATION OF SMART GRIDS (n.d.), *available at*

challenges that will face implementers of Smart Grid products will be understanding and complying with the many different SDO rules and policies associated with this wide assortment of standards.

D. *The Smart Grid Standards Ecosystem*.

The various agencies and organizations involved in developing interoperability standards for the Smart Grid engage in a complex set of interactions. Figure 3 illustrates the interrelationship among these actors with respect to Smart Grid standards development and adoption.

Figure 3



V. Standards and Patents

Technical standards specify methods by which complex technologies interact and interoperate. As such, the technologies specified by standards are often suitable subject

http://www.nist.gov/smartgrid/upload/eu-us-smartgrids-white-paper.pdf.

matter for patent protection.[55] Because standards are likely to be adopted by large segments of a given market, obtaining patent protection on standardized technologies can appear to be an attractive proposition for companies involved in the standards-development process. The more complicated the technology that a standard specifies, the more likely the standard will be covered by patents owned by members of the SDO or by third parties. Two general patent-related issues arise in the context of technology standardization; these are referred to as *patent stacking* and *patent hold-up*.

A. *Patent Stacking and Patent Pools.*

If many different organizations hold patents that are all required to implement a standard, then a manufacturer must obtain a license from each of these different patent-holding organizations in order to implement the standard. Not only can this multiplicity of patent holders increase the cost of manufacturing and selling a standardized product (sometimes to a level that is excessive in relation to the overall value of the product), it can also prevent manufacturing or sale entirely if any one patent holder elects not to license its patents (usually referred to as "standards-essential" patents) to a manufacturer. This situation is referred to as patent "stacking" or a patent "thicket".[56] If a patent thicket exists and licenses to all of the patents in the thicket are not available on economical terms, the standardized technology may be rendered uncompetitive in comparison to products that do not conform to the standard.

55. Standards themselves, as written documents, are subject to copyright protection, and the SDOs that develop standards often hold trademarks in their names and certain standards (e.g., WiFi and Bluetooth). Copyright and trademark issues are generally beyond the scope of this Article. For a general discussion, *see* Contreras, *supra* note 9.

56. The economic and legal literature exploring this phenomenon, both within and outside the context of technical standards, is extensive and varied. *See, e.g.*, Carl Shapiro, *Navigating the Patent Thicket: Cross-Licenses, Patent Pools and Standard Setting*, *in* 1 INNOVATION POLICY AND THE ECONOMY 119 (Adam B. Jaffe et al. eds., 2004); Mark A. Lemley & Carl Shapiro, *Patent Holdup and Royalty Stacking*, 85 TEX. L. REV. 1991 (2007); Einer Elhauge, *Do Patent Holdup and Royalty Stacking Lead to Systematically Excessive Royalties?*, 4 J. COMPETITION L. & ECON. 535 (2008).

More seriously, if any of the holders of such patents elect not to license their patents to those wishing to implement a standardized technology, then the technology may not become widely implementable and substantially diminished in value.

One technique that has evolved to address patent stacking is the creation of patent "pools". In a patent pool, multiple patent owners contribute or license their standards-essential patents to a common agent (sometimes one of the patent holders and sometimes a newly-formed entity). This licensing agent then offers licenses to the entire pool at a single royalty rate, and net revenues are allocated among the pool participants in accordance with a pre-determined formula. Such pools have been used effectively in connection with consumer electronics standards such as the MPEG audio compression format,[57] the DVD video compression format[58] and third generation wireless communications standards.[59] In each of these cases the U.S. Department of Justice approved the proposed pool, pointing to certain features that reduced potentially anticompetitive effects.[60] For example, each such pool contained only patents that were "essential" to the implementation of the standard; licensees were always free to obtain patent licenses directly from the patent holders, rather than from the pool; licensing of the pooled patents was conducted on a non-discriminatory basis; and any licenses that the patent holders required from their licensees only covered

57. Letter from Joel I. Klein, Asst. Att'y Gen., Antitrust Div., Dep't of Justice, to Gerrard R. Beeney, Esq., Sullivan & Cromwell (June 26, 1997), *available at* http://www.justice.gov/atr/public/busreview/215742.htm.

58. Letter from Joel I. Klein, Asst. Att'y Gen., Antitrust Div., Dep't of Justice, to Gerrard R. Beeney, Esq., Sullivan & Cromwell (Dec. 16, 1998), *available at* http://www.justice.gov/atr/public/busreview/2121.htm; Letter from Joel I. Klein, Asst. Att'y Gen., Antitrust Div., Dep't of Justice, to Carey R. Ramos, Esq., Paul, Weiss, Rifkind, Wharton & Garrison (June 10, 1999), *available at* http://www.justice.gov/atr/public/busreview/2485.htm.

59. Letter from Charles A. James, Asst. Att'y Gen, Antitrust Div., Dep't of Justice, to Ky P. Ewing, Esq., Vinson & Elkins L.L.P. (Nov. 12, 2002), *available at* http://www.justice.gov/atr/public/busreview/200455.htm.

60. U.S. DEP'T OF JUSTICE & FED. TRADE COMM'N, ANTITRUST ENFORCEMENT AND INTELLECTUAL PROPERTY RIGHTS: PROMOTING INNOVATION AND COMPETITION 74-85 (2007) [hereinafter DOJ/FTC Report], *available at* http://www.ftc.gov/reports/innovation/P040101PromotingInnovationandCompetitionrpt0704.pdf.

patents that were, themselves, essential to implementation of the standard.[61]

Of course, the value of a patent pool may be limited if certain holders of standards-essential patents elect not to join. Such a situation arose in the case of the Federal Communication Commission's (FCC) ATSC standard for digital television transmission. Though many holders of patents essential to implementation of the mandatory ATSC standard did elect to form a patent pool, one patent holder, Funai Electric Company, did not join. Instead Funai sought to charge royalties for its single patent at a rate equal to that charged by the entire ATSC pool (approximately 5 percent of the television price).[62] When Funai sought to bar imports of televisions by Vizio, Inc., a manufacturer that refused to pay this royalty, Vizio sought temporary relief from the FCC. Though the matter was rendered moot because Vizio was found not to infringe the asserted patent,[63] the dispute highlights the risks that can arise when patent pooling arrangements do not include all relevant patent holders.

B. *Patent Ambushes and Policy Measures*.

The second major issue that can arise in the standards context is patent "ambush," which occurs when a patent holder seeks to assert a previously unidentified patent against implementers of a standard after the standard has been approved.[64] If a patent ambush occurs after the industry has

61. *Id.* at 68-84.

62. Resp'ts Req. Temporary Relief, Vizio, Inc. v. Funai Electric Co., 24 F.C.C.R. 2880 (Feb. 20, 2009).

63. Vizio, Inc. v. Int'l Trade Comm'n, 605 F.3d 1330 (Fed. Cir. 2010).

64. *See* Elhauge, *supra* note 56, at 536; M. Sean Royall, Amanda Tessar & Aaron Di Vincenzo, *Deterring "Patent Ambush" in Standard Setting: Lessons Learned from* Rambus *and* Qualcomm, 23 ANTITRUST 34 (2009); *see generally* Lemley, *supra* note 12. Some commentators include patent ambush within a broader scope of opportunistic patent holder behavior that has been termed patent "hold-up". *See, e.g.*, Farrell et al., *supra* note 12; Lemley, *supra* note 12. This description, however, has been criticized as an inaccurate use of the term as it is generally understood in the economics literature. *See* Richard A. Epstein, F. Scott Keiff & Daniel F. Spulber, *The FTC, IP and SSOs: Government Hold-Up Replacing Private Coordination* 8 J. COMPETITION L. & ECON. 1, 1 (2012). For purposes of this article, I will use the

devoted significant resources to production, marketing, and training with respect to standardized products (in economic terms, after the standard has become "locked-in"), unexpected royalty demands can severely disrupt the market, driving up the cost of standardized products to levels that are inefficient and uncompetitive with alternative technologies.[65]

Patent ambushes can occur either with patents held by participants in the SDO or by non-participating third parties. The risk posed by SDO participants' patents is perceived as particularly serious because, unlike non-participating third parties, SDO participants can potentially shape the technical parameters of a standard toward their own patent positions.[66] In response, many SDOs have adopted policies that attempt to address ambush by requiring that its participants must: (1) disclose all standards-essential patents prior to the standard's approval, and/or (2) license all standards-essential patents to implementers of the standard, either on a royalty-free basis or on terms that are "reasonable and nondiscriminatory."[67] Obligations to disclose standards-essential patents ensure that standards developers receive adequate information to assess the relative patent-related costs and risks of technologies under consideration for standardization and to "design around" potentially blocking patents, and licensing obligations ensure that such patents will be licensed on terms that are, at least roughly, understood.[68]

term "patent ambush" to refer to the described conduct by a patent holder.

65. *See* Lemley, *supra* note 12, at 154-55; Farrell et al., *supra* note 12, at 608 ("[S]tandards hold-up is … a public policy concern because downstream consumers are harmed when excessive royalties are passed on to them.").

66. There is also far less that can be done about the assertion of patents by non-participants, as they have no formal relationship with the relevant SDO.

67. *See* DOJ/FTC Report, *supra* note 60, at 42-48; SECTION OF SCI. & TECH. LAW, COMM. ON TECHNICAL STANDARDIZATION, AM. BAR ASS'N, STANDARDS DEVELOPMENT PATENT POLICY MANUAL, xiii-xiv (Jorge L Contreras ed., 2007) [hereinafter ABA Standards Manual]; Nicos L. Tsilas, *Toward Greater Clarity and Consistency in Patent Disclosure Policies in a Post-*Rambus *World*, 17 HARV. J.L. & TECH 475, 478-81 (2004); Farrell et al., *supra* note 12, at 624-44.

68. ABA Standards Manual, *supra* note 67, at xiv.

1. Disclosure Requirements and Their Violation.

Despite the adoption by many SDOs of such patent disclosure policies, there have been several prominent instances in which SDO participants have failed to make the required disclosures and then, after lock-in of the standard, have sought to enforce their patents or collect royalties from implementers. The first of these cases to attract significant attention involved Dell Computer, which failed to disclose patents relevant to the VL-bus standard developed in the Video Electronics Standards Association (VESA).[69] Following approval of the standard, Dell sought to enforce its patents against other computer manufacturers. The Federal Trade Commission (FTC) brought an action against Dell for engaging in unfair business practices under Section 5 of the Federal Trade Commission Act. The FTC reasoned that

> where there is evidence that the association [VESA] would have implemented a different non-proprietary design had it been informed of the patent conflict during the certification process, and where Dell failed to act in good faith to identify and disclose patent conflicts - enforcement action is appropriate to prevent harm to competition and consumers.[70]

The FTC action resulted in the entry of a 1996 consent order permanently restricting Dell from enforcing those patents against any third party.[71]

Perhaps the most-cited episode of an SDO participant's failure to disclose patents involved the semiconductor technology developer Rambus, Inc. Hundreds of articles have been written about the decade-long legal battles in which Rambus sought to assert various patents covering dynamic random access memory (DRAM) against virtually every other DRAM manufacturer after those technologies had been standardized by the Joint Electron Device Engineering Council

69. Dell Computer Corp., 121 F.T.C. 616 (1996).
70. *Id.* at 624.
71. *Id.*

(JEDEC), a voluntary SDO in which Rambus participated in the early 1990s.[72] Ultimately, Rambus was exonerated with respect to allegations that it violated JEDEC's patent disclosure rules, primarily due to the vagueness of the rules themselves.[73] Yet, due to its strategic patenting of technologies under consideration at JEDEC, Rambus has the potential to extract more than a billion dollars in royalty income from the semiconductor industry over the life of its patents.[74]

SDO disclosure rules are not only relevant to the information technology industries. In the late 1980s, the California Air Resources Board (CARB) began to develop standards for the composition of low-emissions gasoline. Union Oil Company of California (Unocal), together with several other gasoline refiners and automobile producers, actively participated in the agency's standard-setting processes. In 1996, shortly before new CARB regulations based on these standards went into effect, Unocal announced that it held patents essential to implementing the new emissions requirements, and that it intended to charge royalties on all gasoline sold in California.[75] After an unsuccessful attempt by competitors to invalidate the asserted patent, in 2003 the FTC brought an action against Unocal, charging it with attempted

72. *See, e.g.*, ABA Standards Manual, *supra* note 67, at vii-viii; Mark A. Lemley, *Intellectual Property Rights and Standard-Setting Organizations*, 90 CALIF. L. REV. 1889, 1929-30 (2002); Tsilas, *supra* note 67, at 481-83; Joel M. Wallace, Rambus v. F.T.C. *in the Context of Standard-Setting Organizations, Antitrust, and the Patent Hold-Up Problem*, 24 BERKELEY TECH. L.J., 661 (2009); Robert A. Skitol & Kenneth M. Vorrasi, *Patent Holdup in Standards Development: Life After* Rambus v. FTC, 23 ANTITRUST 26 (2009).

73. Rambus, Inc. v. Infineon Techs AG, 318 F.3d 1081, 1102 (Fed. Cir. 2003), *cert. denied*, 540 U.S. 874 (2003) (in which the court, while questioning Rambus's business ethics, nevertheless concluded that it did not violate the vague JEDEC disclosure policy).

74. Press Release, Federal Trade Comm'n, FTC Issues Complaint Against Rambus, Inc.: Deception of Standard-Setting Organization Violated Federal Law (June 19, 2002), *available at* http://www.ftc.gov/opa/2002/06/rambus.shtm ("Rambus could, over the life of its patents, extract royalty payments well in excess of a *billion* dollars from the memory industry.") (internal quotation marks omitted).

75. Union Oil Co. of Cal., No. 9305, 2003 WL 22977696 (F.T.C. Nov. 25, 2003) (initial dec.); *see also* Janice M. Mueller, *Patent Misuse Through the Capture of Industry Standards*, 17 BERKELEY TECH. L.J. 623, 626-27 (2002).

monopolization and unreasonable restraints on trade.[76] The matter was ultimately settled when Unocal agreed to cease enforcement of its standards-essential patents.[77]

2. The Many Meanings of F/RAND.

Many SDOs require that participants commit to license standards-essential patents on terms that are "reasonable and non-discriminatory" (RAND) or "fair, reasonable and non-discriminatory" (FRAND). This requirement is built into ANSI's "Essential Requirements" for all ANSI-accredited SDOs[78] and is equally pervasive in Europe and other jurisdictions. Despite the intuitive appeal of these requirements, however, a consistent and practical definition of F/RAND has been notoriously difficult to pin down. Rysman and Simcoe have argued that F/RAND commitments are inherently imprecise, and that patent holders may, in fact, "offer [F]RAND pricing commitments with the belief that this commitment is so vague and ill-defined that it is in fact vacuous."[79] Recently, F/RAND-related litigation has embroiled large segments of the telecommunications and computing industries, both consuming otherwise productive resources and inserting significant uncertainty into major product markets.[80]

F/RAND commitments are difficult to quantify because there is no objective standard by which "reasonableness" (or "nondiscrimination," for that matter) is measured.[81] In order to

76. Union Oil Co. of Cal., 2003 WL 22977696.

77. Union Oil Co. of Cal., No. 9305, 2005 WL 2003365 (F.T.C. Aug. 2, 2005) (dec. and order).

78. AM. NAT'L STANDARDS INST., GUIDELINES FOR IMPLEMENTATION OF THE ANSI PATENT POLICY § II (rev. ed. 2011), *available at* http://publicaa.ansi.org/sites/apdl/Documents/Standards%20Activities/American%20National%20Standards/Procedures,%20Guides,%20and%20Forms/Guidelines%20for%20Implementation%20of%20ANSI%20Patent%20Policy%202011.pdf.

79. Marc Rysman & Tim Simcoe, A NAASTy Alternative to RAND Pricing Commitments 2 (unpublished manuscript), *available at* http://people.bu.edu/tsimcoe/documents/published/NAAST.pdf.

80. *See* Jorge L. Contreras, *The FRAND Wars: Who's on First?*, PATENTLY-O (Apr. 17, 2012), *available at* http://www.patentlyo.com/patent/2012/04/the-frand-wars-whos-on-first.html.

81. *See, e.g.*, Anne Layne-Farrar et al., *Pricing Patents for Licensing in*

determine whether a licensing offer by a patent holder complies with F/RAND requirements, the specific facts of the situation must be evaluated. These facts include not only relevant royalty rates in the market, but also customary practices relating to non-royalty terms such as reciprocity, grantback licenses, defensive suspension, confidentiality, and the like.[82] Also, given that a patent holder's F/RAND licensing terms are often not revealed until negotiations that occur *after* a standard has been adopted (i.e., "locked-in"), parties involved in standards setting can experience uncertainty regarding the ultimate cost of adopting a standard encumbered by patents, even if a F/RAND commitment exists.[83] Put another way, the uncertainty of F/RAND licensing terms may simply result in a new form of hold-up that replaces, but does not alleviate, the risk of hold-up by unknown patents.[84]

3. Ex Ante Disclosure of Licensing Terms.

Several commentators have suggested that permitting or requiring patent holders to disclose their royalty rates and licensing terms to SDO participants prior to the adoption of a standard (i.e., ex ante) would alleviate the F/RAND hold-up problems described above.[85] Such advance disclosure, it is argued, would enable SDO participants to evaluate the cost of including particular patented technologies in a standard prior

Standard-Setting Organizations: Making Sense of FRAND Commitments,74 ANTITRUST L.J. 671, 671 (2007).

82. ABA Standards Manual, *supra* note 67, at 56-67.

83. Wallace, *supra* note 72, at 665.

84. *Id.*; Justin (Gus) Hurwitz, *The Value of Patents in Industry Standards: Avoiding License Arbitrage with Voluntary Rules*, 36 AIPLA Q.J. 1, 3-4 (2008). *But see* Joseph Scott Miller, *Standard Setting, Patents, and Access Lock-In: RAND Licensing and the Theory of the Firm*, 40 IND. L. REV. 351, 357 (2007) (arguing that RAND obligations are not "materially underspecified").

85. Lemley, *supra* note 12, at 158-59; Gil Ohana et al., *Disclosure and Negotiation of Licensing Terms Prior to Adoption of Industry Standards: Preventing Another Patent Ambush?*, 24 EUR. COMPETITION L. REV. 644, 648-50 (2003); Robert A. Skitol, *Concerted Buying Power: Its Potential for Addressing the Patent Holdup Problem in Standard Setting*, 72 ANTITRUST L.J. 727, 741-42 (2005); Wallace, *supra* note 72, at 689-92.

to adoption, and would thus enable more efficient decision making while the standard is being developed.

Critics of this approach have argued that such ex ante disclosures present both practical and legal issues. They contend that the disclosure of licensing terms during the standards development process could cause the process to become more cumbersome, lengthy and expensive.[86] However, there is little empirical evidence to support these claims, and a recent NIST-funded study conducted by the Author failed to find evidence that ex ante disclosure policies had any negative effect on the groups studied.[87]

It has also been suggested that ex ante licensing disclosures could facilitate the improper exchange of information among competitors and might place too much power in the hands of licensees acting collectively. That is, potential implementers of a standard, in negotiating ex ante license terms with a patent holder, could collectively exert anticompetitive pressure, causing royalties to decrease below their fair (or optimal) level.[88] Following this argument to its logical conclusion, group pressure could drive all royalty rates toward zero, resulting in the devaluation of patents covering a standard. In the NIST-funded study mentioned above, there was no evidence that such depression of royalty rates occurred in practice.[89]

The U.S. Department of Justice (DOJ) has also approved SDO ex ante disclosure policies in two recent Business Review Letters. In 2006, the DOJ indicated that it would not take enforcement action against the VMEbus International Trade Association (VITA), which required participants to disclose

86. DOJ/FTC Report, *supra* note 60, at 50; *see* Skitol, *supra* note 85, at 734.

87. Jorge L. Contreras, *An Empirical Study of the Effects of Ex Ante Licensing Disclosure Policies on the Development of Voluntary Technical Standards* 1 (Nat'l Inst. of Standards & Tech. 2011) [hereinafter *Effects of Ex Ante Licensing Disclosure Policies*], *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1916743.

88. *See* DOJ/FTC Report, *supra* note 60, at 52-53; Skitol, *supra* note 85, at 735.

89. *Effects of Ex Ante Licensing Disclosure Policies*, *supra* note 87, at 46-48.

their "most restrictive" licensing terms on an ex ante basis.[90] In approving the VITA policy, the DOJ reasoned that ex ante disclosures of licensing terms is more likely to promote than hinder competition among patent holders.[91] Likewise, in its 2007 IEEE Business Review Letter, the DOJ approved a policy in which patent holders were given the *option* to disclose licensing terms, including royalty rates, prior to the adoption of a standard.[92] The DOJ considered the IEEE policy "a sensible effort to preserve competition between technological alternatives before the standard is set in order to alleviate concern that commitments by patent holders to license on RAND terms are not sufficient to avoid disputes . . .."[93] In a similar vein, the European Commission's guidelines, relating to horizontal competition, express a general level of comfort with ex ante licensing disclosures.[94]

VI. Intellectual Property Challenges and Opportunities for Smart Grid Standards

A. *Patents and the Smart Grid.*

Like any area characterized by rapid technological innovation and growth, numerous components of the Smart Grid are likely to be covered by patents. One study found that in 2009 ninety-one new U.S. patents were issued covering technologies relating to utility metering and the smart grid.[95]

90. Letter from Thomas O. Barnett, Asst. Att'y Gen., Antitrust Div., Dep't of Justice, to Robert A. Skitol, Esq., Drinker, Biddle & Reath, LLP (Oct. 30, 2006), *available at* http://www.justice.gov/atr/public/busreview/219380.htm.

91. *Id.*

92. Letter from Thomas O. Barnett, Asst. Att'y Gen., Antitrust Div., Dep't of Justice, to Michael A. Lindsay, Esq., Dorsey & Whitney LLP (Apr. 30, 2007), *available at* http://www.justice.gov/atr/public/busreview/222978.htm.

93. *Id.* at pt. IV.

94. *Guidelines on the Applicability of Article 101 of the Treaty on the Functioning of the European Union to Horizontal Co-operation Agreements,* 2011 O.J. (C 11) 1, ¶ 299.

95. JOHN M. LAZARUS, CLEANTECH ENERGY PATENT LANDSCAPE ANNUAL REPORT 2010: INVESTMENT AND LICENSING OPPORTUNITIES MAY ARISE IN NEW AREAS 20 (2010) (on file with author).

Another study identified 318 smart grid patents held as of October 2009 by eight key industry participants including Siemens, ABB, General Electric, Hitachi, and Samsung.[96]

Southern California Edison (SCE) attracted significant attention in 2008 when it was revealed that it had applied for broad patent protection on a "Method of Communicating between a Utility and its Customer Locations."[97] The breadth of SCE's pending patent claims, which address a wide range of two-way communications between a utility and its customers using an "advanced utility meter," alarmed many in the industry.[98] While SCE has committed to license this patent on a royalty-free basis and not to seek patent protection on additional Smart Grid technologies,[99] the potential for broad claims covering other aspects of emerging smart grid technologies continues to cause concern.[100]

Of even greater concern than the SCE patent are patents held by so-called non-practicing entities (NPEs) or patent-assertion entities (PAEs), entities whose primary business is seeking monetary returns from patent licensing and

96. *Global Smart Grids Patent Portfolios Analysis*, TECHIPM LLC BLOG (Oct. 21, 2009), http://techipm-innovationfrontline.blogspot.com/2009/10/global-smart-grids-patent-portfolios.html.

97. U.S. Patent No. 626,810 (filed Jan. 24, 2007) [hereinafter SCE Smart Grid Patent].

98. *See, e.g.*, Phillip Bane, *Utility Attempts to Patent Advanced Metering*, SMARTGRIDNEWS (Sept. 11, 2008), http://www.smartgridnews.com/artman/publish/industry/Utility_Attempts_to_Patent_Advanced_Metering.html.

99. *Edison Smart Connect Open Innovation & IP*, S. CAL. EDISON (Sept. 2008), http://osgug.ucaiug.org/sgsystems/Shared%20Documents/SCE%20AMI%20Use%20Case%20Patent%20Overview%20%20080919.pdf.; *Non-Exclusive Royalty Free License for SCE's Use Cases*, SMART GRID INFORMATION CLEARINGHOUSE, (last visited March 4, 2012), http://www.sgiclearinghouse.org/UseCases?q=node/2028&lb=1.

100. It should be noted that the susceptibility of different industries to capture by patents varies significantly. *See generally* DAN L. BURK & MARK A. LEMLEY, THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT (2009) (describing substantial differences between patenting behavior in industries such as pharmaceuticals, semiconductors and software); Cahoy, *supra* note 16, at 26 (observing the possibility for differing patent behaviors even within fields such as renewable energy).

enforcement.[101] In its comprehensive 2011 report *The Evolving Marketplace*, the Federal Trade Commission observes that such entities "can deter innovation by raising costs and risks without making a technological contribution."[102] In the Smart Grid area, two related NPEs, SIPCo and Intus, have brought numerous patent infringement suits against Florida Power & Light, Reliant Energy, and other power distribution companies, regarding wireless communications technology used in the energy industry.[103] To date, most of these suits have resulted in settlements of a confidential nature,[104] but the threat of further enforcement activities by such entities remains.

B. *Patents on Smart Grid Standards*.

As noted in Section V, Smart Grid standards are being developed by a broad range of standards development organizations and consortia. Each of these groups has its own intellectual property policies and procedures that have been developed independently and, for the most part, without reference to the Smart Grid. In some cases, disclosure of standards-essential patents may be required, in others not. In some cases licensing of standards-essential patents may be required on a royalty-free basis, or on F/RAND terms, or not at all. This diversity of approaches is not surprising, given that the groups involved in Smart Grid standards development come from a variety of different industries and have differing membership structures, commercial goals, and histories. Nevertheless, the lack of a consistent approach toward intellectual property among the groups developing Smart Grid standards, and the resulting potential that patent hold-up and stacking may have on the Smart Grid infrastructure, have caused concern among potential implementers and regulators.

101. U.S. FED. TRADE COMM'N, THE EVOLVING IP MARKETPLACE: ALIGNING PATENT NOTICE AND REMEDIES WITH COMPETITION 8 n.5 (2011).

102. *Id.* at 9.

103. *See* ERIC L. LANE, CLEAN TECH INTELLECTUAL PROPERTY: ECO-MARKS, GREEN PATENTS, AND GREEN INNOVATION 142, 143 (2011).

104. *Id.* at 142-45.

Intellectual property concerns were raised in July 2010 during Congressional hearings relating to the Smart Grid[105] and again at a January 2011 technical conference convened by FERC.[106] At this technical conference, Paul Di Martini, a former Southern California Edison executive and the current Smart Grid Chief Technology Officer of Cisco Systems,[107] expressed significant concern regarding the "transparency and predictability of licensing terms for patents that are necessary to implement [Smart Grid] standards" and urged SGIP participants to consider patent licensing information when evaluating which standards to recommend for industry adoption.[108]

The 2009 NIST Framework document establishes as a "guiding principle" that Smart Grid standards be "openly available under fair, reasonable, and nondiscriminatory terms."[109] But as discussed in Section V.C.3 above, compliance with such vague F/RAND requirements is notoriously difficult

105. *Smart Grid Architecture and Standards: Assessing Coordination and Progress: Hearing Before the Subcomm. on Tech. & Innovation of the H. Comm. on Sci. & Tech*, 111th Cong. 111-104 (2010) (statement of Dr. George Arnold, Nat'l Inst. of Standards & Tech.). In response to questions by Rep. Biggert (R - Ill.) regarding potential intellectual property issues with Smart Grid standards, Dr. George Arnold cited the F/RAND requirement as addressing the issues. *Id.*

106. U.S. FED. ENERGY REGULATORY COMM'N, DOCKET NO. RM11-2-000, TECHNICAL CONFERENCE ON SMART GRID INTEROPERABILITY STANDARDS (2011) [hereinafter FERC TECHNICAL CONFERENCE]. On October 10, 2010, NIST submitted five "foundational families of standards" to FERC for consideration in its rulemaking.

107. Mr. Di Martini is also the first named inventor on the SCE Smart Grid patent application. *See* SCE Smart Grid Patent, *supra* note 97 and accompanying text.

108. FERC TECHNICAL CONFERENCE, *supra* note 106 (statement of Paul Di Martini), *available at* http://www.ferc.gov/EventCalendar/Files/20110131084624-De%20Martini,%20Cisco.pdf. In July 2011, after considering public input, FERC formally declined to institute a rulemaking proceeding with respect to the five NIST-recommended standards families, determining that there was "insufficient consensus" for adoption. Order on Smart Grid Interoperability Standards, 136 FERC ¶61,039 (July 19, 2011). In making its ruling, the Commission cited concerns regarding both cybersecurity and "potential unintended consequences from premature adoption of individual standards." *Id.*

109. NIST FRAMEWORK 1.0, *supra* note 7, at 48.

to assess.[110] Compounding the inherent uncertainty of this F/RAND regime is the fact that, in this case, F/RAND availability of patent licenses is not required, but is merely one of several non-exclusive guiding principles that may be followed.[111] At the December 2010 plenary meeting of SGIP, however, Dr. George Arnold, the NIST National Coordinator for Smart Grid Interoperability, called for greater scrutiny of patents that may cover Smart Grid standards.[112] In particular, he noted that Smart Grid standards "must be . . . implementable at reasonable and affordable cost to rate-payers/consumers".[113] To achieve this goal, he outlined several potential approaches, including early disclosure of known patents, patent pools and ex ante disclosure of license terms.[114]

Despite this guidance, NIST and SGIP have taken few concrete steps toward implementing mechanisms to avoid patent hold-up and stacking that may affect Smart Grid standards. In late 2010, SGIP formed an Intellectual Property Rights Working Group to develop and maintain an SGIP intellectual property policy and serve as a forum for intellectual property discussions within SGIP.[115] One of the initial projects of this group was to form a task force to suggest types of patent-related information that could be collected with reference to standards being considered for inclusion in the SGIP Catalog of Standards.[116] After a year of deliberation, this task force, which primarily consisted of representatives of information technology and telecommunications vendors and

110. *See* Rysman & Simcoe, *supra* note 79.

111. NIST FRAMEWORK 1.0, *supra* note 7, at 45-46.

112. GEORGE W. ARNOLD, NAT'L INST.OF STANDARDS AND TECH., PATENTS AND STANDARDS" IN THE CONTEXT OF SMART GRID 5 (2010), *available at* http://collaborate.nist.gov/twiki-sggrid/pub/SmartGrid/SGIPGWorkingGroupIPRWG/IPRWG_12-10-2010_003_NISToverviewfromCWGeorge-Arnold-.pdf.

113. *Id.* at 3.

114. *Id.* at 5.

115. *See* SGIP Intellectual Property Rights Working Group, *Working Group Charter*, http://collaborate.nist.gov/twiki-sggrid/pub/SmartGrid/SGIPGWorkingGroupIPRWG/SGIPIPRWG_Charter_DRAFTREV1.0.doc (last visited Mar. 3, 2012).

116. The Author served as chair of this task force at the request of the IPR Working Group chair.

their advisors, reached consensus on collecting only six items of patent-related information about proposed SGIP standards consisting primarily of hyperlinks to publicly-accessible SDO intellectual policies and patent disclosures.[117] Information about patent transfers, disputes, licensing terms, and other facets of the standards development process were deemed unsuitable for collection by SGIP and rejected by the majority of task force members.[118] Thus, it is unlikely that any assurance that patent licenses will be available on the terms outlined by Dr. Arnold will be forthcoming from SGIP.

C. *An Opportunity for Action.*

As noted above, patents that cover technical standards have the potential to cause significant disruption of markets.[119] Left alone, patent holders interested in the Smart Grid could engage in the types of opportunistic behavior cited in the *Dell*, *Rambus*, and *Unocal* cases, thus endangering the deployment and operation of technology critical to the national energy infrastructure. The Smart Grid standardization effort is still in its early stages, and it is too early to tell whether such scenarios are likely or not.[120] But even at this early stage,

117. *See* SMART GRID INTEROPERABILITY PANEL, SGIP CATALOG OF STANDARDS DEVELOPMENT PROCESS STATEMENT (DPS): SSO XXXXX (2012), *available at* http://collaborate.nist.gov/twiki-sggrid/pub/SmartGrid/SGIPCatalogOfStandards/SGIP_CoS_DevelopmentProcessStatement.doc; SMART GRID INTEROPERABILITY PANEL, CATALOG OF STANDARDS INFORMATION (SIF) TEMPLATE (2011), *available at* http://collaborate.nist.gov/twiki-sggrid/pub/SmartGrid/SGIPCatalogOfStandards/SGIPCatalogOfStandards_StandardsInformationForm.xls.

118. *See* SMART GRID INTEROPERABILITY PANEL, IPR ATTRIBUTES FOR COLLECTION BY SGIP (2012), *available at* http://collaborate.nist.gov/twiki-sggrid/pub/SmartGrid/SGIPGWorkingGroupIPRWG/Non-Consensus_Matrix_w_Rationale_for_Inclusion_OBY_submission_02_17_12.docx (explained as follows on the SGIP web site: "The IPR WG Task Force #1 discussed some proposed IP attributes for collection by SGIP, which, for lack of consensus, were not provided to SGIP for inclusion in the SIF or DPS information sought from SDOs. These "non-consensus" items are listed here with their proponents' rationales for inclusion").

119. *See* Lemley, *supra* note 12, at 154-55.

120. *See* DIETER ERNST, AMERICA'S VOLUNTARY STANDARDS SYSTEM – A "BEST PRACTICE" MODEL FOR INNOVATION POLICY? 56 (2012), *available at*

opportunities exist for government to address patent-based risks to Smart Grid standards before a crisis occurs. Some of these opportunities may be implemented at the agency and regulatory level, while others would require legislative or judicial action. A brief outline of potential governmental measures that can be taken in this regard follows.

1. NIST/SGIP Selection Preferences.

SGIP is chartered with the task of selecting the hundreds of standards and protocols that will be necessary to implement the national Smart Grid.[121] NIST is then responsible for recommending these standards to FERC and state PUCs. When making selections among competing standards and technologies, SGIP and NIST should expressly consider intellectual property issues and give a preference to standards and technologies that are unencumbered by patents or available with minimal economic and other burdens. For example:

a. SGIP should undertake an *independent investigation* to determine whether standards under consideration are covered by patents.
b. If so, standards should be favored if essential patents are committed to be licensed on a *royalty-free* basis.
c. If royalty-free licensing is not available, then patent holders should at least *disclose* their maximum royalty rates and other licensing terms prior to consideration of the standard by SGIP.
d. SGIP should also attempt to determine, based on independent investigation, whether standards under consideration are subject to disputes

http://www.eastwestcenter.org/sites/default/files/private/econwp128.pdf ("It is still too early to judge whether the Smart grid model . . . provides a robust framework for solving the daunting tasks of the Smart Grid Interoperability Standards project. Speed and efficiency it might well improve, but what about providing a reasonably fair distribution of the costs and the rents to be reaped from Smart Grid standardization?").

121. NIST FRAMEWORK 1.0, *supra* note 7, at 7.

involving patents, aggressive patent licensing campaigns, or other potentially disruptive factors.

2. SGIP/NIST Patent Policies.

In the event that SGIP or NIST initiates Smart Grid standards development activities of its own, it should ensure that patents held by participants in the standards development process are licensed either on a royalty-free basis, or that maximum royalty rates and other licensing terms are disclosed prior to any vote to approve the standard. Such disclosures would give potential standards adopters and implementers necessary information regarding the cost of implementing Smart Grid standards and the likely economic impact to utilities and, ultimately, consumers. Such information, which would likely be beneficial in a wide variety of standards-dependent industries, is particularly salient in the realm of electricity generation and distribution, where rates are carefully regulated by state PUCs and FERC.[122]

3. Federal March-In Rights.

If SGIP or NIST convene or participate in the development of Smart Grid standards, the presence of federal funding may trigger federal "march-in" rights under the Bayh-Dole Act of 1980.[123] Such rights would enable the federal government to direct that patents to which the Act applies be licensed to third parties (i.e., implementers of the standard) on "terms that are reasonable under the circumstances."[124] In order to provide the greatest level of information to potential implementers of a standard, the government could predetermine the total royalty burden on the standard, and then allocate royalties collected among the holders of all identified essential patents on an equitable basis.[125]

122. *See supra* notes 44-48 and accompanying text.

123. *See* Bayh-Dole Act of 1980, Pub. L. No. 96-517, 94 Stat. 3015 (codified at 35 U.S.C. §§ 200-212).

124. 35 U.S.C. § 203(a) (2012).

125. Under the Act, disputes regarding the royalty determination are adjudicated by the U.S. Court of Federal Claims. 35 U.S.C. § 203(b).

4. Government Use.

Under 28 U.S.C. § 1498, the U.S. government may use or manufacture any patented invention without liability for patent infringement, provided that it pays "reasonable and complete" compensation to the patent holder.[126] This provision also applies to the "use or manufacture of an invention . . . by a contractor, a subcontractor, or *any person*, firm, or corporation for the Government and with the authorization or consent of the Government."[127] Thus, there is a case to be made that the government, in support of the implementation and maintenance of the national Smart Grid (a federal mandate under EISA), could invoke the provisions of 28 U.S.C. § 1498 for the benefit of all implementers of NIST-recommended Smart Grid standards. Then, as with the above proposal regarding Federal March-In Rights, the government could predetermine the total royalty burden on a particular standard and allocate it among all identified essential patents.

5. Compulsory Licensing.

A "compulsory" license permits the use of a patented technology without the express permission of the patent holder, subject to the payment of compensation to the patent holder. Compulsory licenses are common under U.S. copyright law, which establishes a widely-used compulsory licensing structure for musical compositions. Under U.S. patent law, however, there have been few instances of governmental compulsory licenses. Nevertheless, provisions authorizing governmental compulsory licensing exist under the patent law. For example, 28 U.S.C. § 1498 represents a statutory "compulsory licensing" regime applicable to governmental use of patented inventions.[128] Two other statutory compulsory licensing regimes exist in the U.S. in areas of strong national importance: the Atomic Energy Act, which authorizes the

126. 28 U.S.C. § 1498(a) (2012). Disputes regarding compensation are adjudicated by the U.S. Court of Federal Claims. *Id.*

127. *Id.* (emphasis added).

128. *Id.*

compulsory licensing of patents "[u]seful in the production or utilization of special nuclear material or atomic energy"[129] and the Clean Air Act, which authorizes compulsory licensing of patents relating to the prevention of air pollution.[130] Compulsory licensing is also expressly authorized under international agreements to which the U.S. is a party, particularly the Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement[131] and subsequent Doha Declaration, which have been limited to addressing issues of access to medicines in the developing world,[132] but which could have broader applicability to other critical technologies.[133]

Given the critical national importance of the Smart Grid, Congress may wish to consider an addendum to EISA or other legislation creating a compulsory licensing regime with respect to the implementation of national Smart Grid standards.

6. Bar on Injunctive Relief.

A different approach that would achieve a result similar to that described in paragraphs 3, 4, and 5 above is legislation barring injunctive relief in patent infringement actions against implementers of Smart Grid standards. Such a bar would effectuate the "public interest" prong of the test for injunctive

129. Atomic Energy Act, 42 U.S.C. § 2183(c) (2012).

130. Clean Air Act, 42 U.S.C. § 7608 (2012).

131. *See* Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, THE LEGAL TEXTS: THE RESULTS OF THE URUGUAY ROUND OF MULTILATERAL TRADE NEGOTIATIONS 320 (1999), 1869 U.N.T.S. 299, 33 I.L.M. 1197 (1994). Although Article 31 of the TRIPS Agreement does not use the term "compulsory licensing," it speaks to practice of patents "without the authorization of the right holder, including use by the government or third parties authorized by the government . . . ." *Id.* at 333.

132. *See, e.g.*, Colleen Chien, *Cheap Drugs at What Price to Innovation: Does the Compulsory Licensing of Pharmaceuticals Hurt Innovation?* 18 BERKELEY TECH. L.J. 853, 855-56 (2003); J. H. Reichman, *From Free Riders to Fair Followers: Global Competition Under the TRIPS Agreement*, 29 N.Y.U. J. INT'L L. & POL. 11, 53 (1996); Alan O. Sykes, *TRIPS, Pharmaceuticals, Developing Countries, and the Doha "Solution,"* 3 CHI. J. INT'L L. 47, 49, 62 (2002).

133. *See* Cahoy, *supra* note 16, at 43-44 (suggesting the possibility of compulsory licensing in the context of renewable energy and other green technologies).

relief formulated by the Supreme Court in *eBay v. MercExchange*,[134] given the strong national interest in the rapid deployment and uninterrupted operation of the Smart Grid. Again, fair compensation would be payable to patent holders, but the elimination of the injunctive remedy would serve to limit the disruptive effect of patent assertions on the implementation and operation of the Smart Grid. It is significant that in February 2012 three leading information technology producers—Microsoft, Apple, and Google—each issued public statements indicating that they would forego injunctive relief with respect to industry standards subject to F/RAND licensing commitments.[135] These statements were viewed with approval by the DOJ, which relied on them in approving Google's $12 billion acquisition of Motorola Mobility and Microsoft's and Apple's participation in the consortium purchasing a large patent portfolio from bankrupt Nortel Networks.[136] These statements by three leading technology vendors support the need for a broader prohibition on injunctive relief as it applies to industry standards, particularly in the case of critical infrastructure projects such as the Smart Grid.

7. Patent Pools.

As discussed in Section V.A, voluntary patent pools are not uncommon among developers of industry standards, and

134. eBay, Inc. v. MercExchange, L.L.C., 547 U.S. 388, 389 (2006) (holding that in order to obtain a permanent injunction against use of an infringing article, a patent holder must demonstrate "(1) that it has suffered an irreparable injury; (2) that remedies available at law are inadequate to compensate for that injury; (3) that considering the balance of hardships between the plaintiff and defendant, a remedy in equity is warranted; and (4) that the public interest would not be disserved by a permanent injunction").

135. Press Release, Office of Pub. Affairs, Dep't of Justice, Statement on Decision to Close Investigations of Google's Acquisition of Motorola Mobility and the Acquisitions of Certain Patents by Apple, Microsoft and Research in Motion (Feb. 13, 2012), *available at* http://www.justice.gov/opa/pr/2012/February/12-at-210.html. For a discussion of the companies' statements and the DOJ statement, see Jorge L. Contreras, *Guest Post: The February of FRAND,* PATENTLY-O (Mar. 6, 2012), http://www.patentlyo.com/patent/2012/03/february-of-frand.html.

136. *See* Contreras, *supra* note 135.

pervasive standards such as CD, DVD, Bluetooth, ATSC, and MPEG all rely on pooled patent resources. It would not be unreasonable for NIST and/or FERC to encourage the holders of patents covering Smart Grid standards to form patent pools with a consolidated, reasonable royalty rate available to all implementers of the standards. If patent holders are unwilling to join such patent pools voluntarily, legislative or regulatory solutions could be explored in which participation in such a patent pool became a mandatory prerequisite to the sale of equipment or technology for the national Smart Grid.[137]

VII. Conclusion

Securing the nation's energy independence, and improving the reliability, security, and capacity of the national electric grid are urgent national priorities. The Smart Grid, mandated by Congress in 2007, can help to achieve these national goals. However, the viability of the Smart Grid could be jeopardized by the opportunistic enforcement of patents covering key standards that ensure the Smart Grid's interoperability. Market-based private solutions have proven ineffective to stem the rising tide of patent litigation in standards-intensive industries such as telecommunications and semiconductors. Thus, in order to ensure the rapid deployment and uninterrupted operation of the national Smart Grid, it is incumbent upon NIST, FERC, and Congress to implement rules that will maximize transparency of the standards-development process and prevent disruption of this critical national resource.

137. Such a mandatory patent pool has not previously been implemented in the United States, though some commentators feel that such a result was achieved *de facto* in 1917 through the formation (not least through the efforts of then-Assistant Secretary of the Navy, Franklin D. Roosevelt) of the Manufacturer's Aircraft Association, when disputes among patent holders had nearly paralyzed the U.S. aviation industry on the eve of World War I. Mfrs. Aircraft Ass'n, Inc. v. United States, 77 Ct. Cl. 481 (Ct. Cl. 1933); *see* Harry T. Dykman, *Patent Licensing Within the Manufacturer's Aircraft Association (MAA),* 46 J. PAT. OFF. SOC'Y 646 (1964).