x. Standards and Related Intellectual Property Issues for Climate Change Technology

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1 Introduction

Almost every product sold today must conform to standards, whether relating to its design, manufacture, operation, testing, safety, sale or disposal, and sometimes to many of these at once. At their root, standards are no more than written requirements or design features of a product, service or other activity.[1] They can be breathtakingly detailed or disarmingly general, ranging from thousands of pages in length to just a few sentences. Standards are set by a wide range of bodies, from governmental agencies to industry consortia to multinational treaty organizations. Some standards are adopted into local, state or federal legislation and attain the force of law, others remain voluntary, yet are adopted by entire industries. This chapter provides a brief overview of the standards development landscape as it pertains to climate change technologies, also sometimes referred to as "clean tech", "green tech" and sustainability technologies, as well as the critical intellectual property issues that affect standards setting today.

2 Standards and Standard Setting: A Brief Overview

2.1 *Types of Standards*. Standards serve a variety of purposes and functions. Below is a brief description of the types of standards prevalent today:

2.1.1 *Prophylactic.* Prophylactic standards specify requirements intended to protect public health and safety, to preserve the environment and to prevent fraud and other abuses. These include most standards relating to food and drugs, air and water quality, hazardous materials, construction, transportation, handling of personal data, and the like. Prophylactic standards such as emissions limitations are frequently associated with climate change technologies.

2.1.2 *Quality*. Related to prophylactic standards are more general quality and performance standards. Compliance with these standards may signify the achievement of a specified level of quality; for example, the cut, color, clarity and carat ratings for diamonds and the Green Building Council's LEED "green building" certification.[2] In some cases, quality standards may also be adopted to differentiate among product variants in a consistent and uniform manner (e.g., whole, 2%, 1% and skim milk). Professional accreditation societies such as the American Medical Association (AMA), American Bar Association (ABA), and professional engineering societies also adopt quality-based standards as conditions to professional licensure and/or designations of specialization.

2.1.3 *Informational.* Some standards, such as automotive mileage (mpg highway/city) ratings and the Food and Drug Administration's (FDA) nutritional labeling requirements, provide a common format in which information must be provided to consumers, regulators or others. They do not otherwise affect the products that they describe.

2.1.4 *Interoperability.* Interoperability or compatibility standards specify design features that enable products and services offered by different vendors to work together. Electrical outlets, for example, share a common design in the United States that enables any appliance to be plugged into any outlet anywhere in the country (though, as any frequent traveler knows, these standards vary dramatically from country to country). More complex, but equally illustrative, are the numerous networking (USB, Ethernet, WiFi), Internet (TCP, HTML, WWW), telecommunications (CDMA, GSM) and digital media (CD, DVD) standards that enable devices manufactured by different vendors to interact with one another in a manner that is largely invisible to the consumer.

2.2 *Mandatory and Voluntary Standards*. At the highest level of generality, standards may be categorized as either *mandatory*, meaning that compliance is required by an external body such as a governmental agency or a professional accreditation organization, or *voluntary*, meaning that compliance is not required, though it may be prudent or even necessary from a commercial standpoint. Thus, a cap on airborne pollutants imposed by the Environmental Protection Agency (EPA) would be mandatory, whereas a set of industry guidelines recommending such caps would be voluntary.

2.2.1 *Mandatory Standards*. In exercising their responsibility to ensure the health and welfare of their citizens, governments typically adopt standards that are *prophylactic* or *informational*. Such standards may arise due to a perceived public need for regulation, often occurring in the aftermath of a highly-publicized incident or a new study demonstrating the harmful effects of a substance, or as a result of petitioning by private parties.[3]

Governmental standards may be developed either by technical experts working within governmental agencies or by non-governmental groups (such as those described in Section 2.2.2 below). Local and state governments seldom possess the technical skill or staff to develop their own standards, and generally adopt standards developed by industry associations (examples being local building, electrical and plumbing codes and the vehicle emissions standards adopted by the California Air Resources Board (CARB)[4]). In February 2011, a biodiesel producer in New Mexico sought to enjoin ASTM from adopting a standard specification for triglyceride burner fuel that would cap the allowable amount of biodiesel blended with petroleum-based diesel fuel at five percent.[5] The biodiesel producer argued that adoption of the standard would exclude it from the relevant market because the standard would become the law by reference in over thirty states, but the court denied the request for injunction due to the lack of imminent harm.[6] The court ultimately dismissed all of the biodiesel producer's claims, holding that the producer failed to allege a plausible antitrust violation because it could compete in the relevant market despite the adoption of the standard.[7]

Many federal agencies, too, adopt privately-developed standards both for the sake of expediency and because the relevant technical data is often in the hands of industry.[8] The Federal Office of Management of Budget's (OMB) guidelines for Federal agencies require that agencies adopt suitable "voluntary consensus standards" in their procurement and regulatory activities except to the extent "inconsistent with law or otherwise impractical".[9] At an international level, the World Trade Organization's (WTO) Uruguay Round Agreement on Technical Barriers to Trade requires that if recognized international standards exist with respect to a technical area, national governments developing standards in that area must adopt such international standards as the basis for their own national standards.[10]

When warranted, large U.S. federal agencies such as the EPA, FDA and NIST may employ internal technical experts to develop standards, test products and investigate incidents of non-compliance. These agencies operate under the general "notice and comment" rulemaking procedures outlined in the Administrative Procedures Act (APA)[11] and, though they work independently, rely heavily on technical input and expertise from industry and consumer groups.[12] Multiple rounds of "negotiation" with industry representatives typically occur before any significant standard is adopted, and even after adoption federally-mandated standards are subject to challenge under the APA and to revocation if found to be arbitrary, capricious or an abuse of discretion.[13]

2.2.2 *Voluntary Standards*. Organizations that develop voluntary standards are referred to generally as standards-development organizations (SDOs). SDOs vary greatly in size and composition. Some, which are sometimes referred to as consortia or "special interest groups" (SIGs),[14] may consist of just a few companies that collaborate on a narrow set of technical specifications, sometimes for a single product. Standards for consumer electronics devices and media such as the DVD disc and player were developed in this manner. Other SDOs are very large and encompass many different standardization activities at any given time. ASTM International, for example, is one of the largest SDOs and regularly develops standards in areas as diverse as electrical wiring, playground equipment, composite materials, unmanned aircraft and nanotechnology.[15] Voluntary standards, particularly those in fields such as computing, telecommunications and networking, are typically *interoperability* standards, though SDOs may also adopt *quality*, *informational* and *prophylactic* standards.

The work of individual SDOs is sometimes coordinated at the national and international levels. In the United States, the American National Standards Institute (ANSI)[16] accredits more than 200 different SDOs and establishes basic policies and criteria ("Essential Requirements") for its members. The International Organization for Standardization (ISO)[17] is a Geneva-based non-governmental organization (NGO) whose members constitute 163 national standards institutes from across the globe. ISO both coordinates standards-development activities among its members and develops its own consensus standards through numerous committees. Among its many projects, ISO has developed voluntary best practices for greenhouse gas quantification and reporting.[18]

2.3 *Standards Conformity and Assessment*. Once a standard is adopted and released, determining whether a product or service conforms with the standard may require sampling, testing, inspection, analysis and other activity.[19] In the case of purely voluntary standards, such as those relating to product interoperability, the marketplace may provide a sufficient test of conformity. That is, products that do not conform fully to an interoperability standard may not work as intended, and may thus not satisfy consumer demands. More formal means of conformity assessment are required, however, with voluntary certification programs such as the Energy Star efficiency label (discussed in Section 3.5 below) and the LEED green building certification (discussed in Section 3.7 below), each of which permit application of the relevant designation based on self-certification by the program participant.

Conformity with governmental and other mandatory standards is typically a matter of legal compliance and can be monitored internally, subject to periodic regulatory inspection, or through more formal standards conformity assessments. In some areas, third party organizations have evolved to measure and certify compliance with both mandatory and voluntary standards. Underwriters Laboratories (UL), for example, serves as an independent product certification body for both governmental and non-governmental standards, including clean energy technologies such as photovoltaics and wind turbines.[20] NIST and other governmental agencies also provide conformity assessment services, and in areas such as eco-labeling and climate change, a plethora of private third party certifying groups has arisen.[21] The growing role of third party certifiers has been viewed by some commentators with concern, as there is little oversight or regulation of such third party certifiers, making it difficult to detect and prevent potential bias and lack of competence.[22]

3 Standards and Climate Change

Below is a brief summary of the current standardization landscape for climate change technology in the United States.

3.1 *Emissions*. In the United States, atmospheric emissions, whether by motor vehicles, aircraft or stationary sources such as factories and power plants, are regulated by the EPA under the Clean Air Act.[23] EPA's *prophylactic* clean air standards have traditionally sought to reduce airborne carcinogens and other toxic air pollutants, to reduce acid rain and to protect the ozone layer.[24] Recently, however, the EPA has sought to address climate change by establishing permitting standards for greenhouse gas emissions from stationary sources.[25] In conjunction with the Department of Transportation's (DOT) National Highway Traffic Safety Administration (NHTSA), the EPA also recently adopted new greenhouse gas emission standards for passenger vehicles and light trucks.[26] While the United States is not a party to the Kyoto Protocol on greenhouse gas reduction[27], the EPA's recent activity would, for the first time, implement Kyoto-style greenhouse gas reduction standards into U.S. regulation. The EPA's effort in this regard has been subject to a recent (and unsuccessful) legislative challenge claiming that Kyoto-style emissions controls could "kill jobs and increase costs."[28]

Organizations besides the EPA have also begun to develop emissions standards. ASTM has established a voluntary standard that provides basic options for greenhouse gas management strategies for unregulated small entities that want to prepare for increased regulation.[29] ISO has also developed a standard intended to quantify, monitor, and report greenhouse gas emissions.[30] President Obama has also issued an Executive Order mandating that Federal Agencies become implement greenhouse gas emissions management requirements to reduce their emissions from direct and indirect activities.[31] Likewise, the European Union has set a goal of reducing emissions to 80-95% below 1990 levels by 2050.[32]

3.2 *Fuel Efficiency*. Vehicle fuel efficiency in the U.S. is regulated by the EPA and NHTSA as well as state agencies. In April 2010, the EPA and NHTSA jointly issued aggressive new fuel economy requirements for passenger cars and light trucks in conjunction with the greenhouse gas standards noted in Section 3.1 above.[33] These requirements mandate the achievement of fleet-wide fuel economy ratings of 34.1 mpg by model year 2016. In July 2011, the Obama Administration announced the next phase in the program to increase fuel efficiency for all new cars and trucks sold in the United States, which would require a fleet-wide fuel economy rating of 54.5 mpg by model year 2025.[34] Fuel efficiency standards are *prophylactic* in a dual sense. First, like vehicle emissions standards, fuel efficiency standards are intended to address environmental concerns by reducing fuel-based emissions and by decreasing the use of fossil fuels. In addition, fuel efficiency standards are intended to provide consumer cost savings, a predominant political rationale for the enactment of such standards.[35]

3.3 *Biofuels*. Biofuels include a broad range of solid, liquid and gaseous fuels derived from plant and animal sources. Biofuels are seen by proponents as long-term replacements for petroleum-based fossil fuels. To-date, only bioethanol and biodiesel fuels are commercially traded or used on a wide scale and are produced primarily by the United States, the European Union and Brazil.[36] In the Energy Independence and Security Act of 2007 (EISA), Congress mandated minimum levels of renewable fuels (including biofuels) that must be used for transportation purposes.[37]

Standardization activities relating to biofuels cover diverse aspects of the production and distribution cycle and have been conducted by a variety of national and industry SDOs including ASTM International (fuel specifications), the American Society of Mechanical Engineers (ASME) (pipeline transmission, storage tanks), the American Petroleum Institute (storage and distribution), Underwriters' Laboratories (UL) (dispensing devices) and SAE International (vehicular fuel systems).[38] ANSI has recently sought to coordinate international standardization efforts around biofuels through its Biofuels Standards Coordination Panel.[39]

3.4 *Renewable Energy Sources*. Renewable energy comprises a diverse array of non-depletable energy sources including wind, solar, geothermal, hydroelectric, hydrogen, tidal and biomass. In 2008 the European Union adopted its Renewable Energy Directive, which mandates that by 2020 at least 20% of all energy use, and 10% of transportation energy use, be derived from renewable sources.[40] Though the United States has not adopted comparable legislation at the federal level, a majority of U.S. states have enacted renewable or alternative energy targets.[41] From a technical standpoint, standardization activity for renewable energy sources is carried out across a wide spectrum of SDOs, consortia and working groups each focusing on a specific technology or practice. ISO, for example, has initiated separate working groups focused on solar energy, hydrogen technologies, wind turbines and bioenergy.[42]

3.5 *Energy Efficiency*. The widely-recognized "Energy Star" certification is a voluntary labeling program sponsored by the EPA and the Department of Energy (DOE) that is intended to promote energy-efficient household products, appliances, and buildings.[43] EPA standards in 60 different product categories dictate when manufacturers may apply the Energy Star label to a product. Though the Energy Star program is voluntary, it has achieved mandatory status in certain cases, for example, through federal regulations requiring that all lighting products in federal buildings be Energy Star compliant.[44] In general, however, Energy Star guidelines are more stringent than mandatory federal efficiency standards which have been set for products such as light bulbs, dishwashers, dehumidifiers, refrigerators and clothes washers.[45] Moreover, though definitions of "energy efficiency" vary, many states have also adopted energy efficiency targets and standards directed primarily toward power generators.[46]

3.6 *Smart Grid*. The "smart grid" refers to a next-generation, distributed national power grid that when implemented will enable two-way communication and power transmission between generators, consumers and intermediate points.[47] It is hoped that implementation of the smart grid will dramatically improve the efficiency of power generation and consumption in the United States.[48] Under EISA, NIST is directed to coordinate the development of a new interoperability framework for the smart grid.[49] In 2010 NIST announced the first 75 standards in this framework, covering technologies ranging from electricity storage to utility metering to cyber security.[50] These standards were selected from existing specifications and standards developed by NIST itself as well as other governmental agencies (e.g., Department of Homeland Security), international bodies (e.g., the International Electrotechnical Commission (IEC) and International Telecommunications Union (ITU)), ANSI-accredited SDOs (e.g., IEEE and the National Electrical Manufacturers Association (NEMA)), and private consortia (e.g., HomePlug Powerline Alliance and the Zigbee Alliance).

Since 2010, NIST has continued developing an interoperability framework for the smart grid. 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.[51] In October 2011, NIST released a draft of version 2.0 of its interoperability framework for the smart grid, which added twenty standards to the framework to help fill gaps identified in version 1.0.[52] 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.[53] Among the many 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. (See Section 4.3 regarding patent policies.)

3.7 *Building Sustainability*. Residential and commercial buildings consume significant quantities of energy and otherwise impact the environment in terms of their construction, materials and ongoing cooling, heating, lighting and operations.[54] Accordingly, significant attention has recently been paid to standards and specifications for "green" and "sustainable" buildings,[55] and there has been a proliferation of standards relating to sustainability.[56] Among the most widely-recognized of such standards is the LEED building certification system administered by the U.S. Green Building Council, which rates buildings based, among other things, on siting, water efficiency, energy conservation, materials and indoor environmental quality.[57] In 2009 the International Code Council (ICC), working together with the American Institute of Architects (AIA) and ASTM International, released a model International Green Construction Code (IGCC) specifying minimum standards for commercial buildings in areas such as energy efficiency, water use, carbon footprint, building maintenance and waste management.[58] When published in final form (expected in 2012), the IGCC will be available for adoption by jurisdictions on a mandatory basis.[59] Despite the proliferation of standards relating to building sustainability, materials sustainability standards lack a consistent vocabulary, as well as a consistent and transparent means for measuring and testing sustainability criteria.[60] These issues make sustainability standards difficult to compare in a meaningful way, which is further complicated by the fact that many standards purport to certify the same, or very similar, product characteristics.[61]

3.8 *Electric Vehicles*. Electric vehicles provide great potential for reducing fuel-based emissions and dependence on foreign fuel sources. Accordingly, ANSI has created the Electric Vehicles Standards Panel (EVSP) to foster coordination and collaboration among stakeholders in order to develop standards for electric vehicle technologies and infrastructure.[62] The EVSP plans to produce a strategic roadmap of the standards and conformity assessment programs that are necessary for the widespread acceptance and deployment of electric vehicles.[63] The EVSP has identified the need working groups to focus on standards in areas ranging from energy storage systems and vehicle components to charging systems and infrastructure user interface.[64]

4 Intellectual Property and Standards

Standards often implicate and are affected by intellectual property. Indeed, standards themselves may specify patentable inventions, and the written embodiments of standards are generally protectable by copyright. Furthermore, the more complicated the technology is that a standard specifies, the more likely the standard is to implicate patents owned by members of the SDO or by third parties. SDOs and implementers of technical standards are therefore likely to encounter numerous intellectual property issues outlined in this section.

4.1 *Copyright in Standards*. Technical standards typically take the form of written descriptions of how products or services should be designed, built or operated. As written documents, standards are typically protected by copyright, meaning that they cannot be reproduced, displayed or modified without permission of the copyright owner (often the SDO). Many SDOs earn significant revenue from the sale of standards (some of which extend to hundreds of pages) and warn against illegal copying and distribution,[65] though a number of major SDOs allow their standards to be downloaded and copied without charge.[66] The tension between copyright protection of standards and the social utility of standards becomes particularly clear when a proprietary standard is adopted and referenced by a governmental agency and thereby becomes “the law”.[67] Use of a copyrighted standard may become mandatory by statute or regulation, yet access to that standard can be controlled by the SDO that owns the copyright.

Such a situation developed when the federal Health Care Financing Administration (HCFA)[68] required the use of the Current Procedural Terminology (CPT)[69] standard for Medicare and Medicaid reimbursement claims.[70] The copyright on this standard was owned by the American Medical Association (AMA), which granted the HCFA “a non-exclusive, royalty free, and irrevocable license to use, copy, publish and distribute” the standard.[71] In *Practice Management Information Corp. v. American Medical Ass'n*., Practice Management Information Corp., desiring to publish the CPT standard, sought a declaratory judgement that the AMA no longer possessed a valid copyright on the CPT after the HCFA mandated use of the CPT standard.[72] The U.S. Court of Appeals for the Ninth Circuit declined to hold the AMA’s copyright invalid and affirmed that the AMA may control the copyrighted text of the CPT standard, even as adopted into law.[73] This approach is consistent with the OMB’s guidance to Federal agencies, which states that agencies adopting voluntary consensus standards “must observe and protect the rights of the copyright holder.”[74]

The Court of Appeals for the Fifth Circuit, however, has taken a different approach to this issue. In *Veeck v. Southern Building Code Congress Intl*.,[75] Peter Veeck, the operator of a non-profit web site, posted the local building codes of two Texas municipalities. The municipal codes were taken verbatim from Southern Building Code Congress International’s (SBCCI) published Standard Building Code. When Veeck published the codes on his web site, SBCCI sued for infringement of its copyrights. The *en banc* Fifth Circuit, relying on precedent that copyright cannot prevent the reproduction and distribution of "the law", held that while SBCCI retains copyright in its model codes, once they are enacted into law, they may be reproduced and distributed freely.[76] Important to the court's reasoning was the fact that SBCCI's model codes were developed specifically to be adopted by municipalities into their local building codes. The court distinguished this case from one in which a governmental agency simply incorporates an extrinsic standard into its regulations by reference, noting precedent in at least two other circuits holding in favor of the SDOs in such cases.[77]

SDOs often see the licensing of standards as revenue sources, and claim that the development of standards requires copyright ownership as an incentive.[78] Widespread adoption of the standard, however, creates tension between society's need for access to the standard and the SDO's financial interest in controlling reproduction of the standard.

4.2 *Patenting and Standards*.

4.2.1 *Patents Covering Standardized Technology*. As noted above, standards are written descriptions of particular attributes of specified products and services. A simple biofuel standard might specify, for example, that in order to be certified as a "Type X" biofuel, a mixture must contain at least 80% ethanol and no less than 3% of substance X. Assuming that statutory requirements of utility, novelty and non-obviousness are overcome, a patent could be obtained on a biofuel that conforms with this standard, or the methods of producing, storing or utilizing it. Such a patent would ordinarily not be obtained by the SDO in which the standard was developed, as SDOs seldom develop complete products and almost never seek to patent their work. Rather, if such a patent were obtained, it would be obtained by a participant in the SDO or an outsider, and sometimes both. Two general patent-related issues thus arise in the context of technology standardization; these are referred to as *patent stacking* and *patent ambush*.

4.2.2 *Patent Stacking and Patent Pools*. Patent or royalty "stacking", also referred to as a patent "thicket" or anti-commons, is said to occur when multiple entities each hold patents claiming aspects of a single standardized technology.[79] In order for a producer to implement the standardized technology in a product, it must obtain licenses from multiple parties, each acting independently and each seeking to maximize its gains. The risk of stacking is thus that the sum of individual royalty demands may be excessive in relation to the overall value of the product, making the standardized product uncompetitive in comparison to products that do not conform with the standard.

One method of addressing stacking concerns is through the creation of a patent pool. In a patent pool, multiple patent owners contribute or license patents that are essential to the implementation of the standard to a common agent (sometimes one of the patent holders and sometimes a newly-formed entity). Licensees are charged a single royalty to practice the entire group of patents, 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,[80] the DVD video compression format[81] and third generation wireless communications standards.[82] In each of these cases the U.S. Department of Justice approved the proposed patent pool, provided that it possessed certain features that are viewed to lessen potentially anticompetitive effects. For example, such pools must contain only patents "essential" to the implementation of the standard (as the inclusion of patents on substitute technologies could lessen competition among technical alternatives), licensees must have the freedom to obtain licenses to the patents independently from the pool, licensing of the pooled patents must be conducted on a non-discriminatory basis, and to the extent that the patent pool owners require licensees to "grant back" licenses to them, such grantback licenses must only cover patents that are, themselves, essential to implementation of the standard.[83]

It is important to note that the utility of a patent pool may be limited to the extent that fewer than all holders of essential patents become members of the pool. Such a situation arose recently with respect to the Federal Communication Commission's (FCC) ATSC standard for digital television transmission. Though a patent pool comprising many holders of patents essential to implementation of the mandatory ATSC standard was formed, one patent holder, Japan's Funai Electric Company, did not join the pool and sought to charge royalties for a single patent at a rate equal to the rate charged by the entire ATSC pool.[84] When Funai sought to bar imports of televisions by Vizio, Inc., a U.S. manufacturer that refused to pay this royalty, Vizio sought temporary relief from the FCC. Though the matter was rendered moot when the Federal Circuit held that Vizio did not infringe the asserted patent,[85] the dispute highlights the fragility of patent pooling arrangements that do not include all relevant patent holders.

4.2.3 *Patent Ambush*. The second major patent issue that arises in the standards context is patent ambush, also known as "hold-up", which occurs when a patent holder seeks to assert a previously unidentified patent against implementers of a standard after the standard has been adopted (either by an SDO or a governmental agency).[86] If patent hold-up occurs after the industry has 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 from patent holders can have an extremely disruptive effect on the market, driving up the cost of standardized products to levels that are inefficient and uncompetitive with alternative technologies.[87]

4.3 *SDO Patent Policies.*

4.3.1 *Policy Measures to Address Patent Issues*. Patent stacking and ambush can arise in the context of either patents held by participants in the SDO or patents held 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. In response, many SDOs have adopted formal policies that attempt to address these issues by imposing one or both of the following obligations on participants: (1) an obligation to disclose patents essential to implementation of a standard, and/or (2) an obligation to license patents essential to implementation of a standard, either on a royalty-free basis or on terms that are "reasonable and nondiscriminatory."[88] Such obligations are intended to ensure that standards developers have at their disposal sufficient information to assess the relative costs and risks of technologies under consideration for standardization. That is, disclosure obligations ensure that standards developers know whether and which patents cover technologies under consideration, giving them the opportunity to "design around" patents if they so wish, and licensing obligations ensure that such patents will be licensed on terms that are, at least roughly, understood.[89]

4.3.2 *Disclosure Requirements and Their Violation*. Despite the adoption by many SDOs of policies requiring disclosure of patents essential to standards under development, several highly-publicized instances have arisen 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 against other implementers of the standard. The first of these cases to gain significant attention involved Dell Computer, which failed to disclose patents relevant to the voluntary VL-bus industry standard developed in the Video Electronics Standards Association (VESA).[90] When Dell sought to enforce its patents against other computer manufacturers following approval of the standard, the Federal Trade Commission (FTC) brought an action that resulted in the entry of a 1996 consent order permanently restricting Dell from enforcing those patents against any third party. The Dell decision remains controversial, as there was no allegation that the Dell representative knew of Dell's pending patent or the potential for infringement at the time the VL-bus standard was adopted.[91] In response, SDO policies today often specify that searches of corporate patent portfolios not be required to comply with SDO disclosure requirements, or that disclosure be limited to the "knowledge" of an SDO participant's individual employees participating in standards development.[92]

The most notorious incidence of disclosure failure within an SDO involved the semiconductor technology vendor Rambus, Inc. Volumes have been written about the decade-long legal battles in which Rambus sought to assert various dynamic random access memory (DRAM) patents against the entire DRAM industry after those technologies had been standardized by the Joint Electron Device Engineering Council (JEDEC), a voluntary SDO in which Rambus participated in the early 1990s.[93]

Ultimately, Rambus was exonerated with respect to the allegations that it violated JEDEC's patent disclosure rules, primarily due to the vagueness of the rules themselves.

In one often-cited case, the Court of Appeals for the Federal Circuit criticized the JEDEC policy as suffering from "a staggering lack of defining details" that left SDO participants with "vaguely defined expectations as to what they believe the policy requires".[94] The court excused Rambus's behavior on the basis that the poorly-crafted JEDEC policy was simply too imprecise an instrument to support liability. It concluded that, "while such actions impeach Rambus's business ethics, the record does not contain substantial evidence that Rambus breached its duty under the … policy."[95]

In a subsequent action, the FTC found Rambus liable, among other things, for attempted monopolization in violation of Section 2 of the Sherman Act and deceptive conduct under Section 5 of the FTC Act.[96] The FTC's decision, however, was reversed by the Court of Appeals for the District of Columbia, which held that Rambus's attempt to increase prices following adoption of a standard did not amount to anticompetitive conduct unless such conduct also resulted in adoption of the standard, which was not shown.[97] This decision has been criticized, both on the basis of its antitrust analysis and as a matter of public policy inasmuch as it seemingly condoned conduct that has been widely condemned as deceptive.[98]

SDO disclosure rules are also relevant in the context of mandatory standards. In the late 1980s, the California Air Resources Board (CARB) began to formulate regulations and standards for reducing emissions from gasoline. Union Oil Company of California (Unocal), together with other companies, actively participated in the agency's standard-setting proceedings. Shortly before the new CARB regulations went into effect in 1996, Unocal announced that it held patent rights necessary to practice the standard and that it intended to collect royalties of $0.0575 per gallon of gasoline sold in California.[99] After an unsuccessful attempt by competitors to invalidate the asserted patent, in 2003 the FTC brought an action against Unocal, charging it with attempted monopolization and imposing unreasonable restraints on trade.[100] The matter was ultimately settled with Unocal's agreement to cease all enforcement of the relevant patents.[101]

4.3.3 *Royalties for Standards-Essential Patents*. Many SDOs require that participants commit to license patents essential to their standards 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[102] 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 terms has proven to be notoriously difficult to pin down. In several recent cases, parties have disputed whether the terms under which licenses have been proffered violate or conform with F/RAND requirements.[103]

F/RAND licensing commitments tend to fail because there is no universal, objective standard by which "reasonableness" (or "nondiscrimination") can be measured.[104] In order to make a F/RAND determination, the specific facts of each situation must be evaluated. These facts include not only relevant market norms for royalties, but also customary practices relating to non-royalty terms such as reciprocity, grantback licenses, defensive suspension, confidentiality and the like. Also, given that a patent holder's F/RAND licensing terms are generally not revealed until negotiations occurring *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. Put another way, the uncertainty of F/RAND licensing may simply substitute the risk of patent hold-up arising from unknown patents with hold-up arising from unknown F/RAND licensing terms.[105]

4.3.4 Ex Ante *Disclosure of License 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.[106] Such advance disclosure, it is argued, would enable SDO participants to evaluate the cost of including particular patented technologies in a standard prior to adoption, and would thus enable more efficient decision making with respect to the technical design of the standard.

Critics of *ex ante* disclosure, however, argue that *ex ante* disclosures in the standards context present both practical and legal issues. The introduction of legal licensing terms to the technical standards development process might cause the process to become more cumbersome, lengthy and expensive.[107] Concerns have also been raised that allowing *ex ante* licensing negotiations 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 on the patent holder, causing royalties to decrease below their fair (or optimal) level.[108] Following this argument to its logical conclusion, group pressure could drive all royalty rates toward zero, resulting in the devaluation of any patents covering a standard.

Despite these considerations, the U.S. Department of Justice (DOJ) has on two recent occasions issued Business Review Letters approving limited *ex ante* disclosure policies in SDOs. In the case of the VMEbus International Trade Association (VITA), the DOJ indicated in 2006 that it would not take enforcement action against an SDO that required participants to make *ex ante* declarations of the "most restrictive" licensing terms in their RAND licenses. In approving the VITA policy, the DOJ concluded that *ex ante* disclosure of restrictive licensing terms would promote, rather than hinder, competition among patent holders.[109] Likewise, in its 2007 Business Review Letter to IEEE,[110] the DOJ approved a proposed arrangement in which patent holders were given the *option* to disclose their most restrictive licensing terms, including royalty rates, prior to the adoption of a standard. The DOJ called the IEEE proposal "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 …".[111] The European Commission has also expressed a general level of comfort with *ex ante* licensing disclosures in a recently-released set of guidelines relating to horizontal competition.[112] It remains to be seen whether these recent developments result in greater or lesser efficiency, transparency and fairness in the standards development process. [An empirical study of the effects of *ex ante* disclosure of licensing terms on IEEE, VITA and other SDOs is currently being undertaken by the author with the support of NIST.]

4.4 *Trademarks and Certification Marks for Standards*. As noted above, numerous standards relating to climate change and sustainability permit the application of a certification label (such as ENERGY STAR or the LEED "green building" certification) to a product or service. Such "certification marks" may be registered by the SDO with the U.S. Patent and Trademark Office in a manner similar to trademarks, though they differ from trademarks in several important regards. Whereas trademarks are used to indicate the origin of a product or service and thereby to assure its quality to the consumer, certification marks are used to indicate compliance by a product or service with a particular standard of quality, without regard to its origin.[113] Certification marks may be applied to goods or services by any organization adhering to the relevant standard, but may *not* be applied by the mark's owner.[114] Moreover the holder of the certification mark must allow any organization that complies with the standard to apply the mark,[115] essentially creating, as McCarthy has observed, a compulsory licensing scheme for certification marks.[116] Violation of the foregoing requirements can result in cancellation of the certification mark.[117]

Margaret Chon has noted several weaknesses in current U.S. law governing certification marks.[118] In recent years, numerous certification marks purport to indicate to consumers various characteristics about a product, such as compliance with an organic farming or fair trade standard.[119] However, in a global marketplace with widespread supply chains, the consumer and competitors are largely unable to confirm compliance with the standard represented by the certification mark.[120] That task is left with the certification mark owner, yet certification mark owners often collect revenue from the use of the mark. This creates a conflict of interest in which the organization charged with ensuring that only complying products bear the mark is the same as that receiving revenue from use of the mark.[121] U.S. law lacks a robust system of oversight for checking and monitoring compliance with standards represented by the certification marks.[122] This lack, combined with high levels of complexity and limited transparency into the certification process lead to consumer ignorance and confusion over certification marks, leaving little to deter unscrupulous and overzealous use of certification marks.[123] To address this and other issues, Chon proposes various changes to the statutory framework governing certification marks, including a requirement that greater information about the standards underlying certification marks be disclosed by registrants, an expansion of the doctrines of trademark "abandonment" and misuse to certification marks, and the allowance of various consumer actions against both holders of certification marks and entities applying those marks in the case of fraud, deceit and false marking.[124] It remains to be seen whether these suggestions gain traction within the standards community or are taken up by legislators and consumer advocacy groups and ultimately embodied in law.

5 Conclusion

Technical standards are likely to play an increasingly prominent role in the development, adoption and regulation of technologies relating to climate change and clean energy. And whether such standards relate to the chemical composition of new biofuels, sustainability characteristics of new buildings or the exchange of data among smart grid components, intellectual property rights will play a key role in determining which of these standards are broadly adopted, and at what price.

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