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USING INTELLECTUAL PROPERTY TO IMPROVE ENVIRONMENTAL PROTECTION

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> [W]e face the question whether a still higher "standard of living" is worth its cost in things natural, wild, and free. For us of the minority, the opportunity to see geese is more important than television, and the chance to find a pasque-flower is a right as inalienable as free speech.**

INTRODUCTION

A central tenet of our economic system is that technological innovation is necessary to maintain and improve our standard of living. Yet, few would dispute that technology causes pollution and wastes natural resources. During the past twenty years there has been an increased recognition that much of the technology employed in manufacturing, agriculture, and transportation damages the environment. However, other technology can reduce and prevent pollution and minimize waste of resources. An environmental perspective, therefore, distinguishes between harmful and beneficial technologies, and discourages the former while encouraging the latter.[1]

This Article examines practical ways to improve environmental protection by promoting innovation in beneficial environmental technology through application and reformation of intellectual property laws. Section I identifies the broad characteristics of technology and outlines the roles of intellectual property laws and environmental laws in promoting environmental technological innovation from invention to commercialization. Environmental protection is best achieved by coupling incentives for innovation in beneficial technologies with restrictions on

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** A. LEOPOLD, A SAND COUNTY ALMANAC xvii (1949).

1. *See* Gray, *The Paradox of Technological Development*, in TECHNOLOGY AND ENVIRONMENT 192 (Ausubel & Sladovich eds. 1989). The paradox of technology is that while technological development can create opportunities for improving the environment, it can also disrupt and harm the environment. By distinguishing between harmful and beneficial technology, the paradox can be resolved.

harmful technologies.

Section II surveys the interaction between intellectual property law and environmental law. A primer is included on the different proprietary rights that can attach to innovative environmental technology — trade secrets, patents, and trademarks. The role of proprietary rights in international efforts to improve environmental protection is also discussed.

Section III examines the licensing of environmental technology. Commercial success of new technologies depends in large part on the effectiveness of licensing strategies. Governmental influence through compulsory licensing provisions and cooperative technology transfers is also examined.

Section IV discusses technology-forcing regulations and the compromises they manifest between proponents of technology and environmentalists. Technology-forcing regulations can create incentives for innovation, and intellectual property laws allow one to take advantage of those innovations. Specifically, this section describes how a company can reap the benefits of new technology by auditing its own environmental technology and tracking the state of the art. Such measures can help companies reduce compliance costs and obtain revenue by exploiting patents, trade secrets, and other proprietary rights in environmental technologies.

Because this Article encompasses a broad range of material from several distinct legal specialties, a detailed survey and rigorous theoretical framework are beyond its scope. Instead, the focus is on provisions that have practical application and the basics of laws applicable to environmental technological innovation. This Article concludes that increased reliance on intellectual property by environmental policymakers, regulators, and managers will improve environmental protection while stimulating beneficial economic and technical progress.

I. ENVIRONMENTAL TECHNOLOGICAL INNOVATION

Before surveying the interaction between intellectual property and environmental law provisions affecting environmental technology, the disparate effects of each field on innovation must be recognized. Environmental technology must be defined and placed within the context of the technology innovation cycle. In essence, intellectual property creates incentives for new technologies, either beneficial or harmful. Environmental regulation restricts the use of harmful technologies, and improves the market for beneficial ones.

A. Approaches to Environmental Technological Innovation

Intellectual property has had a neutral impact on the environment. Technical ingenuity thrives on the incentive system established by intellectual property law, which provides the prospect of remuneration for creative problem solving. An innovator can rely on the law of trade secrets, patents, copyrights, and trademarks to protect his or her new technology. Unfortunately, incentives for inventing and using environmentally beneficial technology have generally been no greater than those for environmentally harmful technology.[2] Proprietary rights in destructive technology are indistinguishable from rights in beneficial technology.

Most environmental statutes include provisions intended to promote technical solutions to environmental problems.[3] However, the effectiveness of some technology-forcing provisions has been cast into doubt.[4] Nonetheless, environmental law does greatly influence the technologies available to society. Some laws, which are intended to eliminate harmful technologies or substances such as asbestos or polychlorinated

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2. *See infra* Section II.

3. *See generally* ENVIRONMENTAL LAW INSTITUTE, LAW OF ENVIRONMENTAL PROTECTION §§ 3.02, 3.03, 3.07 (M. Novick ed. 1990). Rodgers establishes that the approach of technology-forcing to solve environmental problems has strong roots in the common law of abating nuisances. W. RODGERS, ENVIRONMENTAL LAW, § 2.7(C) (1989). LaPierre surveyed environmental laws in the early 1970s and distinguished the technology forcing effects of health-based standards from those of technology-based standards. *See* LaPierre, *Technology-Forcing and Federal Environmental Protection Statutes*, 62 IOWA L. REV. 771 (1977). He concluded that although health-based standards are more effective at stimulating innovation, economic constraints lead the courts and the EPA to favor less effective technology-based standards. *Id.* at 837.

4. The Technology Innovation and Economics Committee of the National Advisory Council on Environmental Policy and Technology ("TIEC/NACEPT") has identified how environmental statutes and regulations limit innovation in unintended ways. *See* TECHNOLOGY INNOVATION AND ECONOMICS COMMITTEE OF THE NATIONAL ADVISORY COUNCIL ON ENVIRONMENTAL POLICY AND TECHNOLOGY, PERMITTING AND COMPLIANCE POLICY: BARRIERS TO U.S. ENVIRONMENTAL TECHNOLOGY INNOVATION (Berg ed. October 1990) [hereinafter TIEC/NACEPT REPORT]. The TIEC/NACEPT Report provides recommendations for the EPA Administrator and Congress on how to remove regulatory limitations on innovation and promote innovative pollution-control and prevention measures. *See also* Ashford, Ayers & Stone, *Using Regulation to Change the Market for Innovation*, 9 HARV. ENVTL. L. REV. 419, 425–427 (1985) (regulations differ in their effect on innovation depending, *inter alia*, on their stringency, the time for compliance, the regulated community's ability to innovate, and the existence of economic incentives); Ashford & Heaton, *Regulation and Technological Innovation in the Chemical Industry*, 46 LAW & CONTEMP. PROBS. 109, 118–129 (1983) (regulations requiring submission of trade secrets may penalize technological innovation because they decrease the protection and the rewards available to new technologies). *But see* LaPierre, *supra* note 3, at 805 (EPA's relaxation of health-based standards reduced their effectiveness in promoting innovation).

biphenyls ("PCBs"), actually bring about radical innovation.[5] Other laws encourage or require the use of beneficial technology. For example, a factory that discharges pollutants into the air or water may be subjected to a permit condition requiring the factory to employ pollution control or treatment technology,[6] or the owner of a hazardous waste site may be ordered to pump and treat contaminated groundwater using a sophisticated bioremediation system.[7]

Just as intellectual property law does not generally distinguish between environmentally harmful and beneficial technology,[8] environmental law does not generally take intellectual property incentives into account in seeking to protect the environment.[9] The consequences of these general principles and some exceptions are discussed below.

B. The Scope of Environmental Technology

Environmental technology includes: (1) industrial processes which minimize resource consumption and waste production, (2) consumer products which are environmentally benign throughout their life cycles, (3) recycling equipment and processes, (4) waste management technologies for solid and hazardous waste, (5) pollution control devices, and (6) products and methods for cleaning up pollution.[10] Environmental

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5. For a discussion on how more stringent regulations such as banning hazardous substances leads to radical innovation see Ashford, Ayers & Stone, *supra* note 4, at 431 (considering bans on PCBs, CFCs in aerosols, and asbestos, among others).

6. *See* Clean Air Act, 42 U.S.C. §§ 7401–7642 (1988); Clean Water Act, 33 U.S.C. §§ 1251–1387 (1988).

7. Such remedies are effected pursuant to the provisions of the National Contingency Plan under the Comprehensive Environmental Recovery, Compensation and Liability Act ("CERCLA"), 42 U.S.C. §§ 9601–9675 (1988).

8. *See* Diamond v. Chakrabarty, 447 U.S. 305, 316–317 (1980) (potential environmental hazards of genetically engineered bacteria not relevant to patentability).

9. Environmental law is often thought to force industry to internalize what would otherwise be external costs to the environment, and hence to the public. In a complementary fashion, intellectual property permits an innovator to internalize some of the benefits of technical progress that would otherwise be in the public domain. Under this analysis, a company that is forced to pay for the environmental costs of a polluting technology and finds an innovative solution to its problem can then use intellectual property as a vehicle to receive payment from others who want to copy the innovation, thereby offsetting the costs to that innovator.

The TIEC/NACEPT Report recommends, for example, improving trade secret protection relating to environmental disclosures and establishing a national clearinghouse of environmental technology information to promote invention and diffusion of appropriate technologies. TIEC/NACEPT REPORT, *supra*, note 4, at 55–56.

10. *See* Gollin, *Patent Law and the Environment/Technology Paradox*, 20 Envtl. L. Rep. (Envtl. L. Inst.) 10171 (1990). The different categories can also be described as technologies for pollution prevention (1)–(3) and pollution control (4)–(6). Pollution prevention technologies reduce or eliminate the environmental degradation that accompanies transportation, manufacturing, and agriculture. Policymakers are coming to recognize that success-

technology is not limited to control equipment, but is also important in manufacturing, waste management, utilities, and the environmental service industry. This cross-cutting list of technologies has only recently come to be viewed as a discrete industrial sector with legal, technical, and commercial characteristics of its own.[11]

The common thread linking these six categories of technology is the intention to solve environmental problems, and to fill the need for pollution control and prevention. Environmental technology innovation can help achieve the following goals:

(1) A net environmental benefit in comparison with existing technologies, taking into account resources consumed, wastes produced, and risks to human health and the environment;
(2) Reduced costs of environmental compliance; and
(3) Reduced risk of environmental liability.

In addition, as with all technology innovation, environmental technology can:

(1) Reduce costs of materials,
(2) Reduce costs of production,
(3) Increase rates of production, and
(4) Increase attractiveness of products in the marketplace.

Ultimately, as with all innovation, an overarching goal is to gain a competitive advantage in the marketplace. Intellectual property protection can play a role in improving environmental protection by securing a marketplace advantage for environmental innovators.

C. The Technology Innovation Cycle

The technology cycle can be viewed as having three phases: invention, innovation, and diffusion. Invention is the implementation of a new idea or concept leading to a new product or process; innovation, the

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ful pollution prevention efforts are preferable to control and cleanup technologies from the perspective of both cost and effectiveness. *See, e.g.*, EPA, POLLUTION PREVENTION STRATEGY, 56 Fed. Reg. 7849 (1991).

11. This phenomenon has been seen in other areas. For example, when computer science was young, a specialty in computer law developed to bring together relevant aspects of intellectual property, contract, corporate, licensing, communications, and international law in the technical context of computer engineering. Likewise as biotechnology has burgeoned as an industry, specialists have crossed traditional boundaries, including intellectual property and environmental law, to face problems specific to the new industry.

development and initial commercial transfer of an invention; and diffusion, the spread of a new process or product within or across markets.[12] Environmental laws affect all three phases. The laws provide the impetus for invention by defining problems to be solved and needs to be filled. They may promote innovation and diffusion, for example, by requiring companies to use best available technology. Intellectual property laws also affect each of the three phases. They promote invention, and also facilitate development and diffusion by serving as assets that can be bought or sold.

Like any assets, intellectual property rights can be strong or weak and can be managed well or poorly. A skillful manager of environmental technology can find opportunities to create and utilize intellectual property rights even when faced with potential environmental liabilities, and turn compliance costs into competitive gains. For example, a company could invent a patentable method of cleaning up its own hazardous substances and then license the technology to others with similar problems.[13] In this example, the impetus for the invention derives from both environmental liability and intellectual property laws. The resulting commercial exploitation of property rights in the invention leads to an abatement of pollution.

II. AN OVERVIEW OF PROPRIETARY RIGHTS IN ENVIRONMENTAL TECHNOLOGY

Most people find intellectual property law to be somewhat elusive and confusing. As a result, the practice of law relating to trade secrets, patents, and trademarks has become highly specialized. For this Article's purposes, however, there is no need to grasp all the details of these legal areas; an understanding of fundamental principles will suffice. In some instances, intellectual property can be analogized to real property which lay people and generalists understand from direct

12. *See* Merges, *Commercial Success and Patent Standards: Economic Perspectives on Innovation*, 76 CALIF. L. REV. 803, 807 (1988). This "trichotomy" is attributed to the late economist Joseph Schumpeter. *See id.* at 843–46; *see also* T. Curlee & R. Goel, *The Transfer and Diffusion of New Technologies: A Review of the Economics Literature*, Oakridge National Laboratory/TM–11155 (1989).

13. In 1989, General Electric Company received U.S. Patent No. 4,843,007, which claims *Alcaligenes* bacteria that digest PCBs, an extremely hazardous class of halogenated organic compounds. The inventors isolated the bacteria from Hudson River sediment that General Electric had itself contaminated with PCBs. One might complain that the company enjoys a reward for its misconduct. However, the issues of enforcement and penalties for environmental malfeasance are best treated separately. There is good reason to encourage such patents — they provide an incentive to develop innovative remediation solutions.

experience. A license is comparable to a lease, royalties to rent, infringement to trespass, assignment to sale, and investment in commercially developing a technology to developing and improving real property through construction.

The usefulness of such analogies is limited because the sources of protection are different. To grasp the differences, one should understand the scope of protection offered, how to establish the proprietary right, and how to enforce it. It is also important to distinguish between inside and outside technology.[14] These features are important for existing and evolving types of intellectual property, both domestically and globally.

The following survey of intellectual property law applicable to environmental technology touches on issues of special concern to legal practitioners, regulators, and managers who need to assess their companies' proprietary rights in environmental technology. Trade secrets, patents, and trademarks are considered. This discussion is followed by a consideration of international aspects of protecting environmental technology. Voluntary efforts to protect biodiversity are also considered as an example of how proprietary rights can serve the ends of conservation.

A. Trade Secrets

Trade secrecy is a common law doctrine that has been codified in several statutes.[15] A trade secret is defined in the Restatement (First) of Torts as:

> any formula, pattern, device or compilation of information which is used in one's business, and which gives him an opportunity to obtain an advantage over competitors who do not know or use it. It may be a formula for a chemical compound, a process of manufacturing, treating or preserving materials, a pattern for a machine or other device, or a list of customers. . . . Generally it relates to the production of goods, as, for example, a machine or formula for the production of an article. It may, however, relate to the sale of goods or to other operations in the business. . . .[16]

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14. Inside technology consists of the products, processes, and know-how invented or developed inside a business. Outside technology is all other technology, which may be purchased or licensed by a company as needed.

15. *See generally* D. Bender, *Standards of Protectable Trade Secrets*, in M. BENDER, INTELLECTUAL PROPERTY COUNSELING AND LITIGATION 5–1 (1990).

16. RESTATEMENT (FIRST) OF TORTS § 757 comment b (1939).

This definition emphasizes that protection attaches only to information which provides a competitive advantage.

A slightly different formulation was adopted in the Uniform Trade Secrets Act:

> [I]nformation, including a formula, pattern, compilation, program, device, method, technique, or process, that: (i) derives independent economic value, actual or potential, from not being generally known to, and not being readily ascertainable by proper means by, other persons who can obtain economic value from its disclosure or use, and (ii) is the subject of efforts that are reasonable under the circumstances to maintain its secrecy.[17]

This definition adds the requirement that the trade secret owner take efforts to maintain secrecy. Without this requirement, a potential user of the technology might have great difficulty in ascertaining what information may be subject to a proper claim of trade secrecy.

There has been debate over whether trade secrets are protected primarily under a theory of misappropriation or as property. In the environmental context, the Supreme Court has determined that trade secrets are intangible property rights protected by the Takings Clause of the Fifth Amendment.[18]

1. Sources of Law

The protection of trade secrets derives from the common law, but statutory protection of trade secrets has advanced in the states. More than half of the states have adopted the Uniform Trade Secrets Act.[19] Criminal statutes protecting trade secrets have been adopted in a similar

17. UNIF. TRADE SECRETS ACT § 1, 14 U.L.A. 539 (1980).

18. U.S. CONST. amend. V. *See* Ruckelshaus v. Monsanto Co., 467 U.S. 986 (1984) (upholding, in part, Monsanto's claim that EPA's consideration and disclosure of pesticide data required to be submitted to EPA constituted a taking without just compensation).

19. The Uniform Trade Secrets Act has been adopted with some modification in Alabama, Alaska, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Hawaii, Idaho, Illinois, Indiana, Kansas, Louisiana, Maine, Minnesota, Montana, Nevada, North Carolina, North Dakota, Oklahoma, Oregon, Rhode Island, South Dakota, Virginia, Washington, West Virginia and Wyoming. M. JAGER, TRADE SECRETS LAW § 3.04, at 3–30 (1990). Variations of the Act have been adopted in Nebraska and New Jersey. *See id. See also*, D. Bender, *supra* note 15, § 5.01 [3].

number of states,[20] since civil damages are difficult to prove and collect, and are an insufficient deterrent. The economic incentive to misappropriate a trade secret is often greater than the prospect of damages from a civil lawsuit. However, as a practical matter, the high burden of proof in a criminal action will be hard to sustain in most trade secret cases.[21]

Federal protection of trade secrets is found in the interstices of many statutes. The Trade Secrets Act, discussed below in the context of environmental legislation, provides criminal penalties for federal employees who disclose trade secrets unless authorized by law.[22]

The Freedom of Information Act ("FOIA")[23] provides some protection for trade secrets submitted to federal agencies. The agencies are not required to disclose such information in response to a FOIA request. "[T]rade secrets and commercial or financial information obtained from a person and privileged or confidential" are exempt from disclosure by federal agencies.[24] However, FOIA does not affirmatively prevent agencies from disclosing trade secrets.[25] Agency employees may be prevented from making such disclosure by the Trade Secrets Act.

Moreover, many of the statutes establishing specific agencies contain provisions intended to protect trade secrets disclosed to the agencies. For example, the Patent Act provides that a patent application is secret and may not be disclosed without the applicant's permission until and unless a patent is granted.[26] Environmental statutes also contain provisions protecting trade secrets, but the degree of protection varies substantially by statute.[27]

One of the most important sources of trade secret protection, whether in a commercial or employment setting, is contract law, which allows individuals to obtain broader protection than otherwise afforded. Many disputes over trade secrets have their genesis in confidentiality or noncompetition agreements. For example, a person may execute a confidentiality agreement, review the details of a secret process, and then

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20. *See* D. Bender, *supra* note 15, § 5.09.

21. *See infra* Section II.A.2.

22. 18 U.S.C. § 1905 (1988). *See infra* notes 32–33 and accompanying text.

23. 5 U.S.C. § 552 (1988).

24. 5 U.S.C. § 552(b)(4) (1988).

25. *See* Chrysler Corp. v. Brown, 441 U.S. 281 (1979).

26. *See* 35 U.S.C. § 122 (1988) (also permitting disclosure if necessary to comply with an act of Congress or under special circumstances to be determined by the Patent Commissioner).

27. *See infra* Section II.A.3. Legislation analogous to federal environmental statutes exists for many state environmental programs. *See, e.g.*, N.Y. ENVTL. CONSERV. § 39–0107(4) (1980) (requiring the Commissioner of the Department of Environmental Conservation to hold certain sewage system trade secrets confidential).

use a very similar process for personal gain.[28] More commonly, an employee may sign a non-competition agreement with a first employer, then leave for another job, where he or she uses techniques, formulas, or processes learned at the first job.[29]

2. Creation and Protection of Trade Secrets in Environmental Technology

Summarizing the elements from above, a trade secret is information having commercial value that is not publicly known and is maintained in secret. The information potentially subject to trade secrecy is quite extensive. The following may constitute trade secrets:

(1) Technical information, *e.g.*, chemical formulas, product specifications, equipment designs, process and engineering drawings, laboratory notebooks, invention disclosures, performance data, manuals, and risk assessments;
(2) Business information, *e.g.*, earnings reports, budgets, financial statements, tax returns, corporate minutes, stockholder identities, business plans, and personnel records;
(3) Marketing information, *e.g.*, customer lists, sales estimates, and market analyses; and
(4) Legal matters, *e.g.*, contracts, negotiation materials, legal opinions, and material prepared for lawsuits.

Certain measures will reduce inadvertent disclosure of trade secrets and discourage theft. The first is security—limiting access to the plant or parts of it. Second, all confidential material should be designated as such in some conspicuous manner. Third, disclosure of secret information should be limited to those who need to know it.

A written trade secret protection policy will help. It functions both to notify employees and contractors of proper procedures and as evidence of efforts to protect secrets. All employees should enter confidentiality agreements to educate them about security and to provide additional protection should litigation become necessary. Likewise, confidentiality agreements should be required, where appropriate, for vendors, customers, and service providers. In addition, brochures, publications, speeches and submissions to state and federal agencies should be

28. *See, e.g.*, Sandlin v. Johnson, 152 F.2d 8, 11 (8th Cir. 1945).
29. *See, e.g.*, Morgan's Home Equip. Corp. v. Martucci, 390 Pa. 618, 136 A.2d 838 (1957).

reviewed to be sure they do not unintentionally reveal trade secrets.

A periodic review of the trade secret inventory will enable management to concentrate security measures on valuable trade secrets, and to stop protective measures for information that has become obsolete, has become public, or lacks value.

3. Disclosures of Trade Secrets Required by Environmental Regulations

The task of protecting trade secrets in environmental technology is rendered extraordinarily difficult, however, by the broad disclosures required by environmental legislation and regulation. A pervasive feature of environmental regulation is the broad disclosure required.[30] Environmental disclosure presents great risk to industry because much of the information required to be disclosed in, for instance, a permit application or an emissions report, relates to processes, equipment, and formulas at the heart of a company's competitive position. To alleviate the legitimate concern of industry that such disclosure may damage competitive advantage, and encourage full disclosure, most environmental statutes couple the duty to disclose with provisions protecting trade secrets.[31]

As a general rule, disclosures must specifically designate trade secrets to protect them from public disclosure. Furthermore, the disclosing person must police the agency to minimize the risk of public disclosure in administrative or judicial proceedings. A trade secret can be lost through one inadvertent disclosure, even though countless other disclosures were properly protected. Moreover, a crafty competitor can combine information from disclosures under different reporting programs to obtain secrets. So, one must consider all disclosures together.

Most environmental statutes refer to the Trade Secrets Act.[32] In

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30. *See, e.g.*, Community Right to Know Act, 42 U.S.C. §§ 11041–11050 (1988), discussed *infra* Section II.A.3.a.

31. *See* National Parks & Conservation v. Morton, 498 F.2d 765 (D.C. Cir. 1974).

32. 18 U.S.C. § 1905 (1988). The Trade Secrets Act applies to all government employees and provides:

> Whoever . . . publishes, divulges, discloses, or makes known in any manner or to any extent not authorized by law any information coming to him in the course of his employment or official duties or by reason of any examination or investigation made by, or return, report or record made to or filed with, such department or agency or officer or employee thereof, which information concerns or relates to the trade secrets, processes, operations, style of work, or apparatus, or to the identity, confidential statistical data, amount or source of any income, profits, losses, or expenditures of any person, firm, partnership, corporation, or association; or permits any income return or copy thereof or any book containing any abstract or particulars thereof to be seen or examined by any person except as provided by law; shall be fined not more than $1,000, or imprisoned not more than one year, or both; and

construing the Trade Secrets Act, EPA defines trade secrets similarly to the First Restatement.[33] The trade secret provisions of various statutes are discussed below. These provisions must be considered in an audit of environmental technology,[34] because environmental disclosures can have a serious impact on a company's intellectual property portfolio. The statutes of broadest applicability are considered first.

Trade secrets relating to toxic or hazardous substances and pollutants are harder to maintain than for substances which present lower hazards. Hence, there are incentives to use non-hazardous substances to reduce reporting requirements[35] and to minimize loss of trade secrets.[36] There is nothing in the statute to suggest that Congress envisioned or intended these salutary results.[37] Such effects of environmental regulations should be addressed by Congress in future reauthorizations and legislation.

In examining disclosure requirements, statutes of broadest applicability will be considered first.

a) The Emergency Planning and Community Right to Know Act

The Emergency Planning and Community Right to Know Act ("EPCRA")[38] has very broad reporting requirements. Companies which use listed substances must: (1) report routine emissions of toxic chemi-

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shall be removed from office or employment.

Id. There are no reported cases of the Act's enforcement in the environmental arena.

33. *Compare* RESTATEMENT (FIRST) OF TORTS § 757 comment b, *supra* note 16 and accompanying text *with* 40 C.F.R. § 2.201 (1988). *See also* Horn, *Protecting Trade Secrets in the Information Age*, 4 NAT. RES. & ENV'T 22, 23 (1990).

34. *See infra* Section IV.B (describing the reasons for and method of conducting an environmental technology audit).

35. *See* Baram, *Corporate Risk Management and Risk Communication in the European Community and the United States*, 2 HARV. J.L. & TECH. 85, 147–49 (1989).

36. For example, imagine a company choosing between two processes for producing a widget. One process uses only toxic, volatile, corrosive substances and the other uses primarily stable, non-hazardous chemicals. It will be harder to maintain the secrecy of the first process because of the obligation to disclose the chemicals being used. A competitor who learns which chemicals are being used may be able to deduce the other process parameters. In contrast, competitors would not be able to use environmental disclosures to determine what chemicals were being used in the second process. Hence, there is a relative advantage to using non-reportable substances.

37. *See infra*, notes 38–75 and accompanying text.

38. 42 U.S.C. §§ 11001–11050 (1988) (Title III of the Superfund Amendments and Reauthorization Act of 1986, Pub. L. No. 99–499, 100 Stat. 1613 (1986)).

cals,[39] (2) make "community right-to-know" reports to state and local agencies,[40] and (3) report accidental releases which exceed the reportable quantity of a substance.[41]

Trade secrets subject to EPCRA are defined in Section 322(b).[42] A person submitting information may "withhold from such submittal the specific chemical identity (including the chemical name and other specific identification),"[43] and instead substitute "the generic class or category."[44] The basis for withholding must be included with the submittal.[45]

Despite this broad exclusion, EPCRA presents serious obstacles to a successful trade secret program.[46] The protection offered under Section 322 may be of limited benefit. Any person, including a competitor, may seek disclosure of the identity of a chemical claimed as a trade secret.[47] Moreover, a competitor may be able to deduce sufficient process or formula information from the generic class or category alone. Additionally, secret information cannot be withheld from health professionals.[48] Finally, like each of the other statutes below, EPCRA provides that no information may be withheld from Congress on the basis of confidentiality.[49]

b) The Resource Conservation and Recovery Act

The manifest system for hazardous waste management established in the Resource Conservation and Recovery Act ("RCRA")[50] includes a number of reporting requirements. The RCRA allows the EPA Administrator to require any person who generates, stores, treats, transports, or disposes of hazardous wastes to furnish information and provide access for inspection, in connection with regulatory, permitting, or enforcement

39. *Id.* § 11004(b)(2).
40. *Id.* § 11004(a)(2)(B).
41. *Id.*
42. *Id.* § 11042(b). The definition of trade secrets in the Material Safety Data Sheets provisions of the Occupational Safety and Health Act was held to exclude chemical identities readily discoverable by reverse engineering. *See* United Steel Workers of Am. v. Auchter, 763 F.2d 728 (3d Cir. 1985). That interpretation was carried forward in EPCRA.
43. 42 U.S.C. § 11042(a)(1)(A).
44. *Id.* § 11042(a)(1)(B).
45. *Id.* § 11042(a)(2)(A). *See also* 40 C.F.R. § 350 (1990).
46. *See* Horn, *supra* note 33, at 25. *See also* Baram, *supra* note 35, at 143 n.240.
47. 42 U.S.C. § 11042(d). The determination of the sufficiency or insufficiency of the trade secret claim may be challenged judicially by the petitioner, *id.* § 11042(d)(3)(B), or the claimant, *id.* § 11042(d)(4)(b).
48. *Id.* §§ 11042(e), 11043.
49. *Id.* § 11042(i).
50. 42 U.S.C. §§ 6901–6992 (1988).

activities.[51] The information may be protected from public disclosure only if the person providing information shows that it is confidential pursuant to the Trade Secrets Act.[52]

c) The Clean Water Act

The Clean Water Act ("CWA")[53] requires disclosure of point source discharges of pollutants when submitting permit applications and monitoring reports. A permit typically discloses the control technology used to achieve a particular discharge limitation.

Like the RCRA, the CWA permits the EPA Administrator to require the owner or operator of a point source to provide further information relating to effluent standards, limitations, and prohibitions, or to new source performance standards.[54] A competitor can read a permit and easily determine what control technology is being used. The nature of the discharge may also allow competitors to deduce information about the processes creating the discharge. As with the RCRA, the CWA provides some protection for trade secrets.[55] The scope of information protected under the CWA is determined by the Trade Secrets Act.[56]

d) The Clean Air Act

Permit applications and monitoring reports under the Clean Air Act ("CAA")[57] require substantial disclosure of emissions, control technology, and process parameters. In addition, as under the RCRA and the CWA, the EPA administrator may require an owner of an emission source, and others subject to the CAA, to make reports and "provide such other information as he may reasonably require."[58] The CAA requires the information to be publicly available.[59] The CAA establishes

51. *Id.* § 6927(a).
52. 18 U.S.C. § 1905 (1988). *See* Alcolac v. Wagoner, 610 F. Supp. 745 (W.D. Mo. 1985) (rejecting a challenge to EPA's determination that information submitted in a permit application was not entitled to confidential treatment).
53. 33 U.S.C. §§ 1251–1387 (1988).
54. *Id.* § 1318(a)(1).
55. *Id.* § 1318(b).
56. *Id.*
57. 42 U.S.C. §§ 7401–7642 (1988).
58. *Id.* § 7414(a)(1).
59. *Id.* § 7414(c).

protection for confidential information similar to the RCRA and the CWA.[60]

The Clean Air Act Amendments of 1990[61] did not amend the trade secret provisions. They did, however, augment the requirement that control technologies be disclosed to competitors and to the national "MACT/BACT/LAER Clearinghouse," a data bank for federal and state agencies.[62]

e) Federal Insecticide, Fungicide, Rodenticide Act

Commentators note that among the trade secret provisions scattered throughout the environmental laws, those of the Federal Insecticide, Fungicide, and Rodenticide Act ("FIFRA")[63] and the Toxic Substances Control Act ("TSCA")[64] impose the greatest restrictions on the scope of trade secrecy.[65]

For registration of pesticides under the FIFRA, Congress has required registrants to submit a wide range of data regarding the pesticide's effects. The registrant may rely on data provided by others in registering a similar pesticide.[66] In *Ruckelshaus v. Monsanto Co.*,[67] the Supreme Court upheld EPA's authority to disclose confidential health, safety, and environmental data concerning pesticides, in reviewing subsequent registrations. The Court found that the possibility of disclosure is one price of dealing with pesticides.[68] The FIFRA provides for compensation to the person whose data is disclosed in connection with evaluating another person's application.[69] The compensation is intended to cover the costs for data collection and may be inadequate to protect fully the person whose data is disclosed.

The FIFRA otherwise restricts disclosures of confidential information.[70] Specifically, the FIFRA provides that it is unlawful for any

60. *Id.* § 7414(d).
61. Pub. L. No. 101–549,104 Stat. 2399 (1990).
62. *Id.* §§ 102(d), 108(c).
63. 7 U.S.C. §§ 136–136y (1988).
64. 15 U.S.C. §§ 2601–2671 (1988). *See infra* notes 72–74 and accompanying text.
65. *See* W. RODGERS, *supra* note 3, § 6.2(B), at 386 n.55.
66. 7 U.S.C. § 136a.
67. 467 U.S. 986 (1984).
68. *See id.; see also* McGinley, *Regulatory 'Takings': The Remarkable Resurrection of Economic Substantive Due Process Analysis in Constitutional Law*, 17 Envtl. L. Rep. (Envtl. L. Inst.) 10369, 10376 (1987) (approving the result in *Monsanto*).
69. 7 U.S.C. § 136a(c)(1)(D)(ii).
70. *Id.* § 136h.

person "to use for his own advantage or to reveal" confidential information acquired under the act.[71]

f) The Toxic Substances Control Act

The TSCA provides that information exempt from disclosure under the FOIA[72] may nevertheless be disclosed to federal agencies and federal contractors if necessary to protect health or the environment.[73] Health and safety studies are not protected from disclosure.[74] A company dealing extensively with toxic and hazardous substances may have difficulty maintaining trade secrets.

g) The Safe Drinking Water Act

All suppliers of water are subject to the inspection and disclosure requirements of the Safe Drinking Water Act ("SDWA").[75] Section 300j-4(d) of Title 42 of the United States Code provides that such information can be maintained confidentially unless it relates to the level of contaminants in drinking water. In that situation, the public health would warrant disclosure.

4. Special Issues in Litigation and Enforcement Proceedings

Each of the preceding statutes provides that confidential information may be used in any proceeding under the statute. The risk of trade secret disclosure is highest in a civil or criminal enforcement proceeding. Particularly, the agency is likely to scrutinize closely any confidentiality claim.

Protection of trade secrets is one reason to avoid enforcement proceedings. Conversely, those responsible for environmental enforcement should consider trade secret disclosure problems in exercising their prosecutorial discretion. Trade secrets are also at risk in civil litigation. For example, a private party may bring an action for damages.[76] In court

71. *Id.* § 136j(a)(2)(D).

72. 5 U.S.C. § 552(b)(4) (1988).

73. 15 U.S.C. § 2613 (1988).

74. *Id.* § 2613(b)(1). Processes and proportions of chemicals in a mixture are not subject to disclosure by the agency. *Id.*

75. 42 U.S.C. § 300j-4 (1988).

76. Some information may be protected by discovery rules. Attorney-client privilege and work product doctrine may provide immunity from disclosure in discovery. Information assembled in the course of an audit of environmental compliance status and exposure may be subject to a privilege for self-critical analysis. *See* Leonard, *Codifying a Privilege for Self-Critical Analysis* 25 HARV. J. ON LEGIS. 113 (1988).

and in some administrative proceedings, a protective order may possibly limit disclosure. The reasons for public disclosure may be balanced against the disincentive to innovation created by interference with trade secrets.[77]

Another aspect of environmental enforcement applies to potential "whistle blowers" who may feel constrained by a confidentiality agreement against publicly reporting environmental hazards. Yet, one who does not report a release of hazardous substances may not be able to claim protection under the Fifth Amendment privilege against self incrimination.[78]

B. Patent Law

Legal procedures for recognizing and rewarding invention were put in place in the eighteenth century. Patent law provides a well-established system for promoting innovation in environmental technology.

The origins of patent protection in the United States are found in the Constitution. "The Congress shall have Power . . . To promote the Progress of Science and useful Arts, by securing for limited Times to . . . Inventors the exclusive Right to their . . . discoveries."[79] A patent is a grant from the government to an inventor, conveying "the right to exclude others from making, using, or selling the invention throughout the United States."[80] "Inventors disclose what they have discovered or invented, and society rewards them with a patent."[81]

The Patent Act of 1952[82] codifies the procedural and substantive requirements of the patent system. "Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of [the Patent Act]."[83] Patentees are entitled to enforce their patents against infringers.[84]

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77. *See* Ashford & Heaton, *supra* note 4, at 129.

78. The scope of protection is quite narrow. The CWA, for example, provides only a qualified immunity for failure to disclose an oil spill. 33 U.S.C. § 1321(b)(5) (1988).

79. U.S. CONST. art. I, § 8, cl. 8.

80. 35 U.S.C. § 154 (1989).

81. Merges, *supra* note 12, at 808 (calling the dual functions of the system the "disclosure" function and the "reward" function).

82. 35 U.S.C. §§ 1–376 (1989).

83. *Id.* § 101. There are also provisions for plant patents, *id.* §§ 161–164, and design patents, *id.* §§ 171–173.

84. "[W]hoever without authority makes, uses or sells any patented invention, within the United States during the term of the patent therefor, infringes the patent." *Id.* § 271.

A patentee may obtain an injunction against infringement,[85] or a reasonable royalty and lost profits.[86] Damages may be trebled,[87] and in exceptional cases attorney fees can be awarded.[88]

1. Obtaining a Patent

The substantive requirements for obtaining a patent include: (a) invention—a concept reduced to practice; (b) novelty—not known or used by others prior to invention and not published, in public use or on sale within one year prior to the date of the patent application,[89] and (c) non-obviousness—the "subject matter as a whole would [not be] obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains."[90]

The process for obtaining a patent, called prosecution, requires submitting an application which meets the substantive requirements of the Patent and Trademark Office ("PTO").[91] During prosecution, claims may be rejected and amended, and supplemental information can be submitted. Ultimately, a patent will be issued or the application will be abandoned. After issuance, a patent conveys a 17 year grant of exclusive rights, subject to payment of maintenance fees.[92]

2. Patent Law and Environmental Technology

Patents can protect inventors of advances in pollution control equip-

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85. *Id.* § 283.

86. The patentee can recover "damages adequate to compensate for the infringement but in no event less than a reasonable royalty for the use made of the invention by the infringer, together with interests and costs as fixed by the court." *Id.* § 284.

87. *Id.*

88. *Id.* § 285. The largest patent infringement award to date was $900 million, awarded to Polaroid. *See* Polaroid Corp. v. Eastman Kodak Co., No. 76–1634–MA (D. Mass. 1990) (1991 U.S. Dist. LEXIS 344).

89. *See* 35 U.S.C. § 102.

90. *Id.* § 103. *See* Merges, *supra* note 12, at 511–12 (fuller discussion of the basic requirements for obtaining a patent).

91. An application has two principal parts: a specification and claims. A specification is "a written description of the invention and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and . . . the best mode contemplated by the inventor of carrying out his invention." The claims must "particularly [point] out and distinctly [claim] the subject matter which the applicant regards as his invention." *Id.* § 112.

92. *Id.* § 154. For pharmaceutical patents, the term may be extended to make up for delays in obtaining Food and Drug Administration approval. *Id.* § 155.

ment and other environmental technology.[93] The following discussion touches on some areas of patent law peculiar to environmental technology.

Some patents for environmental technology were issued well before the start of the environmental movement in 1970.[94] The real boom in air pollution control technology, as with most environmental technology, began in the 1970s;[95] patent disputes followed. For example, *John Zink Co. v. National Airfoil Burner Co.*[96] involved a patented nozzle designed for smokeless emission of refinery waste gas. The court weighed environmental protection as a factor supporting validity in upholding the patent: the nozzle, invented "years before the popular concern with air pollution and the environment . . . is precisely the kind of invention the framers of the Constitution wanted revealed and protected."[97] Thus, the environmental benefits of a patented invention can bolster the validity of a patent in an infringement lawsuit.[98]

The patent regulations were amended in 1982 to provide for faster processing of environmental patents.[99] These regulations permit a patent application for environmental technology to be made "special" and receive swifter processing. Environmental inventions are those which "will materially enhance the quality of the environment or materially contribute to the development or conservation of energy resources."[100]

These regulations have not resulted in any great shift toward more

93. *See* Gollin, *supra* note 10, at 10171.

94. For example, U.S. Patent No. 32,879, issued in 1861, and No. 74,260, issued in 1868, relate to a process for removing ink from paper for purposes of recycling. U.S. Patent No. 266,383, issued in 1882, relates to a process for recycling worn out corsets as paper. The vast majority of patents for environmental technology, however, have been issued comparatively recently. Air pollution control patents, for example, first appeared in the 1950s. U.S. Patent No. 2,740,693, issued in 1956, relates to a flue gas scrubber, and U.S. Patent No. 2,970,886, issued in 1958, claims a catalytic converter for removing hydrocarbon from automobile exhaust. As a final example, U.S. Patent No. 3,325,401, issued in 1967, claims a process for pretreating acidified cooling water before discharge.

95. The boom in air pollution control innovation is no doubt immediately related to the passage of the CAA. However, the act itself is a sign of heightened environmental awareness.

96. 613 F.2d 547 (5th Cir. 1980).

97. *Id.* at 559. *But see* I.U. Technology Corp. v. Research-Cottrell, Inc., 641 F.2d 28 (5th Cir. 1981) (patent for stabilizing fly ash and scrubber sludge held obvious in light of prior cement technology).

98. *See also* Environmental Designs v. Union Oil Co., 713 F.2d 693, 697 (Fed. Cir. 1983).

99. *See* 37 C.F.R. § 1.102(c) (1990); *see also* 47 Fed. Reg. 41,276 (1982).

100. 37 C.F.R. § 1.102(c).

rapid issuance of patents for environmental technology.[101] One possible explanation is that applicants, in many instances, are satisfied with a delay in processing if the subject invention is not yet commercialized. Delay in commercialization is common with an experimental environmental technology that has many regulatory hurdles to overcome. By delaying patent issuance, the patent applicant can extend the seventeen year term of the patent (which runs from patent issuance) into the more lucrative later years of the technology instead of the early, non-commercial years.

Making an application special may have no practical effect in some technological areas. The particular subgroup of patent examiners assigned the application may handle principally environmental technology patents. If most of the applications assigned to them were made special, the examining group would not be able to process the applications any faster. In examining groups which cover a broader range of technologies, a special application may be more significant in reducing time to issuance.[102]

In sum, the patent system offers many opportunities to enhance environmental technology innovation. Environmental patents should be made stronger and easier to obtain. Information from the patent literature should remain readily available to innovators and those seeking licenses for compliance purposes. Legislation and regulation affecting patent licenses must balance the interests of patentees and those required to use patented environmental technologies.[103]

C. Trademarks

Trademark protection is relevant to environmental technology for several reasons. The trademark for an environmental product may be critical to its commercial success. The trade name and service marks of a services company are important assets. Trademarks are often treated

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101. The PTO unit responsible for examining most of the chemical industry's patent applications, for example, received 13 petitions under Section 102(c) between October 1, 1990 and April 1, 1991. Two thirds were granted. During the same period, 4500 applications were submitted to the unit overall. Interview with B. Richman, Director, Group Art unit 130 (Apr. 9, 1991).

102. The PTO can facilitate the prosecution of environmental technology patents without regulatory reform by refining the classification of environmental patents, so as to make searching the state of the art easier, and by providing adequate examiner training in newer environmental technologies, such as monitoring equipment, pollution prevention approaches, and recycling. The difficulty is that many environmental technologies cross typical classifications. In any event, the PTO should assure that environmental technology applications are examined by examiners experienced in the particular area.

103. *See infra* Section III.

together with trade secrets and patents in licensing arrangements. Trademarks and the law of unfair competition govern the evolving efforts to introduce green labelling.[104]

Trademarks are designed to identify the origin of goods or services; prevent mistake, deception and confusion with regard to origin; and protect goodwill.[105] Trademark protection, like trade secret protection, has both federal and state components.[106] Federal registration prevents use of a mark where it would "be likely to cause confusion, or to cause mistake or to deceive."[107] Common law provides certain additional protections.[108] The Lanham Trademark Act creates a federal cause of action for unfair trade practices in addition to a cause of action for infringement of a registered trademark.[109]

Domestic and foreign trademark registrations and common law trademark protections are important to the success of any product or service. Since consumers are increasingly interested in environmentally safe products, trademark law can define the market for consumer environmental products.

The recent advent of "green labelling" implicates trademark rights. Examples include statements regarding the environmental characteristics of a product, names connoting environmental benefits, and certification of environmentally benign characteristics by independent organizations such as Green Seal, Inc. and Green Cross Certification Co. These competing non profit companies promote their "seal-for-sale" programs as

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104. *See infra* notes 110–11 and accompanying text.

105. *See* 15 U.S.C. § 1052 (1988).

106. In contrast, patent and copyright law are strictly federal, and preempt conflicting state protection. *See* Sears, Roebuck & Co. v. Stiffel Co., 376 U.S. 225 (1964); Compco Corp. v. Day-Brite Lighting, 376 U.S. 234 (1964).

107. 15 U.S.C. § 1114.

108. *See* B. Keller & L. Reisner, *Checklist of Trademark-Related Causes of Action and Defenses, Including Sample Pleadings,* in M. BENDER, INTELLECTUAL PROPERTY COUNSELING AND LITIGATION § 57.07 (1990). Palming off one's work as the work of another can provide a basis for relief. Dilution of a trademark by use of a similar name in a different market can be prevented, even without a likelihood of confusion. Individual rights of privacy are also protected by common law or by statute in many states. For example, New York prohibits use of someone's likeness unless a written agreement is made. N.Y. CIV. RIGHTS § 50 (1909).

109. The elements of a Lanham Act unfair trade practice claim are:

(1) False statements regarding products or services,
(2) Likelihood of consumer deception,
(3) Materiality of the deception to the purchasing decision, and
(4) Likelihood of injury to defendant.

See 15 U.S.C. § 1125(a).

alternatives to government certification.[110] The Federal Trade Commission and some state Attorneys-General are investigating environmental advertising for possible unfair or deceptive claims.[111]

Some states have taken action to implement green labelling as well. For example, the New York Department of Environmental Conservation ("DEC") adopted regulations governing the use of state-authorized emblems on packaging and products which are reusable, recycled, or recyclable.[112] The DEC plans to maintain a registry of products authorized to use the emblems. The state labelling system is a creative approach that allows companies to achieve a competitive advantage for environmentally beneficial products. The opposite approach, one requiring companies to label products with warnings or labels disclosing the environmental harmfulness of their products, creates a competitive disadvantage.[113] These approaches exemplify use of trademark concepts as an instrument of environmental policy.

D. International Protection of Intellectual Property

Environmental problems have become international concerns. International transfer of and trade in environmental technology can make appropriate technology available where it is needed. Intellectual property plays an important role in technology transfer and trade.[114] International intellectual property rights serve as an incentive for inventors to create new technologies. They also provide the currency for transfers of environmental technology.

The industrialization and economic strength of a country often correspond with: (1) the comprehensiveness of the country's intellectual property protection, (2) its consistency with and adherence to

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110. *See* Harris, *Enviro-Seals Jockey for Public Approval*, ENV'T TODAY, Nov./Dec. 1990, at 1.

111. *See* Smith, *Environmentalists, State Officers See Red as Firms Rush to Market Green Products*, Wall St. J., Mar. 13, 1990, at B1.

112. *See* 6 N.Y. COMP. CODES R. & REGS. tit. 6 § 368 (1990). California has an analogous system for organically raised agricultural products. *See* the labelling provision of the California Organic Foods Act of 1990, CAL. HEALTH & SAFETY CODE § 26569.24 (West 1990).

113. The European Economic Community is considering a directive that would require certain ecologically damaging chemicals to carry the symbol of a dead fish washed up at the foot of a barren tree. Such a symbol could drastically reduce demand for a consumer product.

114. The Montreal Protocol on Substances that Deplete the Ozone Layer has extensive provisions regarding the transfer of technologies that reduce greenhouse gases. *See* Petsonk, *The Role of the United Nations Environment Programme (UNEP) in the Development of International Environmental Law*, 5 AM. U.J. INT'L LAW & POL'Y 351, 371 n.123 (1990). Such transfers of technology involve major shifts in intellectual property assets.

international accords, (3) the degree of inventiveness required to obtain a patent, and (4) the uniformity with which domestic and foreign rights are treated.[115] Countries also vary widely in the stringency of environmental regulation and the likelihood of enforcement against violators.

A number of international treaties and conventions have attempted to harmonize the laws applicable to patents and other intellectual property rights.[116] But many differences remain.[117] Different procedures and standards for patent rights can impede technology transfer. Similarly, ownership and licensing policies can promote or hinder transfers of environmental technology.

Countries have divergent views on how patent systems should be used in international transfers of environmental technologies. Developed countries favor strong protections in order to promote economic and technical progress. Developing nations "hold that the level of protection should conform with overall economic and development policies of the recipient countries."[118] These policies tend to favor reduced protection for intellectual property to allow greater use of technology. Unfortunately, poor protection is likely to lower the level of environmental technology available in developing nations.

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115. *See* Creel & Wintringham, *Patent Systems and Their Role in the Technological Advance of Developing Nations*, 10 RUTGERS COMPUTER & TECH. L.J. 255 (1984). The benefits of having a patent system are many. First, it encourages disclosure in the native language of a technical literature. Second, the existence of a patent system protects the efforts and investments of inventors. Third, patent laws can encourage the availability of a technology in the subject nation, by means of working requirements, which require a patentee to use a technology in the country or lose exclusive rights, and through compulsory licenses. *Id.* Innovation also depends on the level of private and public support for research and development, the quality of education and training, governmental efforts to promote state of the art technology, and geographical factors. For example, high energy and waste disposal costs have led Japan and the European community to develop advantages in energy efficiency and recycling.

116. These include the Paris Convention of 1883, the World Intellectual Property Organization, established in 1967, the Patent Cooperation Treaty of 1970, and the Strasbourg Convention. *See* D. CHISUM, PATENTS § 14.02 (1990). *See also* Creel & Wintringham, *supra* note 115, at 265–74. Similar treaties harmonize copyright and trademark protection around the world.

117. In particular, the required level of novelty and inventiveness varies. Also, some countries have particular restrictions on the subject matter that may be patented. Restrictions on inventions relating to energy and transport, nuclear power, living organisms and chemical inventions continue to exist in some countries. *See* Creel & Wintringham, *supra* note 115, at 275. Historically, some countries have not allowed patents on antipollution technology. *See id.* at 297–300. The trend is to allow patents for environmental technology, and signatories of the Patent Cooperation Treaty may impose no limitations.

118. WORLD METEOROLOGICAL ORGANIZATION/UNITED NATIONS ENVIRONMENTAL PROGRAM INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE: THE IPCC RESPONSE STRATEGIES (1991).

E. Property Rights in Biodiversity

New approaches are possible for creating and protecting intellectual property rights. An intellectual property right gives the holder reasons for protecting the asset and developing it. This principle may be applied creatively to encourage conservation of natural resources. An example of this approach is convervation of biodiversity by creating a system of genetic property rights in indigenous species found in habitats such as rainforests and coral reefs.[119]

Experts agree that the best way to protect biodiversity and eliminate destruction of rainforests and coral reefs is by guaranteeing economic benefits to the custodians of those resources.[120] Grants of proprietary rights may permit such a system to develop through private agreement and international initiatives.

For example, a company may isolate a useful substance from a rainforest plant. The genetic material from the plant may be used to produce a profitable medication by means of biotechnology. In the absence of an agreement regarding property rights in the genetic material, those responsible for maintaining the rainforest receive no benefit from the new discovery which uses these resources. A number of pharmaceutical companies have voluntarily paid royalties to the custodians of rainforests in exchange for the right to isolate products from the rainforests. This system provides incentives for nations and organizations to conserve genetically important ecosystems. Therefore, those resources will not be destroyed and will remain available to future generations.

Implementing a system of proprietary rights in genetic material involves many practical and political problems. A full discussion is beyond the scope of this Article.[121] Arrangements would include foreign

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119. Rainforests and coral reefs can be viewed as a genetic library of useful biological products. The rosy periwinkle, a rainforest plant, is the source of vincristine and vinblastine, important leukemia medications. *See, e.g.*, Meadows, *Don't Send the Gene Pool Down the Drain*, N.Y. Newsday, May 24, 1990, at 81. Sponges and soft corals produce useful antiviral agents and analgesics.

120. *See* Petsonk, *supra* note 114, at 388. *See also* York, *Environment and Economics in Developing Countries*, 10 N.Y. ST. B.A. ENVTL. L. SEC. J. 15, 16 (1990) (preserving biological diversity protects jobs, and offers economic advantages to compete with those of developing rainforest tracts).

A different approach to protecting biodiversity is found in the Migratory Bird Treaty, which renders it unlawful to kill or traffic in migratory birds subject to international treaty. 16 U.S.C. § 703 (1990). *See also* the Endangered Species Act, 16 U.S.C. §§ 1531–1544 (1990).

121. A related issue is environmental regulation of biotechnology. Biotechnology holds the promise of providing ecologically-balanced substitutes for chemical pesticides and production processes, and effective hazardous waste treatment through bioremediation. Domestic regulation of biotechnology is a patchwork of rules which may be deterring innovation in pollution prevention and treatment technologies. Moreover, international

and domestic legislation, international accords, participation by institutions like the World Bank, and domestic United States reforms.[122] Those problems make the approach more difficult to achieve, not less worthwhile.

III. LICENSING ENVIRONMENTAL TECHNOLOGY

Intellectual property incentives for innovation depend on the owner's ability to exploit the property through licensing. Environmental regulation can enhance or diminish the ability to profit from innovation. This Section summarizes the considerations that apply to intellectual property licensing, particularly patents. Problems may arise when a patent owner refuses to license the best technology for a particular environmental application. Compulsory licensing provisions affect rights in that situation. Courts, regulators, and licensing parties should seek to balance the licensor's ability to profit from his or her intellectual property against the public interest in using the most appropriate environmental technology. This approach is consistent with the Federal Technology Transfer Act[123] which applies to licensing of government-owned technology.

A. Licensing in General

The scope of a license depends on the business circumstances, the regulatory climate, and the relative bargaining strength of the parties. Licensing negotiation considers the various alternative arrangements available for conveying rights in technology. First, rights may be assigned for a flat fee or a royalty based on sales. Second, the licensee may receive an exclusive license in which the licensor agrees not to license anyone else. Finally, a less favorable alternative is a nonexclusive license in which the licensor is free to license others to use the technology. Various hybrid arrangements can be made, for example by dividing a market regionally, or by market segment. One licensee may

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approaches to biotechnology regulation diverge greatly; harmonization will be difficult. *See* Stewart, *International Aspects of Biotechnology and its Use in the Environment*, 19 Envtl. L. Rep. (Envtl. L. Inst.) 10511, 10513 (1989).

122. A California Court of Appeals decision that a person had a property right in his own genetic material sufficient to support a cause of action for conversion when the genetic material was used to produce a valuable pharmaceutical product without his consent has been overturned. Moore v. Regents of the Univ. of Cal., 271 Cal. Rptr. 146, 793 P.2d 479 (1990), *reversing* 215 Cal. App. 3d 709, 249 Cal. Rptr. 494 (1988) (refusing to extend conversion doctrine for fear of restricting biotechnology research). *See also* Noonan, *Ownership of Biological Tissue*, 72 J. PAT. TRADEMARK OFF. SOC'Y 109 (1990).

123. 15 U.S.C. §§ 3701–3714 (1988); *see infra* Section III.C.

have exclusive rights to use an NO_x removal system for fossil fuel utilities applications, while another licensee receives exclusive rights for the process of solid waste incineration.[124]

Proprietary rights typically conveyed in a license include patents, trade secrets, technical expertise, as well as trademarks, copyrights, and marketing information.[125] The collection of rights depends on the nature of the product or process that is protected. In some instances, outright sale of a unit might be simpler than negotiating a license, such as when the person seeking the technology needs only a machine, rather than a plant or a system.

Placing a value on a license requires analysis of the licensor's investment, prospective benefits from not licensing, and the licensee's potential profit.[126] For example, a company that has found a way to convert a

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124. Antitrust and patent misuse doctrines may limit the extent to which a patentee may refuse to grant a license, tie a patented to an unpatented product, or extend the effective term of a patent. *See generally* D. CHISUM, *supra* note 116, § 19.04. The Patent Misuse Reform Act of 1988 amended 35 U.S.C. § 271 to explicitly eliminate the defense of misuse except where the patentee has market power, as under antitrust doctrine. *See* 35 U.S.C. § 271(d)(5) (1988); Burchfiel, *Patent Misuse and Antitrust Reform: Blessed Be the Tie?*, 4 HARV. J.L. & TECH. 1 (1991) (this volume). *Cf.* USM Corp. v. SPS Technologies, Inc., 694 F.2d 504 (7th Cir. 1982) (Posner, J.).

125. Copyright protection is not considered in this Article. However, it can be a useful tool in connection with other intellectual property rights to prevent infringement and to bolster licensing revenues. For example, copyright may protect:

(1) Operating programs for pollution monitoring equipment,
(2) Process control programs to optimize inputs and wastes,
(3) Display panels, and
(4) Operating manuals, brochures, and specifications.

See 17 U.S.C. §§ 101–810 (1988).

126. In the case of patent licenses, a useful checklist of 15 factors is set forth in the context of determining a reasonable royalty as damages for infringement in Georgia-Pacific Corp. v. United States Plywood Corp., 318 F. Supp. 1116, 1120 (S.D.N.Y. 1970), *modified and aff'd*, 446 F.2d 295 (2d Cir. 1971), *cert. denied*, 404 U.S. 870 (1971). The court described such factors in the context of hypothetical negotiations:

> Where a willing licensor and a willing licensee are negotiating for a royalty, the hypothetical negotiations would not occur in a vacuum of pure logic. They would involve a market place [sic] confrontation of the parties, the outcome of which would depend upon such factors as their relative bargaining strength; the anticipated amount of profits that the prospective licensor reasonably thinks he would lose as a result of licensing the patent as compared to the anticipated royalty income; the anticipated amount of net profits that the prospective licensee reasonably thinks he will make; the commercial past performance of the invention in terms of public acceptance and profits; the market to be tapped; and any other economic factor that normally prudent businessmen would, under similar circumstances, take into consideration in negotiating the hypothetical license.

318 F. Supp. at 1121. The *Georgia-Pacific* approach has been approved by the Federal Circuit. *See* Hanson v. Alpine Valley Ski Area, Inc., 718 F.2d 1075, 1077 (Fed. Cir. 1983).

batch treatment process into a continuous process may reduce its production and compliance costs. By not licensing the technology, the company would retain lower costs than its competitors. Other factors to consider include savings in development time for alternatives, costs of competing technologies, size of the market, and the potential for product liability.

Perhaps the most important factor affecting the value of proprietary rights of environmental technology is the regulatory climate. For example, EPA may determine that a particular technology is the Best Available Control Technology under the CAA.[127] Anyone contemplating constructing a new air emissions source must either license the required technology or undergo a complex process to convince EPA to designate an alternative technology as acceptable.[128] A patentee can achieve a strong bargaining position if the technology is accepted as the standard.[129] The interaction between technology-based environmental regulation and intellectual property rights is discussed further in Section IV.

1. Licensing Out

A company may own technology it wishes to license to others. Licensing out can be used instead of or in addition to in-house use. Typical reasons for licensing include:

(1) The technology is not integrally linked with the company's other technology, and is easy to segment off;
(2) The intellectual property owner has insufficient capacity to satisfy anticipated demand for the end product;
(3) The technology is in a business that is peripheral to the main direction of the patentee's business (*e.g.*, environmental control as opposed to manufacturing);

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127. *See* Wilson, Martin & Friedland, *A Critical Review of the Environmental Protection Agency's Standards for "Best Available Control Technology" Under the Clean Air Act*, 20 Envtl. L. Rep. (Envtl. L. Inst.) 10067, for an analysis of the process EPA follows in reaching such a determination.

128. *Id.* The problem of a super-monopoly may arise in this context. A permit applicant who is required by regulators to use a technology protected by a patent belonging to someone else is in a bind and may be forced to pay an excessive amount to use the technology or may be precluded from using it at all. This "doomsday scenario" may not be common, but colors negotiations over technologies mandated by regulation.

129. *See infra* notes 168–72 and accompanying text, for a discussion of technology based standards. *See also* Magat, *The Effects of Environmental Regulation on Innovation*, 43 LAW & CONTEMP. PROBS. 4, 18 (1979) ("To the extent that a regulatory agency mandates the wide-spread adoption of a new technology developed by a firm, the agency creates a widely-expanded market for the firm's innovation.").

(4) There is serious potential for liability arising from use of the technology;
(5) The patent or trade secret has limited use as a device to block the efforts of competitors (*e.g.*, there are many competing technologies);
(6) The company has little risk of disclosing related technology (as would be more likely for end-of-pipe pollution controls than processes that reduce generation of pollutants); and
(7) High royalties are obtainable.

When more of these factors are present, the patentee or other intellectual property owner has a greater incentive to seek licensees.

2. Licensing In

One alternative for solving technical problems of environmental compliance is to use an invention owned by someone else. Or, one can attempt to design around a patent from known or proven technologies. The risk of liability for infringement is a prime consideration in choosing between these alternatives. Two general questions are involved in evaluating potential liability for all intellectual property. Is the proprietary right valid and enforceable? Is the proposed activity similar enough to the protected property?

One who designs around a patent can attempt to prove that the accused technology does not infringe. Alternatively, the accused infringer can attack the patent's validity. The risk of liability for damages in addition to injunctive relief may be too great to warrant entry into a new technical area without obtaining a license. A competent written opinion from counsel is crucial to inform such a decision. Opinions are also important to avoid treble damages and attorneys' fees for willful infringement.[130]

Similar considerations apply to the decision to use proprietary processes held in confidence by a competitor, where the secrets were learned in a confidential relationship. To avoid misappropriation of trade secrets, licensing the secrets may be necessary. If a secret is not known, but is known to be useful, a license may be the only legitimate way to gain the benefits of the technology. Pollution prevention approaches often involve process changes that are not patentable or publicly discernible but are quite valuable. A license to use such approaches

130. 35 U.S.C. §§284, 285 (1988); *See generally* D. CHISUM, *supra* note 116, §20.03[4][b][v].

may be worthwhile. The risks may not be so high for trade secrets or trademarks as for patents, but it is unwise to invest in a new venture without confidence that there is no exposure for infringement.

B. Compulsory Patent Licensing

Generally, the right to exclude others from making, using, or selling a patented product or process is absolute.[131] In theory, a patentee cannot be forced to make, use or sell the patented invention. In addition, she is not required to license the technology to others. As a result, the most appropriate technology for a given situation may be described and claimed in a patent, and yet cannot be used.

From an economic viewpoint, a patentee would be unlikely to refuse a reasonable offer of payment or royalty. However, a company may refuse to allow competitors to take advantage of a patent in order to bring economic or public relations ruin upon the competitor.

The following subsections address two legal avenues to preventing such actions. One is compulsory licensing under Section 1498 of Title 28,[132] which applies to use of an invention by or for the United States. The other is mandatory licensing of pollution control technologies under the CAA.

1. 28 U.S.C. § 1498

A statutory provision permits the United States and its contractors to use any patented technology upon payment of a reasonable royalty.[133] A federal contractor, subcontractor or any person who uses a technology or manufactures a product for the United States with governmental authorization and consent is protected from exposure to injunction, treble damages, and an award of attorneys' fees in a district court action. Rather, the worst consequences are an action in the Claims Court to determine

131. It is no defense to an infringement action that a patentee refused to license the patent. 35 U.S.C. § 271(d) (1988). In some countries, compulsory licensing provisions permit others to use a patented technology upon payment of a royalty. For example in Canada, a generic drug manufacturer may apply to the Commissioner of Patents for a license to sell a patented pharmaceutical product; licenses requiring a royalty payment of 4% are routinely granted. A compulsory license provision can seriously undercut a patentee's ability to command a high royalty. In the United States, royalties typically range from 5% to 15%. *See generally* D. CHISUM, *supra* note 116, § 20.03[3][d].

132. 28 U.S.C. § 1498 (1988).

133. "[T]he use or manufacture of an invention described in and covered by a patent of the United States by a contractor, a subcontractor, or any person, firm, or corporation for the Government and with the authorization or consent of the Government, shall be construed as use or manufacture for the United States." *Id.* at § 1498(a).

whether a reasonable royalty is due.[134]

The compulsory license statute can protect a party for use of control or cleanup technology. When contracting with a federal agency which requires the use of a patented technology, the contractor may receive governmental authorization and consent specifying use of the patented technology. Such authorization and consent will establish the basis for a defense under Section 1498. Authorization and consent clauses are standard in government procurement contracts.[135] EPA should make available its explicit authorization and consent to use particular environmental technology in permits and enforcement orders as well as contracts. Such authorization and consent will protect those required to use environmentally beneficial technology from exposure to injunctions and increased damages.

Even in the absence of express authorization and consent one could argue that EPA's requirement of particular proprietary technology for a permit to construct or operate a facility constitutes implied authorization and consent. For example, EPA may require a private party to use specific technology pursuant to the national contingency plan in a remedial action pursuant to CERCLA. The use of that cleanup technology would appear to be with the authorization and consent of the United States.

Negotiation of a favorable license will be preferable to litigation in the Claims Court over the reasonable royalty rate. Hence, the application of Section 1498 to environmental patents most likely will be limited to situations where a patentee has refused to grant a license.

The terms of Section 1498 do not specifically include states and municipal corporations within the definition of "person." Section 1498 embodies a policy belief that allowing federal agencies to use patented technologies serves the public good. For the same policy, provisions should be extended to states or towns that use a patented technology for environmental protection. However, the status of states and municipal corporations under Section 1498 remains unclear.[136]

2. *Mandatory Licensing Under the Clean Air Act of 1970*

Alleged infringers may also avoid liability under the mandatory

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134. *Id.*

135. *See* Gelb, *Intellectual Property Clauses in Government Contracts*, in M. BENDER, *supra*, note 15, § 25.03[8].

136. *See* Chew v. State of California, 893 F.2d 331 (Fed. Cir. 1990) (holding that states are immune from patent infringement actions under the 11th Amendment).

license provision of Section 308 of the CAA.[137] Section 308 authorizes the Attorney General to seek a district court judgment requiring licensing on reasonable terms where certain conditions exist:

(1) The patented invention is needed to achieve emission limitations,
(2) No alternative methods are available, and
(3) The patent reduces competition or monopolizes it.[138]

The legislative history limits the provision to patented technologies; mandatory licensing of trade secrets is not included. The legislation was intended to avoid the "super-monopoly" that could result from imposing environmental standards which necessitated use of patented technology. The statute guarantees all producers in a given field an adequate supply of technology with which to meet the statutory obligations of the CAA.[139]

Commentators have criticized Section 308 as precedent for an onslaught of compulsory licensing provisions.[140] However, Section 308 has never been invoked. The fear of compulsory licensing provisions appears unjustified, at least in the environmental arena. Since a patentee still receives a reasonable royalty for use of her invention, the patent system provides a sufficient incentive for innovation.[141]

3. The Chew *Problem*

A potentially greater concern to patentees occurs when the patent is required by environmental regulation, and *no* royalty is available. A recent case illustrates this problem. Marion Chew patented a method for testing exhaust emissions of automobile engines. California's "Smog Check" program required testing of emissions by a process which Chew

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137. 42 U.S.C. § 7608 (1988).

138. *Id.*

139. *See, e.g.*, Schwartz, *Mandatory Patent Licensing of Air Pollution Control Technology*, 57 VA. L. REV. 719 (1971).

140. *See Id.*

141. Accused infringers may avoid being enjoined from use of a patented environmental technology by calling on the district court's equitable discretion. Roche Prod., Inc. v. Bolar Pharmaceutical Co., Inc., 733 F.2d 858, 866–67 (Fed. Cir. 1984) (dictum that injunctive relief for patent infringement is not mandatory, but is based on equitable considerations including public interest). The outcome of such a plea is uncertain. Because of the disruption that can result when a company is enjoined from practicing a technology, reliance on such a plea without a statutory defense in inadvisable.

asserted infringed her patent.[142]

The district court dismissed the complaint based on state sovereign immunity under the Eleventh Amendment and rejected Chew's argument that California's State Implementation Plan under the CAA constituted implied consent to jurisdiction for a federal patent lawsuit.[143]

On appeal, the Federal Circuit held that the Patent Act does not abrogate the state's Eleventh Amendment immunity.[144] The consequence of the decision is that Chew has no remedy for the alleged infringement. This result frustrates the policy of the patent clause. An inventor whose invention is adopted as part of a regional strategy for pollution control should receive a reasonable reward. Since Chew was not compensated, inventors are informed that the patent system may not protect patents from infringement by the states.

The court suggested a number of other possible actions or grounds for recovery. Chew had filed a claim with the State Board of Control, but it was rejected.[145] Chew could have brought a state court action.[146] An action in the Court of Claims under 28 U.S.C. § 1498 might be possible,[147] but a state is not clearly a person under Section 1498, or subject to jurisdiction in the Claims Court. A takings action could challenge an uncompensated regulatory taking based on the Fifth Amendment provision that private property shall not be taken for public use without just compensation.[148] Chew still may not have recovered in any of these proceedings.

The only certain way to solve the *Chew* problem is by legislative reform. The Patent Act should be expressly amended to permit patent infringement claims against a state.[149] Alternatively, 28 U.S.C. § 1498 could be amended to ensure that a state is subject to suit when it requires use of a patented technology as part of a regulatory program.

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142. *See Chew*, 893 F.2d 331. Chew asserted that implementation of the program injured her. Ordinarily, a patentee is "injured" by delay in implementation of a regulatory program that would require use of her patented device. *See* Clean Air Constituency v. Cal. State Air Resources Bd., 114 Cal. Rptr. 577, 523 P.2d 617 (1974) (manufacturers of pollution control devices were successful in obtaining a writ requiring the state board to implement a nitrogen oxide control program using their technology).

143. *See Chew*, 893 F.2d at 333.

144. *Id.* at 331.

145. *Id.* at 332–33.

146. *Id.* at 336.

147. *Id. See supra* text accompanying note 136.

148. *See* U.S. CONST. Amend. V. The Federal Circuit distinguished takings by a state from takings by Congress. *Chew*, 893 F.2d 331. *See* McGinley, *supra* note 68, at 10376 (criticizing Supreme Court regulatory takings analysis as insufficiently concerned with the public interest in environmental protection).

149. CERCLA, for example, permits an action against a state, abrogating the state's Eleventh Amendment immunity. Pennsylvania v. Union Gas Co., 491 U.S. 1 (1989).

C. Licensing Government-Owned Inventions

The preceding discussion addressed problems that can occur when the government requires use of privately patented technology. The relationship of private use to government-owned inventions is more clearly defined.

The Federal Technology Transfer Act ("FTTA")[150] encourages collaboration between business and government by means of cooperative research and development agreements. The central focus of the statute is a provision that allows federal agencies to license or assign federally-owned inventions. The FTTA is intended to increase such activity.[151] Federal agencies and employees may retain royalties from federally-owned inventions as incentives for innovation and technology transfer. Pursuant to the FTTA, a federal laboratory may provide personnel, services, facilities, equipment, technology, and other resources to collaborative ventures, but funding must come from the collaborating company.

Department of Commerce regulations[152] govern the granting of licenses by federal agencies. Pursuant to the regulations, a notice of availability must be announced in the Federal Register three months before granting an exclusive license. Notice of the prospective exclusive licensee is also required.[153] Application for a license must include the applicant's business plan.[154]

Over five million dollars in licensing fees were received by the United States in 1989.[155] EPA has over 100 patents relating primarily to wastewater treatment, air pollution control, and sampling devices. EPA has instituted a program pursuant to the FTTA to facilitate transfer of the agency's technology.[156]

Federal agencies and state environmental protection agencies should encourage collaborative research efforts in order to facilitate innovation.[157] The licensing and royalty provisions of the FTTA should be applied to such ventures to ensure that inventors receive a share of the income derived from patents and other intellectual property.[158]

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150. 35 U.S.C. §§ 3701–3714 (1988).

151. *See id.*

152. *See, e.g.*, 37 C.F.R. § 404 (1985).

153. *Id.*

154. *Id.*

155. *See* Parker, *Licensing of Government Owned Inventions: A Primer for the Licensing Executive*, LICENSING EXECUTIVE SOC'Y TECH. TRANSFER CONF. REP. Appendix D (1990).

156. *See* Gollin, *supra* note 10, at 10173.

157. National and regional testing centers for innovative technologies have been recommended. TIEC/NACEPT REPORT, *supra* note 4, at 30–38.

Governmental agencies can serve the public interest in environmental protection by balancing individual proprietary rights against the larger goal of promoting progress in environmental technology.

IV. REAPING ECONOMIC BENEFITS FROM ENVIRONMENTAL COMPLIANCE

Technology-forcing environmental statutes and regulations create a market for environmental technology.[159] A detailed survey of technology-forcing regulations as incentives to innovate is beyond the constraints of this Article.[160] Instead, this Section describes how ecological and economic goals are combined and focuses on ways environmental law can create opportunities for innovation. The Section concludes with practical suggestions on how to reap the benefits of innovation by auditing environmental technology and tracking the state of the art.

Environmental law seeks to balance the antithetical interests of those who favor economic development, whatever the damage to the environment, and those who favor preserving nature, whatever the economic cost.[161] Often, these interests are pitted against one another. A better approach would be to find ways to combine economic and environmental goals. Technical and economic progress do not need to come at the expense of the environment. Environmental protection should be economically attractive.[162] The Clean Air Act Amendments exemplify

158. *See id.* at 36.

159. *Id.* at 5. Uncertainties, costs, and delays in the application of permit and compliance regulations create major disincentives for innovation. *Id.* at 4–5. Best available technology standards, in particular, tend to lock in a particular technology and reduce the opportunities for ingenuity. *Id.* at 16–17.

160. See notes 3–4, *supra*, for references to various informative surveys.

161. *See* Commoner, *Failure of the Environmental Effort*, 18 Envtl. L. Rep. (Envt'l L. Inst.) 10195, 10196 (1988), for one outspoken critic's opinion on the linkage between technical progress and environmental destruction. Others recognize that the changes wrought by human technology are themselves part of the self-regulating systems on the planet. *See* J. LOVELOCK, GAIA (1979). Lovelock's theory is devoid of the mystical attachment to the earth-as-organism often described as the Gaia hypothesis. To the contrary, he posits that "pollution is natural," *id.* at 108, and asserts "[t]he very concept of pollution is anthropocentric and it may even be irrelevant in the Gaian context." *Id.* at 110. Lovelock points out that much manmade pollution is minuscule as compared to global ecological equilibria, *id.* at 110–22, but he recognizes that destruction of ecosystems at the continental shelves and in rainforests may have cataclysmic effects. *Id.* at 123–40.

162. T. WIRTH, J. HEINZ, & R. STAVINS, PROJECT 88: HARNESSING MARKET FORCES TO PROTECT OUR ENVIRONMENT: INITIATIVES FOR THE NEW PRESIDENT: A PUBLIC POLICY STUDY, 8 (1988). PROJECT 88 refers to the approach of harnessing market forces to spur both technological advance and sustainable management of national and global natural resources as a "new environmentalism." *See id.* at 1; Stewart, *Economics, Environment, and the Limits of Legal Control*, 9 HARV. ENVTL. L. REV. 1, 4 (1985) (discussing the need for environmental technology-forcing strategies to keep up with economic growth).

this approach. They signal a new era of integration between environmental and economic values.[163]

Since passage of the National Environmental Policy Act in 1969 ("NEPA"),[164] technology-forcing provisions have been central to environmental regulation.[165] Technology-forcing provisions presuppose and rely on advances in the state of the art of environmental technology to bring about improvements in environmental protection. In seeking to reduce air, earth, and water pollution, Congress has set technology-based standards requiring increasingly stringent levels for compliance.[166] Invention and innovation are expected to keep improving the state of the art for pollution control, and industry must keep up with the advancing edge. As older facilities are upgraded or shut down, the trailing edge of technology advances as well.[167]

Technology-based standards[168] include:

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163. Pub. L. No. 101–549 was signed into law by President Bush on November 15, 1990. The law is 877 pages long and incorporates many novel approaches toward achieving clean air by balancing environmental, energy, and economic concerns. The amendments are notable for their emphasis on using market incentives to reduce air pollution by emissions trading and through credits for voluntary early emissions reductions. EPA Administrator William Reilly has announced that EPA is seeking to integrate environmental and economic goals in all new EPA initiatives. *See* 21 Envt'l. Rep. (BNA) 1736 (1991).

164. 42 U.S.C. §§ 4321–4361 (1988). The main thrust of NEPA was to require environmental impact review for federal actions, but the Congressional declaration of national environmental policy in NEPA can be viewed as the starting gun for the environmental legislation that followed. *Cf.* Sive, *Some Thoughts for Environmental Lawyers in the Wilderness of Administrative Law*, 70 COLUM. L. REV. 612, 645–50 (1970).

165. *See, e.g.*, ENVIRONMENTAL LAW INSTITUTE, *supra* note 3, §§ 3.02, 3.03, 3.07.

166. *See* 2 W. RODGERS, *supra* note 3, § 2.7(c).

167. Technology-forcing "command and control" environmental statutes generally share certain assumptions about technology:

(1) The level of environmental technology in use provides inadequate environmental protection;
(2) Improved environmental protection can be obtained through technological advance;
(3) Industry does not uniformly and promptly replace existing technology with improved environmental technology, unless legally required to do so;
(4) Improvements in environmental technology can best be achieved by setting technical standards for new facilities and processes; and
(5) Old facilities with more harmful technology may be grandfathered to one degree or another because the costs of improvements are too high.

Stewart, *Regulation, Innovation, and Administrative Law: A Conceptual Framework*, 69 CALIF. L. REV. 1259, 1270 (1981). Stewart finds that command and control regulation is unsuccessful in bringing about efficient innovation, and recommends several measures, including decentralized economic incentives for innovation. *Id.* at 1373–75.

168. The process employed by EPA to set standards is intended to set specific emissions limitations, rather than technical standards; in order to promote innovation in practice, specific technologies are frequently required. *See* Wilson, Martin & Friedland, *supra* note 127, at 10073–74 (discussing standards under the CAA). *See also* TIEC/NACEPT REPORT, *supra* note 4.

(1) Lowest achievable emissions rate ("LAER"),[169]
(2) Best available control technologies ("BACT"),[170]
(3) Best practical control technology ("BPT"), best conventional control technology ("BCT") or best available and economically feasible control technology ("BAT"),[171] and
(4) Best demonstrated available treatment ("BDAT").[172]

The new CAA Amendments continue these principles by relying on innovation to improve the state of the art of air pollution control. For example, new sources of air emissions must obtain the maximum achievable reduction in emissions achieved by the best controlled similar source ("MACT").[173] The standard is to be set based on the average of the best performing twelve percent of existing facilities.[174]

The current regime of environmental regulation effectively restricts the use of many harmful technologies, but does not effectively promote innovation in beneficial technologies. Intellectual property may provide better incentives. The designation of a particular technology as satisfying one of the above standards can actually stifle innovation by forcing industry to accept a particular technical solution. Another technology may be more appropriate, economical, or effective. Regulation that sets a performance-based standard would appear more effective at stimulating innovation. Each member of the regulated community can find the most effective way to achieve the necessary level of control.[175]

Our economy prefers market forces over command and control regulation for driving environmental technology. The role of intellectual property rights in rewarding inventors and in providing currency for the market in environmental technology should be enhanced.

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169. The LAER standard is applied with the New Source Performance Standards of Section 111 of the CAA, 42 U.S.C. § 7411 (1988).

170. The BACT standard is applied pursuant to National Emissions Standards for Hazardous Air Pollutants under Section 112 of the CAA. *Id.* § 7412.

171. BPT, BCT, and BAT standards are set under Sections 301–02 of the CWA, 33 U.S.C. §§ 1311–1312 (1988).

172. BDAT is a relevant standard under Section 3004(m) of the RCRA, 42 U.S.C. § 6924(m) (1988), and the requirements of Section 3004(o), *id.* § 6924(o).

173. Section 301 of the CAA Amendments of 1990. Pub. L. No. 101–549, 104 Stat. 2540 (1990). Many thousand previously unregulated sources are subject to the new requirement of obtaining a permit. Sive & Hall, *Clean Air Amendments Mean More Litigation*, Nat'l. L.J., Dec. 24, 1990, at 15.

174. Section 301 of the CAA Amendments of 1990. Pub. L. No. 101–549, 104 Stat. 2540 (1990).

175. *See* Magat, *supra* note 129, at 18; LaPierre, *supra* note 3, at 805; Gollin, *supra* note 10, at 10173; and TIEC/NACEPT REPORT, *supra* note 4, at 46. In practice, both technology-setting and performance-based standards may be found together in one regulatory framework, such as under the CWA. *See* 33 U.S.C. §§ 1311–1312 (1988).

B. Environmental Technology Management

Technology-forcing regulatory standards create a moving target.[176] Constantly changing environmental standards present risks and opportunities. A company cannot be sure how its technology compares to regulatory standards and hence whether it is in compliance. The company must take steps to audit its own technology and to track environmental protection technology. As to opportunities, a company may engage in strategic planning by attempting to forecast developments in regulatory obligations. A competitive advantage may be gained or retained by inventing and protecting technology that is important for compliance. Such strategic planning combines aspects of environmental compliance management with intellectual property management and allows a company to benefit from environmental compliance.

1. An Environmental Technology Audit

Environmental technology management is necessarily a hybrid of intellectual property and environmental management techniques. Intellectual property practitioners find benefits in conducting a technology audit.[177] An assessment of proprietary rights helps protect intellectual property assets and can reduce or eliminate liability for infringing the rights of others.[178] Environmental audits have also become increasingly commonplace as managers seek to verify compliance with environmental requirements and assess risks created by hazardous materials and practices.[179] The Exxon Valdez oil spill, for example, increased pressure

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176. *See* Stewart, *supra* note 167, at 1271–72.

177. *See, e.g.*, Rein, *The Technology Audit: A Single Step toward Greater Competitiveness*, 1 J. PROPRIETARY RIGHTS 12 (1988); G. SMITH & R. PARR, VALUATION OF INTELLECTUAL PROPERTY AND INTANGIBLE ASSETS, (1989); M. EPSTEIN, MODERN INTELLECTUAL PROPERTY, 519–36 (2d ed. 1989); Greeley, *Role of Patent Attorneys in Corporate Acquisitions and Divestments*, 17 A.I.P.L.A. Q.J. 20 (1989).

178. Reliance on a competent written opinion of counsel that a new product or process does not infringe a particular patent can preclude a finding of willful infringement; otherwise, an infringer may be liable for treble damages and attorney's fees. *See* Central Soya Co. v. Hormel, 723 F.2d 1573 (Fed. Cir. 1983).

179. *See* 51 Fed. Reg. 25,004, 25,006 (1986) (EPA's Environmental Auditing Policy Statement). *See also*, F. FRIEDMAN, PRACTICAL GUIDE TO ENVIRONMENTAL MANAGEMENT (1988); EDISON ELECTRIC INSTITUTE, ENVIRONMENTAL AUDITING SKILLS AND TECHNIQUES WORKBOOK (1987); EDISON ELECTRIC INSTITUTE, ENVIRONMENTAL SYSTEMS MANAGEMENT ASSESSMENT WORKBOOK (1989); U.S. v. Browning-Ferris Indus. Chem. Serv., 704 F. Supp. 1355 (M.D. La. 1988).

on industry to audit environmental compliance and impact.[180]

The first step in conducting an audit is to select an auditor. Depending on the size of the business and its organizational structure, it may sometimes be preferable to retain an outside engineering or law firm rather than using an employee. The auditor or auditors must be familiar with the various kinds of intellectual property rights used by the particular business, and must have sufficient time, resources, and authority to complete the task.

The next step is to assure participation by notifying management and employees that an audit will be conducted, that the audit is important to all departments in the company, and that everyone should be prepared to spend some time responding to the auditor's questions. The auditor can then obtain the necessary information by reviewing plans and specifications, circulating questionnaires, by interviewing design and production personnel and environmental and production managers, and by conducting inspections. The most difficult part of the audit follows—evaluating the company's products, formulas, and processes and comparing them to records of trade secrets, patents, and trademarks. The auditor must determine which products, formulas, and processes *are* protected, which are not but *should* be protected, and which have lost their protection through disclosure or lapse of time. The auditor should also be able to determine which product lines and processes have become obsolete so that intellectual property protection may no longer be valuable.

The environmental technology auditor should advise management about areas that require emphasis in seeking protection for intellectual

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180. The ten Valdez Principles drafted by the Coalition of Environmentally Responsible Economies are intended to increase the environmental responsibility of signatory companies by improving efforts to protect the biosphere, making sustainable use of natural resources, reducing waste and energy consumption, and including an environmental representative on the board of directors. *See Can the Valdez Principles Green Corporate America*, THE ENVTL. F., Mar./Apr. 1990, at 30–45. *See also* Kass & Gerrard, *Responsible Investigating: The Valdez Principles*, N.Y.L.J., Oct. 30, 1989, at 3, col. 1. Valdez Principle No. 10 calls for annual self-evaluation and independent auditing of progress in implementing the other principles and in environmental compliance. Friedman argues that broad-ranging environmental assessment is more productive than a narrow environmental audit, and that the notion of independent auditors serves primarily to employ outside consultants and counsel. *See* Friedman, *Don't Sign the Valdez Principles*, in THE ENVTL. F., *supra*, at 40.

Corporate enthusiasm for environmental audits has also been tempered by the realization that by gaining knowledge of environmental problems, the corporation becomes responsible for correcting them; in addition, some fear that the results of such an audit may be used directly against the corporation in a civil or criminal enforcement proceeding. The emerging doctrine of a privilege for self-critical analysis could alleviate this concern. *See* Bredice v. Doctors Hosp., 50 F.R.D. 249 (D.D.C. 1970); *see also* Leonard, *supra* note 76.

property, and about areas in which an investment in research and development may be fruitful. The auditor must therefore consider the various federal, state, and local environmental compliance obligations of the company in order to identify intellectual property assets, resources, concerns, and opportunities. An audit report can be organized by department or product line, or according to environmental compliance programs. To the extent the auditor and management can predict the direction of legal and regulatory reform, the company may be able to carve out a competitive niche for the future.

An audit report can highlight areas where a company is not using efficient approaches to environmental technology, and can suggest process or equipment changes to reduce emissions or waste. By reviewing entire operations, rather than individual emissions, a company may find ways to reduce overall pollution and waste, rather than merely shifting control measures from one medium to another.[181] The company will be able to take a proactive rather than a reactive approach to compliance, and can seek to make regulatory permitting, monitoring and enforcement activities more consistent with its business strategy.

2. Tracking the State of the Art

Tracking the state of the art is an important aspect of any environmental compliance program. An environmental technology audit should compare the technology employed by the company with the latest innovations to evaluate the likelihood that the company will have to modernize. For example, if a design engineer knows that new emission control or treatment devices are in the development stage, she can better design a new facility. It is less expensive overall to design a plant that is capable of using a new emission control or pollution prevention technology than to attempt to retrofit the plant later.

Tracking the state of the art is important for more than ensuring compliance with evolving regulatory standards. By careful selection of environmental technology, a company can stay ahead of its competition. For example, where a solvent-free manufacturing process is available, if it is likely that new regulations will restrict use of solvents, a company developing a competing process should seek patent protection so as to profit from the in-house technology. Alternatively, it may be more economical or practical to seek to negotiate a license to use the outside technology. Generally, it will be cheaper to do so before the new

181. This approach will be most effective where regulators are seeking cross-media pollution reduction. *See* TIEC/NACEPT REPORT, *supra* note 4, at 27, 36–38, 49–50.

regulations are enacted. Moreover, it may be better to obtain a license than to face an infringement action later.

Even a private individual can assess the state of the art of a particular technology. Technical literature and trade publications provide news of innovations and evolving technology. Additionally, a vast record of inventions dating back to the eighteenth century is publicly accessible in a library at the Patent and Trademark Office. Domestic patents can be searched by class and subclass of technology, by owner, by inventor, or by date. Each patent describes the advantages and benefits of the invention in comparison with the background of the invention.

Patent statistics can serve as a measure of innovative activity in the aggregate as well. The degree of patent activity in an industry reflects the level of innovation at a given time.[182] For this reason it is important that the PTO continue to expand and improve the classification and subclassification of environmental technology, so as to make it easier for inventors to determine the state of the art of a recycling technique, a groundwater remediation process, a scrubber, or the like.

Furthermore, there are a number of specialized sources of environmental technology information. The so-called "RACT/BACT/LAER clearinghouse" maintained by EPA includes data from EPA and the states regarding the economic and technical assessment of various air pollution control technologies.[183] Pursuant to Section 5004 of the

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182. *See* NATIONAL SCIENCE FOUNDATION, SCIENCE INDICATORS (1978); NATIONAL SCIENCE FOUNDATION, SCIENCE INDICATORS (1980); NATIONAL SCIENCE FOUNDATION, SCIENCE INDICATORS (1982); NATIONAL SCIENCE FOUNDATION, SCIENCE INDICATORS (1990). *See also* R & D, PATENTS AND PRODUCTIVITY (Griliches ed. 1984); Scherer, *Research & Development Expenditures and Patenting*, 10 A.I.P.L.A. Q.J. 60, 75 (1982).

Indeed, one can use the patent library to determine whether technology-forcing regulations have the desired effect of stimulating innovation. The patent system is a measure of innovation. For example, four times as many patents were issued for landfill leachate controls (in Class 210, liquid purification or separation, subclass 901, specified landfill feature (prevention of groundwater fouling)) between 1982 and 1990, after passage of CERCLA and the RCRA, than between 1969 and 1981. This is a promising approach to learn more about the impact of regulation on innovation. *Cf.* Stewart, *supra* note 167, at 1368–69 (recommending innovation impact analysis).

Patent statistics are useful not only to a private party seeking to ascertain the state of the art, but also to policymakers and regulators attempting to determine the overall level of innovation. Patent application rates provide a measure of the effectiveness of environmental regulation at stimulating technology innovation; regulations that stimulate a burst of patent activity can be said, objectively, to have promoted innovation.

183. According to a telephone conversation with Robert Blayzak, Office of EPA Air and Radiation, the Clearinghouse was set up by EPA in the early 1980s in response to requests from states and public agencies for information regarding control technologies. Section 108(c) of Title I of the Clean Air Act Amendments of 1990 now provides for support of the RACT/BACT/LAER Clearinghouse. Pub. L. 101–549, § 108(c), 104 Stat 2466 (1990).

RCRA,[184] the Department of Commerce is authorized to develop a data base regarding commercial feasibility findings for purposes of assisting persons in choosing resource recovery facilities. The definition of resource recovery facility under RCRA is quite broad, and includes "any facility at which solid waste is processed for the purpose of extracting, converting to energy, or otherwise separating and preparing solid waste for reuse."[185] EPA's Office of Pollution Prevention has also begun operating a Pollution Prevention Information Clearinghouse.[186]

Information clearinghouses can greatly facilitate advances in the state of the art through diffusion of improved technology. Clearinghouses also enable regulators to be consistent in setting environmental standards. The availability of clearinghouses for environmental technology information should be encouraged.[187] Consideration should also be given to whether the several clearinghouses could advantageously be incorporated into one environmental technology clearinghouse. Economies of scale and expanded publicity for such a clearinghouse may make merger worthwhile.[188]

Forecasting technology development is difficult in any field but even more so for environmental technology because innovation is so heavily driven by regulations. A company must understand not only the state of the art and the advances of competitors, but also anticipate the course of legislation and regulation at the federal, state, and local levels. Such forecasting is more difficult than trying to predict long-range weather patterns, but the effort is important to minimize risk, to protect the corporate image, to maximize efficiencies of production, and ultimately to maximize environmental protection. Individuals should be encouraged to take action to track the state of the art and to innovate or license innovative technologies. Legislation and regulation should be applied to encourage individual efforts; consistency in regulation would help greatly.

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184. 42 U.S.C. § 6954 (1988).

185. 42 U.S.C. § 6903(24) (1988).

186. *See* EPA, POLLUTION PREVENTION STRATEGY 21 (1991). The Clearinghouse includes a hotline, a library, a computer database, and networking programs. *See id.*

187. *Cf.* TIEC/NACEPT REPORT, *supra* note 4, at 53, 55–57.

188. The National Academy of Sciences is considering a proposal to create an agency dubbed the National Institute for the Environment. *See* Booth, *Does the Earth Need a Government Institute?*, Washington Post, Dec. 10, 1990, at A13. The Institute would coordinate environmental research and would be a central clearinghouse for environmental technology information. An alternative is to encourage cooperation among the many individual clearinghouses.

CONCLUSION

Regulators, industry, private citizens, and their counsel need to balance economic and technical progress with environmental protection. Intellectual property law can provide helpful means for identifying, selecting, and encouraging environmentally beneficial technology that is profitable. Coordination of environmental regulation and intellectual property laws can help achieve the desired balance between progress and protection.

Environmental regulation to date has been more effective at restricting the use of harmful technology than at promoting innovative beneficial technology. Intellectual property law is a well-established system for promoting invention and facilitating commercial development. Therefore, application of intellectual property principles can promote innovation of environmental technology. Intellectual property law can be applied to improve environmental protection in several ways.

Reliable criteria for categorizing a technology as harmful or beneficial need to be developed. Distinctions are difficult because the scope of beneficial environmental technologies cuts across traditional industrial classifications. Since trade secrets, patents and other intellectual property systems are inter-industry, they can promote innovation in industries and technologies—from pollution control devices to remediation methods, and from agriculture to manufacturing. However, intellectual property can also promote innovation in harmful technologies. Discouraging harmful technologies is best achieved through environmental regulation. Regulation can reduce the incentive for harmful innovation by prohibiting it directly or by rendering it uneconomical.

Several problems arise from the interaction of environmental regulations and intellectual property laws; these problems hinder development and implementation of beneficial technology. The treatment of trade secrets in the principal environmental statutes is inconsistent with promoting innovation. Conflicting policies for public disclosure of environmental and health risks and protecting proprietary information have caused the inconsistencies. By focusing on the distinction between beneficial and harmful technology, however, these two policies could complement each other. Hazardous processes and substances are less easily protected as trade secrets than technologies that present lesser risks. Congress and the regulatory agencies should consider the effects of environmental regulations on trade secrets. If beneficial technology is easier to protect than harmful technology, it would be more valuable, and the law would better protect the environment.

Environmental technology patents can be strengthened or made easier to obtain through several means. The Patent and Trademark Office

should continue to refine its classifications of environmental technology patents. Information regarding environmental technology would be centralized to facilitate compliance, innovation, and tracking the state of the art. State and federal agencies should respect and enforce the rights of patentees, and should assure payment of royalties where appropriate. Royalties are important particularly when use of a patented technology is required.

Creative measures can be implemented to improve environmental protection by applying the principles of intellectual property law. The success of green labelling is likely to depend on whether trademark recognition adds to the value of environmentally benign products. Trademark and unfair competition laws will settle competing claims and prevent confusion in the marketplace. International efforts to protect the global environment may rely on intellectual property laws to increase environmental technology transfer. Biodiversity may be preserved through measures guaranteeing property rights to the custodians of critical habitats.

Companies can use intellectual property assets in environmental technology to profit from environmental regulation. However, incentives require proper coordination. Intellectual property managers must be conversant with environmental affairs, because the market for environmental technology is largely defined by laws and regulations. By the same token, environmental managers should consider the existence of licenses, patents, trade secrets, and other intellectual property assets in selecting the best compliance strategies for their companies. Federal and state environmental agencies should develop an awareness of and sensitivity to the effect of governmental activity on the incentives to the public. There is, of course, no guaranteed way of ensuring that beneficial technologies replace harmful ones. Nonetheless, increased reliance on intellectual property law can improve environmental protection.