Introduction: the wizards of Menlo Park – Thomas Edison, General Electric Inc. and Ecomagination

> I find out what the world needs, then I proceed to invent.
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> Thomas Edison[1]

> One lingered long among the dynamos, for they were knew, and they gave to history a new phase.
>
> Henry Adams[2]

> Edison's vision, Uncle liked to say, of light for the masses had finally come true in the incandescent bulb. If someone could look at the earth from outer space, see how it rotated every twenty-four hours into the shadow of night, they would see millions, hundreds of millions, of incandescent bulbs light up nightly, glowing with white-hot tungsten, in the folds of that shadow – and know that man had finally conquered the darkness. The incandescent bulb had done more to alter social habits, human lives, Uncle would say, than any other invention he could think of.
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> Oliver Sacks, *Uncle Tungsten*[3]

In a nostalgic, sentimental way, the United States Patent and Trademark Office paid tribute to Thomas Edison – inventor, entrepreneur, and patent applicant:

> Edison's inventions have been a mainstay of our economy for over 100 years. At the turn of the 20th century, Edison's New Jersey laboratory (now a national monument), was the hub around which factories employing 5,000 people produced new products, including the mimeograph, the fluoroscope, the alkaline storage battery, dictating machines, and motion picture cameras and

[1] Quoted in Carr, Nicholas (2009), *The Big Switch: Rewiring the World, From Edison to Google*, New York and London: W.W. Norton.
[2] Ibid.
[3] Sacks, Oliver (2001), *Uncle Tungsten: Memories of a Chemical Boyhood*, New York: Vintage, 47.

> projectors. The electric light bulb, his most famous invention, was the foundation for today's General Electric Company.[4]

Edison has become the personification of an inventor and scientific entrepreneur. Randall Stross reflects that a rich and sometimes not altogether accurate popular mythology has developed around Edison: 'Edison is the patron saint of electric light, electric power, and music-on-demand, the grandfather of the Wired World, great-grandfather of iPod Nation.'[5]

The objects of Edison's research have themselves become iconic. As Lee Shaver has reflected, the electric light bulb has become a visual cliché for representing innovation:

> More than a century after its introduction, the light bulb remains the defining icon of invention. Justifiably so, in my opinion, because this widget almost single-handedly drove the demand for electrification. The light bulb was the killer app, if you will, for electric power. Which in turn enabled a whole new *era* of innovation.[6]

By extension, the image of the electric light bulb has often been appropriated for use more generally as an icon for intellectual property law.

The representation of the sole, independent inventor as a Promethean, romantic genius is a powerful characterisation. Keith Aoki comments that the 'inventive genius who is encouraged and rewarded by a patent has two different aspects: the scientist and the entrepreneur'.[7] He comments: 'As with the romantic author, the image of the originary scientific genius is an extremely historically contingent formation, running counter to many recent accounts of the history and sociology of scientific invention and progress.'[8] Thomas Hughes comments that Edison is an example of an independent professional inventor – 'free from the constraints of organizations, such as industrial or government research laboratories, independent

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[4] United States Patent and Trademark Office (2002), 'Patent for Phonograph Issued February 19, 1878', Press Release, 15 February, http://www.uspto.gov/news/pr/2002/02-13.jsp.

[5] Stross, Randall (2007), *The Wizard of Menlo Park*, New York: Three Rivers Press, 1.

[6] Shaver, L. (2010), 'Illuminating the Impact of Intellectual Property Law on Innovation', Yale Law School, Information Society Project, 11 June, http://yaleisp.org/2010/06/patents-and-innovation/.

[7] See, for instance, Aoki, K. (1994), 'Authors, Inventors and Trademark Owners: Private Intellectual Property and the Public Domain', *Columbia-VLA Journal of Law and the Arts*, **18**, 191 at 214.

[8] Ibid., at 217.

inventors can roam widely to choose problems to which they hope to find solutions in the form of inventions'.[9]

Looking at the example of Edison and other high profile inventors, James Brooke-Smith suggests that authorship, invention, and scientific genius were re-imagined in the nineteenth century: 'Broadly speaking, science shifted from being the preserve of privately funded amateurs, towards what we would now recognize as professional scientists: men (and sometimes women) in white coats in institutional laboratories.'[10] He contends: 'Whereas the presiding model of scientific invention within the institutional realm was more frequently based on analytical process, bureaucratic procedure and a gradualist approach to the production of knowledge, there was a countervailing tendency in the popular press to figure invention in terms of sublimity, awe and momentary flashes of inspired genius.'[11]

Henry Kressel and Thomas Lento consider Edison's legacy in the development of the modern industrial laboratory:

> The twentieth century has often been called the Age of Edison, because he played a role in creating many of the technologies that shaped the modern industrial world. With 1,093 patents to his name, Edison has been held up as the archetype of the lone inventor, producing innovations by sheer force of genius. This is a myth. Thomas Edison did not work alone. He may have been the driving force behind many of his inventions, but he was supported by a hand-picked research team assembled for that purpose. The composition of his team marked a change in attitude toward scientific endeavour.[12]

Kressel and Lento note that one of Edison's key contributions was to bridge the gap between scientists and technologists, highlighting his establishment of the industrial laboratory in Menlo Park, New Jersey, known as the 'Invention Factory' in 1876 and the research and development centre, the Edison Laboratory in 1887. The pair observe: 'The spectacular results from his labs made history, producing the phonograph, motion pictures, incandescent lighting, and electric power generation (among

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[9] Hughes, T.P. (1999), 'The Evolution of Large Technological Systems', in Biagioli, Mario (1999), *The Science Studies Reader*, New York and London: Routledge, 207.

[10] Brooke-Smith, J. (2006), 'Thomas Edison and the Forms of Invention', Con/texts of Invention, Case Western University, April, http://www.case.edu/affil/sce/contexts%20of%20invention%20abstracts.html.

[11] Ibid.

[12] Kressel, Henry with Thomas Lento (2007) *Competing for the Future: How Digital Innovations are Changing the World*. Cambridge: Cambridge University Press, 105.

many other breakthroughs).'[13] The authors conclude: 'If the research lab is Edison's greatest invention, as some have claimed, his focus on teamwork and creating products makes his lab the forerunner of all commercial research strategies.'[14]

This introduction provides a history of battles over scientific authorship, inventions, and intellectual property in relation to energy technologies in the nineteenth century.[15] The patent litigation between Edison and his rivals over the electric light bulb foreshadows contemporary debates over intellectual property and clean technologies. In *The Making of Modern Intellectual Property Law*, Brad Sherman and Lionel Bently contend that an understanding of nineteenth century patent law is invaluable in making sense of contemporary controversies: 'The image of intellectual property that developed during the nineteenth century and the narrative of identity which this engendered played and continues to play an important role in the way we think about and understand intellectual property law.'[16] Kathy Bowrey and Natalie Fowell have called for a greater appreciation of the historical underpinnings of contemporary debates over intellectual property law: 'An understanding of history should also lead to a more nuanced understanding of legal power and its relation to politics – including of law's essential incompleteness, limits and complications in readily securing political objectives.'[17]

This introduction engages in a methodology of 'legal storytelling'.[18] In the field of new historicism, the use of anecdotes – *petite histoire* – is a useful way of challenging grand historical narratives. Joel Fineman has observed that the anecdote is 'the literary form or genre that uniquely refers to the real'.[19] This micro-history has three sections. Part I considers Edison as a prodigious patent applicant; a patent litigant; and the developer of patent pools. Part II focuses upon the legacy of Edison, particularly, in providing the foundation for the establishment of the conglomerate, General Electric Inc.,

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13 Ibid.

14 Ibid., 106.

15 Biagioli, Mario and Peter Galison (eds) (2003), *Scientific Authorship: Credit and Intellectual Property in Science*, New York and London: Routledge.

16 Sherman, Brad and Lionel Bently (1999), *The Making Of Modern Intellectual Property Law: The British Experience 1760–1911*, Cambridge: Cambridge University Press, 219.

17 Bowrey, Kathy and Natalie Fowell (2009), 'Digging Up Fragments and Building IP Franchises', *Sydney Law Review*, **31**, 185 at 186.

18 Ginsburg, Jane and Rochelle Cooper Dreyfuss (2006), *Intellectual Property Stories*, New York: Foundation Press.

19 Fineman, Joel (1989), 'The History of the Anecdote', in Veeser, H. Aram (ed), *The New Historicism*, New York and London: Routledge, 49–76.

both an active patent builder and advocate, and an investor in a range of clean technologies. Part III provides an outline of the structure of the book.

I THOMAS EDISON

A Patent Applications

Kressel and Lento relate that an initial failure to commercialise a patent had a significant impact upon the approach of Edison:

> In 1868, he had patented his first invention, an electric voting machine. The idea was to speed up the legislative process by eliminating time-consuming roll calls through instant tallying of yea and nay votes in the Massachusetts house (he was living in Boston) and in the US Congress. The machine worked perfectly, but found no buyers. Legislators liked roll calls because they represented an opportunity for oratory. The lawmakers also used the delays during roll calls to cut deals with other lawmakers for the passage or defeat of the bills being debated. After this disappointment, Edison decided he would never again work on a technology that didn't have a good chance of commercial success.[20]

As a result of this experience of failure with the commercialisation of this patent, Edison became much more hard-headed about developing inventions, with commercial applications and utilities.

Rutgers University's site on Edison's Papers attests: 'Edison executed the first of his 1,093 successful US patent applications on 13 October 1868, at the age of 21. He filed an estimated 500–600 unsuccessful or abandoned applications as well.'[21] Moreover, Edison received many patents in countries other than the United States. In the 1910 biography, Frank Lewis Dyer and Thomas Commerford Martin provide a compilation of 1,239 non-US patents awarded in 34 countries.[22] Stross reflects that 'most of the patents were for minor variations on previous ones – more than 400 concerned electric light and power and almost 200 were for phonographs and recording'.[23] His work in respect of the electric light has been particularly celebrated.[24]

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[20] Kressel, Henry with Thomas Lento (2007), *Competing for the Future: How Digital Innovations are Changing the World*, Cambridge: Cambridge University Press, 106.

[21] Edison's patents, http://edison.rutgers.edu/patents.htm.

[22] Dyer, Frank Lewis and Thomas Commerford Martin (1910), *Edison, His Life and Inventions*, New York: Harper & Brothers.

[23] Stross, Randall (2007), *The Wizard of Menlo Park*, New York: Three Rivers Press, 283.

[24] Hargadon, A. and Y. Douglas (2001), 'When Innovations Meet Institutions:

A report prepared for Edison's investors boasted of the patent portfolio built around his work: 'By preserving secrecy as the means of accomplishing the various ends Mr. Edison has rapidly entrenched himself in an absolute monopoly without educating others to the point of following him closely or anticipating him in the Patent Office.'[25] The report was supremely confident of the validity of the patents: 'When Mr Edison does enter the courts it will be to show an invulnerability never before attained where so many or so valuable patents were concerned.'[26] Indeed, resorting to hyperbole, the report observed: 'No invention of any age has been so systematically or so thoroughly protected by a close study and application of the patent law as has this of Mr Edison's.'[27] The report concluded: 'He has woven a web so compact that were it to be perforated in a hundred places it would still be an effective defense.' [28]

Theresa Mary Collins and her collaborators suggest that Edison was sometimes over-zealous in his use of the patent system, observing:

> Edison would sometimes urge his lawyers to 'claim the earth' or 'claim the solar system' in regard to a particular invention. One federal judge, while deciding an important electric light case in Edison's favor, chided his lawyers about 'the haste which has always seemed to characterize Mr Edison's efforts to patent every improvement, real or imaginary, which he has made or hoped to make.' Edison understandably wanted his legal rights to be as broad as possible in order to protect himself against competitors.[29]

Such intellectual property maximalist sentiments seem most contemporary in light of modern interactions between inventors, patent attorneys, and competing companies.

Stross comments that Edison was chary about acknowledging and attributing the work of his collaborators: 'Edison had no compunction about claiming credit for work done by assistants.'[30] He elaborates that Edison preferred to claim sole inventorship of patent applications: 'Edison's reluctance to share credit with others is suggesting by the

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Edison and the Design of the Electric Light', *Administrative Science Quarterly*, **46**(3), 476–501.

[25] Collins, Theresa Mary, Lisa Gitelman and Gregory Jankanis (ed.) (2002), *Thomas Edison and Modern America: A Brief History with Documents*, New York: Palgrave Macmillan, 121.

[26] Ibid.

[27] Ibid.

[28] Ibid.

[29] Ibid., 31.

[30] Stross, Randall (2007), *The Wizard of Menlo Park*, New York: Three Rivers Press, 283.

following: For almost his entire career, beginning with the shop in Newark, he depended on the assistance – and inventiveness of others. Yet among his 1,093 patents, in apparently only 20 instances did he share credit with a joint inventor.'[31] The biographer notes: 'Technically gifted individuals who arrived at the lab with their own strong opinions, such as Nikola Tesla and Frank Sprague, clashed constantly with Edison and left.'[32] He noted: '[Samuel] Insull had strong opinions, but stuck around longer than the engineers.'[33]

Kara Swanson suggests that Edison also relied extensively upon ghostwriters to describe his patent applications: 'Rather than assume authorial control [Edison] . . . hired attorneys more experienced in his area of invention to translate his stream of inventive ideas into the commercial property on which he based his business success.'[34] She contends: 'Patent practioners functioned essentially as ghostwriters, for even as they took over the writing tasks previously handled by inventors, the personal identification of the inventor with the patent text remained.'[35]

B Patent Litigation

Lee Shaver comments that Edison was a patent litigant par excellence:

> What Edison did better than all the other inventors took place not in the laboratory, but in the office. His lawyers pursued, obtained, asserted, and litigated key patents on light bulb technology in order to run competing bulb manufacturers out of business. Edison then leveraged his monopoly on bulbs to corner the market in electricity service as well.[36]

Christopher May suggests that 'entrepreneurs (such as James Watt and later Thomas Edison) sought to establish and maintain market advantage

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31 Ibid., 359.
32 Ibid., 166.
33 Ibid.
34 Swanson, Kara (2011), 'Authoring an Invention: Patent Production in the Nineteenth Century United States', in Woodmansee, Martha, Mario Biagioli, and Peter Jaszi (ed.) (2011), *Making and Unmaking Intellectual Property: Creative Production in Legal and Cultural Perspective*, Chicago: University of Chicago Press, 48.
35 Ibid., 47.
36 Shaver, L. (2010), 'Illuminating the Impact of Intellectual Property Law on Innovation', Yale Law School, Information Society Project, 11 June, http://yaleisp.org/2010/06/patents-and-innovation/.

by denying their competitors access to the inventions upon which their businesses were built'.[37]

Dyer and Martin comment that Edison was involved in epic litigation over lamp patents:

> The litigation on the Edison lamp patents was one of the most determined and stubbornly fought contests in the history of modern jurisprudence. Vast interests were at stake. All of the technical, expert, and professional skill and knowledge that money could procure or experience devise were availed of in the bitter fights that raged in the courts for many years. And although the Edison interests had spent from first to last nearly $2,000,000, and had only about three years left in the life of the fundamental patent, Edison was thoroughly sustained as to priority by the decisions in the various suits.[38]

Lee Shaver reflects upon the significance of the light-bulb litigation: 'The story of the light bulb reveals that the relationship between patents, innovation, and the spread of new technologies is more complex than is widely understood.'[39] She notes that 'Companies who stand to benefit from longer, stronger patent protection would have us believe that patents promote innovation by providing greater incentives to invention.'[40] However, she argues that the light-bulb litigation suggests that 'the result can be a paradoxical delay in scientific advancement, widespread access to new technologies, and opportunities for new businesses and opportunities that build upon that technology'.[41]

Oliver Sacks comments on the rivalry between Joseph Swan and Edison: 'Swan, in England, and several others, had started experimenting with platinum bulbs in the 1860s . . . and Edison, intensely competitive, now joined the race, but found, like Swan, that there were major difficulties: platinum's melting point, though high, was not high enough.'[42] He focuses upon Edison's breakthrough: 'Edison's bulbs opened up the possibility of

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[37] May, Christopher (2010), *The Global Political Economy of Intellectual Property Rights: The New Enclosures*, Abingdon and New York: Routledge, 148.

[38] Dyer, Frank Lewis and Thomas Commerford Martin (1910), *Edison, His Life and Inventions*, New York: Harper & Brothers, 313–14.

[39] Shaver, L. (2010), 'Illuminating the Impact of Intellectual Property Law on Innovation', Yale Law School, Information Society Project, 11 June, http://yaleisp.org/2010/06/patents-and-innovation/.

[40] Ibid.

[41] Ibid.

[42] Sacks, Oliver (2001), *Uncle Tungsten: Memories of a Chemical Boyhood*, New York: Vintage, 49.

a real revolution – though, of course, they had to be tied to a whole new system of dynamos and power lines.'[43]

The historian of Victorian inventions, Stephen van Dulken, explores the patent dispute between Swan and Edison:

> Unfortunately for Swan he delayed filing for a patent. Edison was independently working on similar lines, and on 22 October 1879 after countless experiments with different materials successfully tested a lamp with a carbonised sewing thread. Swan's bulb was in fact better. The patent was swiftly filed on 1 November and was published as US223898 in January 1880. Thread was found not to be robust and was soon replaced by carbonised paper, one of many improvements.[44]

The historian reflected that: 'When Edison applied for a British patent an action was brought against him for infringement and the two were forced to merge as the Edison and Swan United Electric Light Company.'[45]

Edison's key disputed patent was United States Patent No. 223,898 for an 'electric lamp' (see Figure 0.1 above).[46] The patent application featured the declaration:

> To all whom it may concern: Be it known that I, Thomas Alva Edison, of Menlo Park, in the State of New Jersey, United States of America, have invented an improvement on Electric Lamps, and in the method of manufacturing the same, (Case No. 186,) of which the following is a specification. The object of this invention is to produce electric lamps giving light by incandescence, which lamps shall have high resistance, so as to allow of the practical subdivision of the electric light.[47]

The patent had four claims. The first claim was for 'An electric lamp for giving light by incandescence, consisting of a filament of carbon of high resistance, made as described, and secured to metallic wires, as set forth.'[48] The second claim was for 'The combination of carbon filaments with a receiver made entirely of glass and conductors passing through the glass, and from which receiver the air is exhausted, for the purposes set forth.'[49] The third claim related to 'a carbon filament or strip coiled and connected to electric conductors so that only a portion of the surface of such carbon conductors shall be

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43 Ibid.

44 Van Dulken, Stephen (2001), *Inventing the 19th Century: The Great Age of Victorian Inventions*, London: The British Library, 80.

45 Ibid.

46 Edison, T.A. (1880), 'The Electric Lamp', United States Patent No. 223,898.

47 Ibid.

48 Ibid.

49 Ibid.

exposed for radiating light, as set forth.'[50] The fourth claim concerned 'The method herein described of securing the platiua contact-wires to the carbon filament and carbonising of the whole in a closed chamber, substantially as set forth.'[51] The patent featured in a score of patent disputes.

In the 1891 suit against the United States Electric Lighting Company, Wallace J of the United States Circuit Court for the Southern District of New York observed:

> [Mr Edison] . . . was the first to make a carbon of materials, and by a process which was especially designed to impart high specific resistance to it; the first to make a carbon in the special form for the special purpose of imparting to it high total resistance; and the first to combine such a burner with the necessary adjuncts of lamp construction to prevent its disintegration and give it sufficiently long life. [52]

The judge held:

> By doing these things he made a lamp which was practically operative and successful, the embryo of the best lamps now in commercial use, and but for which the subdivision of the electric light by incandescence would still be nothing but the ignis fatuus which it was proclaimed to be in 1879 by some of the reamed experts who are now witnesses to belittle his achievement and show that it did not rise to the dignity of an invention.[53]

In the 1892 case of *Edison Electric Light Co.* v. *US Electric Lighting Co.*, the United States Circuit Court of Appeals found in favour of the Edison Electric Light Company in its action for patent infringement of its incandescent lamps against the US Electric Lighting Company.[54] The relevant patent was United States Patent No. 223,898.[55] In a lengthy opinion, Lacombe and Shipman JJ held:

> Edison's invention was practically made when he ascertained the theretofore unknown fact that carbon would stand high temperature, even when very attenuated, if operated in a high vacuum, without the phenomenon of disintegration. This fact he utilized by the means which he has described, a lamp having a filamentary carbon burner in a nearly perfect vacuum.[56]

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[50] Ibid.
[51] Ibid.
[52] *Edison Electric Light Co.* v. *US Electric Lighting Co.* 47 F. 454 CCSNDY (1891).
[53] Ibid.
[54] *Edison Electric Light Co.* v. *US Electric Lighting Co.* 52 F. 300 C.A.2 (1892).
[55] Edison, T.A. (1880), 'The Electric Lamp', United States Patent No. 223,898.
[56] *Edison Electric Light Co.* v. *US Electric Lighting Co.* 52 F. 300 C.A.2 (1892).

The *New York Times* headlines declared 'Edison's Patent Upheld: The End of the Incandescent Light Litigation'.[57] Lewis of Eaton and Lewis, the attorneys for the Edison Electric Light Company, observed: 'During these years, the United States Company has made thousands of lamps, and has encouraged others to infringe upon our patents.'[58]

In the 1892 case of *Edison Electric Light Co.* v. *Sawyer-Man Electric Co.*, the Second Circuit of the Circuit Court of Appeals considered an appeal against an order restraining Westinghouse from making, using, or vending the incandescent electric lamps of Edison's patent, No. 223,898.[59] Wallace, Lacombe and Shipman JJ observed that 'The present complainants are entitled by the patent laws to a monopoly, for the term of the patent, of the manufacture and sale of the lamps made under it.'[60] The judges noted that an injunction was 'necessary to secure their monopoly and make their patent fruitful'. [61] The court held: 'The injunction order appealed from should be modified so as to cover only lamps made an infringement of the second claim of the patent, the other claims not having been infringed.' [62] The debate over patent remedies and judicial discretion is certainly an issue which has preoccupied contemporary jurists.[63]

The *New York Times* covered the decision, with the headlines, 'Edison Again Successful; His Incandescent Lamp Patent Has Been Infringed; Westinghouse People Restrained From Making, Using, or Vending the Lamp'.[64] The paper elaborated:

> The Edison people consider that they have won a decisive victory. The Westinghouse people do not seem to be disturbed, and although they opposed as vigorously as they could the granting of the injunction, they intimated, after the decision had been rendered, that it didn't make much difference any way, as they had a new lamp which not only didn't infringe the Edison patents, but was a decided improvement over all lamps now in use, and could be sold at much lower prices. As to their World's Fair contracts, they said they would not be affected in the least by the action of the Court of Appeals.[65]

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[57] Staff Writer (1892), 'Edison's Patent Upheld', *The New York Times*, 5 October.
[58] Ibid.
[59] *Edison Electric Light Co. et al.* v. *Sawyer-Man Electric Co.* 53. F. 592, 3 CCA 605 (1892).
[60] Ibid.
[61] Ibid.
[62] Ibid.
[63] *eBay Inc.* v. *MercExchange, LLC*, 547 US 388 (2006).
[64] Staff Writer (1892), 'Edison Again Successful', *The New York Times*, 16 December.
[65] Ibid.

After recounting an abridged version of the decision, *The New York Times* reported: 'It was said at the office of the Edison General Company yesterday that a number of smaller companies were manufacturing the lamps, and that if they persisted they would also be enjoined.'[66] The piece concluded: 'Since the decision in the United States Company's case, however, a number of the smaller manufacturers, it was stated, had stopped.'[67]

There was also much competition between Edison and his former assistant Nikola Tesla – the so-called 'War of the Currents – the Battle to Electrify America'.[68] This has been dramatised in the book *The Prestige* by Christopher Priest, and in the film adaptation by Christopher Nolan.[69] Keith Tutt discusses the rivalry between Edison and Nikola Tesla, General Electric and the Westinghouse company:

> By 1897 [Tesla's] royalties from AC were already worth some $12 million, and had they continued they could have reached billions. Tesla would have been the Bill Gates of his day. It was not to be. Westinghouse came under pressure from his commercial enemies . . . George Westinghouse had to go back to Tesla and ask him to forego all his royalties – past, present, and future – in order that the company could survive independently. Tesla . . . gave up his right to the millions he was due, and accepted a single payment of just $126,000 for the outright purchase of all his AC patents.[70]

Tutt notes that 'Westinghouse survived to fight another day with General Electric over the country's seemingly infinite energy needs, even though court fights over patents would sap the company's financial reserves for many years to come'.[71] A commentator has noted: 'Upon the expiration of the Edison patent, the Westinghouse company resumed manufacture of the all-glass globe type of lamp.'[72]

In another case, in 1894, in the matter of the *Edison Electric Light Company* v. *Boston Incandescent Lamp Company*, the complainants sought an injunction for the patent infringement in respect of the Edison

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66 Ibid.
67 Ibid.
68 Tutt, Keith (2001), *The Scientist, The Madman, The Thief and Their Lightbulb*, London: Simon & Schuster, 16.
69 Priest, Christopher (1995), *The Prestige*, London: Gollancz; and Nolan, Christopher (2006), *The Prestige*, Newmarket Films and Syncopy Films.
70 Tutt, Keith (2001), *The Scientist, The Madman, The Thief and Their Lightbulb*, London: Simon & Schuster, 17.
71 Ibid., 17.
72 Furfari, F.A. (2006), 'Early Development of the Incandescent Lamp', *Industry Applications Magazine*, **12**(2), 7–9.

incandescent lamp covered by United States Patent No. 223,898.[73] In the United States Circuit Court for the District of Massachusetts, Colt J observed: 'Edison made an important invention; he produced the first practical incandescent electric lamp; the patent is a pioneer in the sense of the patent law; it may be said that his invention created the art of incandescent electric lighting.'[74] The judge also stressed that pioneering inventions should be given broad protection under patent law:

> In dealing with a pioneer invention which creates a new art, it hardly seems logical or reasonable to say that, because in the progress of such art some new substance or device has been discovered, which can act as a substitute for one of the elements of the patented invention, any one can appropriate the invention by the employment of such substitute.[75]

In another 1894 action, the Edison Electric Light Company sued Lyman G. Bloomingdale and another for infringement of the Edison incandescent electric light patent through using Buckeye lamps on their premises.[76] While declining to grant an injunction, the judge held: 'The complainants are, however, entitled to insist that the only infringing lamps used hereafter shall be those sold out of the monopoly.'[77]

In *Electric Manufacturing Co.* v. *Edison Electric Light Company*, the Edison Electric Light Company sued the Electric Manufacturing Company, T.A. Pamperin, Julius B. Grunert, and George Beyer to restrain the infringement of a patent.[78] The Circuit Court reflected:

> For years before, scientific minds the world over were concentrated upon the investigation of electricity and electric lighting. Innumerable experiments and failures marked the pathway to success. The division of light was asserted by some of the most eminent electricians of the day to be an idle dream, and an insoluble problem – an *ignis fatuus*, delusive, and unreal. Mr Edison's invention dispelled the clouds of doubt, and demonstrated the accomplished fact.[79]

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[73] *Edison Electric Light Co*. v. *Boston Incandescent Lamp Company* 62 F. 397 (1894).
[74] Ibid.
[75] Ibid.
[76] *Edison Electric Light Co.* v. *Bloomingdale* 65 F. 212 (1894).
[77] Ibid.
[78] *Electric Manufacturing Co.* v. *Edison Electric Light Company* 61 F. 834 (CA 7 1894).
[79] Ibid.

The Circuit held: 'We think, therefore, the court below well held that the patent of Mr. Edison should be protected from invasion *pendente lite*.'[80]

C Patent Pools

Edison was also involved in patent litigation in respect of some of his other key inventions, particularly in relation to his motion picture patents.[81] He was also involved in establishing a patent pool in relation to key technologies associated with cinematography.[82] Peter Drahos and John Braithwaite discuss the competition implications of the Edison patent pool for the film industry:

> Right from the industry's beginnings, when Thomas Edison used his camera and film patents to cartelize the industry, intellectual property rights have been used as an important tool of domination. Edison, unable to conquer his competitors in the courts using patents, formed a patent pool with them in 1908. The Motion Picture Patents Company was formed to control all aspects of the industry, from the production of raw film to the exhibition of pictures. Patents over the film and the manufacture of projectors knitted cartel members together . . . The Motion Picture Patents Company functioned as the private regulator of the industry, collecting royalties, preventing patent infringement and making sure that licensees stick to the terms of the deal.[83]

The device of the patent pool has come back in vogue – with the mechanism being promoted during the discussions in Copenhagen and Cancún over intellectual property and climate change as a means of reconciling the countervailing needs to promote research and development in clean technologies, and provide access to such green innovation, without the disruption of patent owners engaging in litigation or refusing access to key inventions.

II 'WE BRING GOOD THINGS TO LIFE': GENERAL ELECTRIC INC. AND ECOMAGINATION

In her piece 'Law in the Age of Pervasive Technology', Susan Brenner reflected upon the adoption of Edison's technology:

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[80] Ibid.
[81] *Edison* v. *American Mutoscope & Biograph Co.*, 151 F. 767 (1907).
[82] *United States* v. *Motion Picture Patents Co*., 225 F. 800 (D.C. Pa. 1915).
[83] Drahos, Peter and John Braithwaite (2002), *Information Feudalism: Who Owns the Knowledge Economy?*, London: Earthscan, 174.

> By 1900 the supremacy of incandescent lamps . . . was fully recognized: they were convenient, clean, safe, and reliable. Their adoption was, however, controlled by the rate of the development of public electric-supply services. Electric lighting was an accepted feature of urban life by 1900 . . . but its penetration into the countryside was necessarily slow. Though electrical appliances had appeared by 1900, the use of electricity for purposes other than illumination did not become common until the twentieth century.[84]

She observes that electricity was an important foundation for a wide range of consumer technologies: 'Electricity would, however, become extremely important as the source we rely upon to power our machines; in the early twenty-first century, it is the life-blood of the devices that let us "stay connected," as well as of those that perform more mundane functions.'[85] She also notes that electricity functioned as an important metaphor: 'In a sense, electricity is a metaphor for many of the consumer technologies we currently employ and the pervasive technologies we will come to rely upon: like those technologies, electricity connects us; we become accustomed to relying on an external source for support, amusement, and assistance.'[86]

A General Electric Inc.

Another important legacy of Edison is the clean technologies conglomerate, General Electric Inc. Nicholas Carr commented upon Edison's vision of interlocking inventions:

> Unlike lesser inventors, Edison didn't just create individual products; he created entire systems. He first imagined the whole, then he built the necessary pieces, making sure they all fit together seamlessly. 'It was not only necessary that the lamps should give light and the dynamos generate current,' he would later write about his plan for supplying electricity as a utility, 'but the lamps must be adapted to the current of the dynamos, and the dynamos must be constructed to give the character of current required by the lamps, and likewise all parts of the system must be constructed with reference to all other parts, since, in one sense, all the parts form one machine'.[87]

He observed that Edison's offsider, Insull, played a key role managing Edison's operations: 'In 1889, he oversaw the consolidation of Edison's

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[84] Brenner, S. (2006) 'Law in the Age of Pervasive Technology', *Widener Law Journal*, **15**, 667 at 705.

[85] Ibid., 706.

[86] Ibid.

[87] Carr, Nicholas (2009), *The Big Switch: Rewiring the World, From Edison to Google*, New York and London: W.W. Norton, 26.

manufacturing companies into the Edison General Electric Company and, three years later, played a central role in merging it with its largest competitor, Thomson-Houston, to become, simply, General Electric.'[88]

In its somewhat hagiographic, corporate history, the company discusses the legacy of Edison: 'GE has a long history of commercially successful research and innovation from Thomas Edison's light bulb to today's nanotechnology breakthroughs.'[89] The history of the company is discussed:

> By 1890, Edison established the Edison General Electric Company by bringing his various businesses together. During that period, a competitor emerged. The Thomson-Houston Company became a dominant electrical innovation company through a series of mergers led by Charles A. Coffin, a former shoe manufacturer from Lynn, Massachusetts. As both businesses expanded, it had become increasingly difficult for either company to produce complete electrical installations relying solely on their own patents and technologies. In 1892, the two companies combined. They called the new organization the General Electric Company.
>
> Several of Edison's early business offerings are still part of GE today, including lighting, transportation, industrial products, power transmission, and medical equipment. The first GE Appliances electric fans were produced at the Ft. Wayne electric works as early as the 1890s, while a full line of heating and cooking devices were developed in 1907. GE Aircraft Engines, the division's name only since 1987, actually began its story in 1917 when the US government began its search for a company to develop the first airplane engine 'booster' for the fledgling US aviation industry. Thomas Edison's experiments with plastic filaments for light bulbs in 1893 led to the first GE Plastics department, created in 1930.[90]

As David Magee notes: 'Through merger, acquisition, and strategic growth, GE became one of the largest companies in the world in terms of market capitalization (more than $300 billion), annual sales and profits ($172 billion and $22 billion in 2007), and admiration (ranked first in the world by *Fortune* magazine in 2007), participating in an array of industries, including technology, media, and finance.'[91] The company has long been active in cultivating its public profile and persona through marketing and advertising.[92] Its slogan, 'We Bring Good Things To Life', was succeeded by the new marketing catchcry, 'Imagination at Work'.

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[88] Ibid., 33.

[89] General Electric Inc., 'Thomas Edison and GE', http://www.ge.com/company/history/edison.html.

[90] Ibid.

[91] Magee, David (2009), *Jeff Immelt and the New GE Way: Innovation, Transformation and Winning in the 21st Century*, New York: McGraw Hill, 1.

[92] Nye, David (1985), *Image Worlds: Corporate Identities at General Electric*, Cambridge (MA): The MIT Press.

B Ecomagination

General Electric Inc. had a reputation for being an indifferent custodian of the environment – particularly after revelations about its pollution of the Hudson river with toxic waste.[93] Ben McNeil discusses the evolution of General Electric Inc. into a purveyor of clean technologies: 'In mid-2005, GE launched "Ecomagination", a program to develop tomorrow's low carbon solutions, such as solar energy, hybrid locomotives, fuel cells, lower-emission aircraft engines, lighter and stronger materials, efficient lighting and water purification technology.' [94]

At an investor meeting in May 2005, Jeffrey Immelt, the chairman and CEO of General Electric Inc., explained that the Ecomagination initiative was prompted by the convergence of three important factors.[95] First, the company, he said, 'observed how consistently across many of our businesses energy efficiency and emissions reductions came across as being a big technical driver'.[96] Second, Immelt noted the innovation in environmental technologies: 'That took place in our transportation business with aircraft engines; it took place in our rail business in the locomotive business, in our power generating business, in our appliance business, in our materials business in plastics, in our water business and so when we start looking across the industrial panorama of GE, this took on, really, I think, a relatively major theme.'[97] Third, Immelt observed that there was a need to address the concerns of growing markets: 'I was in a meeting in China last fall with a guy who talked about investing $85 billion in environmental technology, improving fuel efficiency, meetings in the Middle East in places like Qatar and throughout the Middle East vis-à-vis desalination.'[98] The chairman and chief executive officer concluded: 'In other words, energy efficiency, environmental technology also is going to mean growing profitability and we thought that this was the right time for GE to take more

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[93] Magee, David (2009), *Jeff Immelt and the New GE Way: Innovation, Transformation and Winning in the 21st Century*, New York: McGraw Hill, 112–13.

[94] McNeil, Ben (2009), *The Clean Industrial Revolution: Growing Australian Prosperity in a Greenhouse Age*, Sydney: Allen and Unwin, 184–5.

[95] General Electric Inc. (2005), 'GE Ecomagination Investor Meeting – Final', 9 May. For a broader discussion of the Ecomagination project, see Magee, David (2009), *Jeff Immelt and the New GE Way: Innovation, Transformation and Winning in the 21st Century*, New York: McGraw Hill, 111–32.

[96] General Electric Inc. (2005), 'GE Ecomagination Investor Meeting – Final', 9 May, 1.

[97] Ibid.

[98] Ibid.

leadership.'[99] Immelt contended: 'Ecomagination is GE's commitment to address challenges such as the need for cleaner, more efficient sources of energy, reduced emissions and abundant sources of clean water.'[100]

In its current formulation, General Electric Inc.'s initiative Ecomagination has been described as 'a business strategy designed to drive innovation and the growth of profitable environmental solutions while engaging stakeholders'.[101] The company observes: 'We invest in innovation through both our own R&D efforts and outside venture capital investments' and 'The resulting products enable GE and our customers to reduce emissions while generating revenue from their sale.'[102] In this vision, there is a virtuous synergy between business profit and environmental protection: 'Combining profits and energy savings, we continue to invest in environmental solutions, perpetuating the cycle.'[103]

In its 2009 Ecomagination annual report, General Electric Inc. provides an overview of the progress of the venture.[104] With the slogan 'efficient, economical, engaged, ecomagination', the company boasted of the success of the venture to its investors, customers, and stakeholders:

> We launched ecomagination in 2005. We've succeeded by embracing the world's environmental issues as an enormous business opportunity . . . Along with our R&D commitment, in 2005 we also committed to a stretch goal of $20 billion in ecomagination sales in 2010. In 2009, we achieved $18 billion, up 6 percent in a year when global economies were down, and we are well on the path to our 2010 goal. Overall, in the first 5 years, we invested $5 billion in clean tech R&D, and we generated $70 billion in ecomagination revenues. This strong revenue performance is a testament to the competitiveness of our ecomagination products and innovations, the direct result of our R&D commitment.[105]

General Electric Inc. emphasised: 'We have created more efficient and economic solutions for our customers, and a more competitive position and earnings for our shareholders.'[106] The company identified 90 products in 2009 from a range of sectors in General Electric Inc., which have been

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[99] Ibid.

[100] General Electric Inc. (2005), 'GE Launches Ecomagination to Develop Environmental Technologies; Company-Wide Focus on Addressing Pressing Challenges', *Business Wire*, 10 May.

[101] Ecomagination, http://ge.ecomagination.com/.

[102] Ibid.

[103] Ibid.

[104] General Electric Inc. (2009) *Ecomagination 2009 Annual Report*, Fairfield (CT): General Electric Inc., http://files.gecompany.com/ecomagination/ge_2009_ecomagination_report.pdf.

[105] Ibid., 1.

[106] Ibid.

branded with the Ecomagination mark. General Electric Inc.'s portfolio of technologies includes forms of energy, such as wind energy, solar energy and nuclear energy; water desalination and membrane technologies; energy efficient appliances and lighting; power stations and smart grids; green transportation, particularly in respect of locomotives and aviation; 'clean coal' facilities and carbon sequestration projects; and energy commercial and financial services.

General Electric Inc.'s Ecomagination campaign has had its detractors, particularly amongst environmental groups. Some have suggested that the campaign is a thin and shallow marketing exercise in corporate social responsibility. Others go further and accuse General Electric Inc. of engaging in 'greenwashing' – labelling products as green, but changing little its underlying practices.[107] Frank O'Donnell, the President of Clean Air Watch, has lambasted the history of the company:

> GE asserts that it really plans to 'build on its legacy of success' with environmental products. There is more than a little truth to that claim: GE has lobbied for years for federal subsidies for nuclear power, 'clean coal' and other products, and seems to be positioning itself now to argue that nuclear power should be part of any global warming slowdown strategy.[108]

In particular, General Electric Inc. has been accused of greenwashing through its support of 'clean coal' technology, and nuclear power. 'Model Miners' was a particularly egregious and notorious piece of advertising, with male and female models pretending to be miners, while promoting the virtues of 'clean coal' technologies.[109] Amusingly enough, General Electric Inc.'s environmental reputation was the subject of a parody by its subsidiary NBC's *30 Rock*, starring Tina Fey and Alec Baldwin – with the storyline focused upon the development of Greenzo, 'America's first non-judgmental, business-friendly environmental advocate'.[110] It should be noted, though, that General Electric Inc. denies any suggestion of greenwashing – and it has not yet been prosecuted by the Federal Trade Commission for any violations of its Green Guides.

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[107] For a general discussion of greenwashing, see: Lane, E. (2010), 'Consumer Protection in the Eco-mark Era: A Preliminary Survey and Assessment of Anti-Greenwashing Activity and Eco-mark Enforcement', *John Marshall Review of Intellectual Property Law*, **9**, 742.

[108] O'Donnell, F. (2005), 'GE's Greenwashing', Tom Paine Common Sense, 13 May, http://www.tompaine.com/articles/2005/05/13/ges_greenwashing.php.

[109] Greenpeace, 'Model Miners – GE', http://stopgreenwash.org/ad/6.

[110] Pollack, Jon and Don Scardino (2007), 'Greenzo', *30 Rock*, Episode Five, Season Two, NBC Universal, 8 November.

From a financial perspective, Amity Shlaes of the *Financial Times* was initially sceptical about the Ecomagination initiative. She observed:

> Ecomagination may be only one of Mr Immelt's plans, but the fanfare suggests that eco-divisions may fit better into GE's future than other businesses. That in turn would undermine the logic of the group. Worse, Ecomagination may hurt innovation. Thomas Edison's inventions were also amazingly diversified (mimeograph, megaphone). But most started in a small lab in Menlo Park. Ecomagination innovation will travel, by contrast, from the top down, with management ordering technology to serve the current demands of certain governments and certain regulators.[111]

She wonders whether the company will be successful in research and development to discover 'things that would keep the globe even cleaner, things waiting to be discovered by GE's current Edisons'.[112]

The rhetoric of General Electric Inc. about the importance of clean technologies for American jobs and employment is somewhat undercut by its practices. It was reported in September 2010 that the last major General Electric Inc. factory making incandescent light bulbs in the United States was to close, because of, amongst other things, more favourable business conditions for manufacturing in China.[113]

C Patent Practices

As a huge conglomerate, General Electric Inc. has assembled a massive war chest of patents. In its 2009 annual report, the company observed that it had filed an astonishing 20,000 patents in the last decade:

> Our competitive advantage in technology is based on robust investment, an innovative team and our ability to create a low-cost position. In 2010, we will spend about 5% of our industrial revenue on R&D. We have filed 20,000 patents this decade. We have nearly 40,000 engineers and scientists around the world.[114]

Carl Horton, a lawyer and executive of General Electric Inc., was somewhat coy about the patentable outcomes of Ecomagination: 'A big chunk of Ecomagination is not about patentable technology, it's about taking responsibility for our own actions, as a corporation, as

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111 Shlaes, A. (2005), 'GE Gambling on Green', *Financial Times*, 8 May.

112 Ibid.

113 Whoriskey, P. (2010), 'Light Bulb Factory Closes: End of Era for US Means More Jobs Overseas', *Washington Post*, 8 September.

114 General Electric Inc. (2009), *2009 Annual Report*, Fairfield (CT): General Electric Inc., 5.

individuals within a corporation.'[115] His colleague, Thaddeus Burns, emphasised that General Electric had increased its investment in eco-friendly technologies; expanded its range of certified Ecomagination products, and increased its revenues from those products. Furthermore, the company has sought to reduce its greenhouse gas emissions and energy usages.[116] In 2008, Thaddeus Burns was somewhat more forthcoming about the patent activities of General Electric Inc. in respect of clean technologies.[117] His diagrams of patent filings in respect of clean energy, clean locomotives, and consumer products showed a steady rise in applications between 2002 and 2007. Burns made similar arguments at the Bonn Climate Change Talks.[118] In 2010, Burns argued that 'strengthened intellectual property rights brings more patent applications, increased R & D [spending], inward FDI, merchandise and service inputs, and an inflow of high-tech products to developing countries'.[119]

General Electric Inc. has participated in landmark disputes about the scope and breadth of patentable subject matter. Not only was it involved in the case of *General Electric Co.* v. *De Forest Radio Co.*, on the patentability of purified tungsten,[120] but it was part of the landmark case of *Diamond* v. *Chakrabarty*, in which the majority of the Supreme Court of the United States held that a patent application on an oil-eating bacteria by a General Electric Co. scientist was patentable.[121] In contemporary times, General Electric Inc. has been involved in a number of patent disputes in respect of clean technologies, particularly relating to wind

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115 Mara, K. (2008), 'Inside Views: General Electric's View On Green IP And Technology', *Intellectual Property Watch*, 12 June.

116 Ibid.

117 Burns, T. (2008), 'Technology Development and Deployment to Address Climate Change', International Chamber of Commerce, UNFCCC, COP14, Poznan, http://copportal1.man.poznan.pl/Doc.ashx?Id=193&Mime=application/pdf&Presentation=True.

118 Burns, T. (2009), 'Addressing the Challenges of Climate Change: Innovative Technology Developed by the Private Sector', Technology Development and Deployment to Address Climate Change, International Chamber of Commerce, 6 April, http://unfccc.meta-fusion.com/kongresse/090329_AWG_Bonn/downl/01_burns20090406.pdf.

119 Burns, T. (2010), 'Open Innovation to Tackle Climate Change', WIPO GA CIED Side Event, September, http://www.ifpma.org/fileadmin/templates/Events/2010/IFPMA-OI-WIPO/pdfs/Burns.pdf.

120 *General Electric Company* v. *De Forest Radio Co.* 28 F 2d 641 (1928).

121 *Diamond* v. *Chakrabarty* 447 US 303 (1980). See Rimmer, Matthew (2008), *Intellectual Property and Biotechnology: Biological Inventions*, Cheltenham (UK) and Northampton (Mass): Edward Elgar Publishing, 24–49.

turbines.[122] The company has also been involved in related antitrust and competition disputes with its rivals.[123] General Electric Inc. has also been involved as an *amicus curiae* – a friend of the court – in key patent disputes. It collaborated with Microsoft on a submission on the patentability of software in the European Patent Office.[124] The company was involved in an amicus brief in the Supreme Court of the United States decision on the threshold standard of non-obviousness in *KSR International Co.* v. *Teleflex Inc.*[125] General Electric Inc. was also involved as a friend of the court in the dispute in *MedImmune Inc.* v. *Genentech Inc.* between companies from the medical and biotechnology sectors.[126] It has been particularly hostile to mechanisms such as compulsory licensing and technology transfer. This animus may have deep historical roots. Famously, in 1953, as a result of violations of the United States competition law, the company was ordered to dedicate to the public, patents on lamps and lamp parts; license existing patents on lamp machinery on a non-exclusive basis; and license any future patents on a non-exclusive basis.[127]

General Electric Inc. has been vocal in advocating an agenda of intellectual property maximalism, in both national and international fora. The company has lobbied the United States Congress and Government on topics such as

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[122] *Eolica* v. *General Electric Company d/b/a GE Wind Energy* 71 U.S.P.Q.2d 1379 (W.D.Wis., 2004); *Gamesa Eolica, S.A.* v. *General Electric Company* 359 F.Supp.2d 790 (2005); *General Electric Company/Variable speed wind turbine, Technical Board of Appeal* 3.5.2 October 4, 2004 [2005] E.P.O.R. 17; *General Electric Company* v. *Mitsubishi Heavy Industries Ltd* (2009), the United States District Court for the Southern District of Texas, Corpus Christi Division; and *General Electric Company* v. *Mitsubishi Heavy Industries Ltd* (2010) 3-10-cv-00276F, United States District Court Northern District of Texas Dallas Division.

[123] *Mitsubishi Heavy Industries Limited and Mitsubishi Power Systems Americas Inc.* v. *General Electric Company* 5-10-cv-05087-JLH (2010) United States District Court for the Western District of Arkansas.

[124] Microsoft Corporation and General Electric Inc. (2008), 'Written Statement in Respect of Referral Under EPC Article 112 (1)(b)', Case No. G3/08, http://patentability-pending.com/files/G3-08%20Amicus%20Curiae%20Brief%20-%20Microsoft%20General%20Electric%20en.pdf.

[125] 3M, General Electric, Johnson & Johnson, and E.I. Du Pont de Nemours and Company 'Amicus Brief *KSR International Co.* v. *Teleflex, Inc.*', 2006 WL3004029; and *KSR International Co.* v. *Teleflex, Inc.* 127 S.Ct. 1727 (2006).

[126] 3M, General Electric, Procter & Gamble and E.I. Du Pont de Nemours and Company, 'Amicus Brief in Support of Respondents in *Medimmune Inc.* v. *Genentech Inc.,* 2006 WL 2153792; and *Medimmune Inc.* v. *Genentech Inc.* 127 S. Ct 764 (2007).

[127] *United States* v. *General Electric Company* 115 F. Supp. 835 (DNJ, 1953); and revisited in *United States* v. *General Electric Company* 358 F. Supp. 731 (DCNY, 1973).

fast-track mechanisms for clean technologies,[128] patent harmonisation,[129] and the interaction between intellectual property and competition law.[130] The company has also been active in international negotiations over intellectual property. Carl Horton and Thaddeus Burns have been prominent opponents of the options for flexible usages of intellectual property related to clean technologies mooted by BASIC countries (Brazil, South Africa, India, and China), developing countries, Least Developed Countries (LDCs), and small island states.[131] The company has been particularly adept at recruiting advocates and *éminences grises* from the ranks of government, such as Q. Todd Dickinson, the former head of the United States Patent and Trademark Office, and Thaddeus Burns, formerly part of the mission of the United States Trade Representative. It is self-evident that General Electric Inc. has been hugely influential on United States patent law, policy, and practice.

The company has also built alliances. General Electric has formed an Alliance for Clean Technology Innovation with like-minded companies to pursue its agenda on intellectual property and climate change.[132] Other

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[128] Kappos, D. (2009), 'Remarks at Press Conference Announcing Pilot to Accelerate Green Technology', United States Chamber of Commerce, 7 December.

[129] Dickinson, Q.T. (2006), 'Statement to the Oversight Hearing on Patent Harmonization', Subcommittee on Courts, the Internet, and Intellectual Property, Committee on the Judiciary, United States Congress, 27 April, 3–4.

[130] Myrick, R. (2002), 'Statement in the Federal Trade Commission and Department of Justice hearings on Antitrust and Intellectual Property Law and Policy', http://www.ftc.gov/opp/intellect/020319ronmyrickpreparedtestimony.pdf; and Whitener, M. (2002), 'Statement in the Federal Trade Commission and Department of Justice hearings on Antitrust and Intellectual Property Law and Policy', http://www.ftc.gov/opp/intellect/020501whitener.pdf.

[131] Horton, C., (2008), 'Inside Views: General Electric's View On Green IP And Technology', *Intellectual Property Watch*, 12 June; Burns, T. (2008), 'Technology Development and Deployment to Address Climate Change', International Chamber of Commerce, UNFCCC, COP14, Poznan, http://copportal1.man.poznan.pl/Doc.ashx?Id=193&Mime=application/pdf&Presentation=True; Burns, T. (2009), 'Addressing the Challenges of Climate Change: Innovative Technology Developed by the Private Sector', Technology Development and Deployment to Address Climate Change, International Chamber of Commerce, 6 April, http://unfccc.meta-fusion.com/kongresse/090329_AWG_Bonn/downl/01_burns20090406.pdf; Burns, T. (2010), 'Open Innovation to Tackle Climate Change', WIPO GA CIED Side Event, September, http://www.ifpma.org/fileadmin/templates/Events/2010/IFPMA-OI-WIPO/pdfs/Burns.pdf.

[132] Alliance for Clean Technology Innovation (2010), 'Submission in Response to the Request of the Intellectual Property Enforcement Coordinator for Public Comments Regarding the Joint Strategic Plan', 24 March, http://www.whitehouse.gov/sites/default/files/omb/IPEC/frn_comments/AllianceforCleanTechnologyInnovation.pdf.

members include 3M, Air Liquide, Alstom, ExxonMobil, Microsoft, Philips, Siemens and Vestas.

In 2008, General Electric Inc. and Google announced a collaboration to lobby for renewable energy policies and to jointly develop clean technologies.[133] The two companies intended to push for government programmes to modernise the electrical grid, which would enable broader use of renewable energy. Immelt commented: 'If we really want to drive renewables to where it could be, we are going to need more transmission capacity, and the government is going to have to [intercede] to make that happen.'[134] In its discussion of the alliance, Google noted the synergies between information technology and clean technology:

> The existing US infrastructure has not kept pace with the digital economy and the hundreds of technology opportunities that are ready for market. In fact, the way we generate and distribute electricity today is essentially the same as when Thomas Edison built the first power plant well over one hundred years ago. Americans should have the choice to drive more fuel efficient cars – or even electric cars – and manage their home energy use to reduce costs, and buy power from cleaner sources, or even generate their own power for sale to the grid.[135]

The two companies promised to mount a joint lobbying effort: 'We'll start by working together in Washington, DC to mount a major policy effort to enable large-scale deployment of renewable energy generation in the United States.'[136] Moreover, the pair vowed: 'We'll also work on development and deployment of the "smart" electricity grid that will empower consumers, utilities, and technology innovators to manage electricity more efficiently and lower their carbon footprint.' [137] Furthermore, the companies would seek to develop new clean technologies: 'Finally, we'll collaborate on advanced energy technologies, including technologies to enable the large-scale integration of plug-in vehicles into the grid and new geothermal energy technologies known as enhanced geothermal systems (EGS).'[138] General Electric Inc. has also announced an Ecomagination Challenge – a prize for the development of technologies associated with the smart grid.[139]

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[133] LaMonica, M. (2008), 'Google and GE Team Up on Clean-energy Policy, Tech', *CNet News*, 17 September.

[134] Ibid.

[135] Google (2008), 'Partnering with GE on Clean Energy', 17 September.

[136] Ibid.

[137] Ibid.

[138] Ibid.

[139] General Electric Inc. (2010), 'GE Ecomagination Challenge: Powering the Grid', http://challenge.ecomagination.com/ideas?randomtokenforcache=12849502249975nP6i.

III OUTLINE

From Edison's patent litigation over the electric light bulb to the rise of General Electric Inc., there has been a long history of debate over patent law and energy technologies. There is a terrible temptation to think about contemporary debates over patent law and clean technologies in an ahistorical fashion, considering such developments as radical and unprecedented. Remembering Edison is a useful corrective to such tendencies. Looking at contemporary discussions, there are a number of echoes to the story of Edison. There are international conflicts over the priority to patent rights. There are many contemporary developers of clean technology which have instructed their lawyers and patent attorneys to 'claim the earth' or 'claim the solar system', much like Edison. The mega-litigation over the Toyota Prius recalls the fierce patent fights over the electric light bulb. Patent pools have become fashionable again, as a means of overcoming the 'tragedy of the anti-commons'. There are tensions between the development of closed systems of technologies, and open innovation.

Building upon this historical case study, this book charts the contemporary conflicts over intellectual property and clean technologies. This text is multi-layered, encompassing battles over international law; the policies and practices of national jurisdictions; and local instances of innovation and best practice. This approach is necessitated by the nature of the debate over intellectual property and climate change, which covers everything from Olympian discussions on treaty text to the gritty details of individual patent applications. This study has a particular focus upon United States patent law, policy, and practice with respect to clean technologies. It considers the various responses of key institutions, including the Obama administration; the United States Congress; the United States courts, particularly the Supreme Court of the United States, and the influential United States Court of Appeals for the Federal Circuit; and the United States Patent and Trademark Office. It also considers the role of public and private research institutions, exemplified by the National Renewable Energy Laboratory, and General Electric Inc. This research draws comparisons with other key developed nations, including members of the European Union; Australia; Canada; Japan; and the Republic of Korea. The book also pays a fair amount of attention to members of the BASIC group – Brazil, India, China, and South Africa. There is also a discussion of the situation of members of the G-77, least developed countries, and small island states.

This book is part of a wider effort to develop a comprehensive discipline of climate law and policy. It seeks to extend the reach of climate law to include intellectual property law. It also tries to 'green' intellectual

property law – making it much more alert to and aware of cross-over issues pertaining to environmental law and climate law.

In terms of its methodology, this book draws upon theories of cultural environmentalism; work on the intersections between intellectual property and environmental law; and research into technology transfer and sustainable development.

This book offers a critique and an extension of the theory of 'cultural environmentalism'. In *The Public Domain: Enclosing the Commons of the Mind*, James Boyle elaborates upon his notion of 'cultural environmentalism'.[140] He drew analogies between the politics of intellectual property and the politics of environmentalism:

> I have argued that in a number of respects, the politics of intellectual property and the public domain is at the stage that the American environmental movement was at in the 1950s. In 1950, there were people who cared strongly about issues we would now identify as 'environmental' – supporters of the park system and birdwatchers, but also hunters and those who disdained chemical pesticides in growing their foods. In the world of intellectual property, we have start-up software engineers, libraries, appropriationist artists, parodists, biographers, and biotech researchers. In the 50s and 60s, we had flurries of outrage over particular crises – burning rivers, oil spills, dreadful smog. In the world of intellectual property, we have the kind of stories I have tried to tell here. Lacking, however, is a general framework, a perception of common interest in apparently disparate situations.[141]

Boyle contended that the intellectual property movement could benefit from the development of a theoretical and analytical framework, like its environmental counterparts. He observed that 'we need a cultural environmentalism, an environmentalism of the mind, and over the last ten years we have actually begun to build one'.[142] There has been much discussion of this theoretical framework.[143]Arguably, the theory of 'cultural environmentalism' as advocated by James Boyle does not go far enough.

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[140] Boyle, James (2008), *The Public Domain: Enclosing the Commons of the Mind*, New Haven and London: Yale University Press.

[141] Ibid., 239.

[142] Ibid.

[143] For notable rejoinders, see: Frischmann, B. (2007), 'Cultural Environmentalism and *The Wealth of Networks*', *The University of Chicago Law School*, **74**, 1083–1143; Van Houweling, M. S. (2007), 'Cultural Environmentalism and the Constructed Commons', *Law and Contemporary Problems*, **70**, 23–50; Sunder, M. (2007), 'The Invention of Traditional Knowledge', *Law and Contemporary Problems*, **70**, 97–124; and Biagioli, M. (2009), 'Environmentalism and the Rethinking of Intellectual Property', McGill University, 4 December, http://philosophysa.concordia.ca/?p=1023.

The connections between environmentalism and intellectual property law are not merely symbolic or metaphorical or inspirational. They are not limited to information ecology. There are a number of tangible contexts in which to think about cultural environmentalism – most notably, intellectual property and climate change.

This book also builds upon scholarship looking at the intersection between intellectual property law and environmental law. One of the pioneers in the field of intellectual property and environmental law is Michael Gollin. In 1991, Gollin considered practical ways to improve environmental protection by promoting innovation in beneficial environmental technology through the application of intellectual property laws.[144] He concluded from his survey of intellectual property law and environmental law: 'Coordination of environmental regulation and intellectual property laws can help achieve the desired balance between progress and protection'.[145] In the 2008 book, *Driving Innovation*, Gollin considered the field of environmental technology innovation.[146] He comments in abstract terms on the inter-relationship between intellectual property and environmental protection:

> Paradoxically, technology innovation both hurts and helps the environment. Therefore, intellectual property, by promoting innovation, can be good or bad for the environment. Although some people suggest that IP laws should be adapted to screen good from bad technologies, my view is that it is better to leave that role to environmental law, so that intellectual property and environmental law can work together to promote beneficial innovation.[147]

Natalie Derzko wrote an influential paper on intellectual property and environmental law for the *Harvard Environmental Law Review* in 1996.[148] She contended that 'the intellectual property system and the regulatory framework must be modified to facilitate and encourage the necessary development of environmental technology'.[149]

Estelle Derclaye from the University of Nottingham is the leading proponent of law reform in respect of patent law and clean technologies

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144 Gollin, M. (1991), 'Using Intellectual Property to Improve Environmental Protection', *Harvard Journal of Law and Technology*, **4**, 193–235.

145 Ibid.

146 Gollin, Michael (2008), *Driving Innovation: Intellectual Property Strategies for a Dynamic World*, Cambridge: Cambridge University Press.

147 Ibid., 333.

148 Derzko, N. (1996), 'Using Intellectual Property Law and Regulatory Processes To Foster The Innovation and Diffusion of Environmental Technologies', *Harvard Environmental Law Review*, **20**, 3–59.

149 Ibid., 59.

in the European Union.[150] She maintains that it is possible to reconcile the dictates of patent law and environmental law: 'If the utilitarian justification encompasses progress in its broadest sense (i.e. not only material progress but also general (social and environmental/climatic) well being), both patent and environmental laws cohabit harmoniously.'[151] A number of academics and scholars have also defended the role of patent law as an incentive to address climate change and global warming.[152]

Finally, this book also considers the significant literature on technology transfer and sustainable development. Stephen Andersen and his collaborators have discussed how the *Montreal Protocol on Substances that Deplete the Ozone Layer* 1987 stimulated the development and worldwide transfer of technologies to protect the ozone layer.[153] Charles McManis has undertaken extensive work on technology transfer under the *Convention on Biological Diversity* 1992.[154] Keith Maskus of the University of Colorado and Jerome Reichman of Duke University School

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[150] Derclaye, E. (2008), 'Intellectual Property Rights and Global Warming', *Marquette Intellectual Property Law Review*, **12**, 263–97; Derclaye, E. (2009), 'Patent Law's Role in the Protection of the Environment – Re-Assessing Patent Law and Its Justifications', *International Review of Intellectual Property and Competition*, **40**, 249–73; Derclaye, E. (2009), 'Should Patent Law Help Cool the Planet? An Inquiry from the Point of View of Environmental Law: Part 1', *European Intellectual Property Review*, **31**(4), 168–84; Derclaye, E. (2009), 'Should Patent Law Help Cool the Planet? An Inquiry from the Point of View of Environmental Law: Part 2', *European Intellectual Property Review*, **31**(5), 227–35; and Derclaye, E. (2010), 'Not only Innovation But Also Collaboration, Funding, Goodwill and Commitment: Which Role for Patent Laws in Post-Copenhagen Climate Change Action', *The John Marshall Review of Intellectual Property Law*, **9**(3), 657–73.

[151] Derclaye, E. (2009), 'Should Patent Law Help Cool the Planet? An Inquiry from the Point of View of Environmental Law: Part 1', *European Intellectual Property Review*, **31**(4), 168 at 183.

[152] See, for instance: Kieff, F.S. (2002), 'Patents for Environmentalists', *Washington Journal of Law and Policy*, **9**, 307–19; Phillips, J. (2010), 'Can IP Save the Day?', *Journal of Intellectual Property Law and Practice*, **5**(2), 67; and Sommer, T. (2010), 'Designing Substantive Patent Law: From Life Sciences to Climate Change?', *Nordic Environmental Law Journal*, **2**, 161–74.

[153] Andersen, Stephen, K. Madhava Sarma and Kristen Taddonio (2007), *Technology Transfer for the Ozone Layer: Lessons for Climate Change*, London: Earthscan.

[154] McManis, C. (1998), 'The Interface Between International Intellectual Property and Environmental Protection: Biodiversity and Biotechnology', *Washington University Law Quarterly*, **76**, 255–80; and McManis, Charles (ed.) (2007), *Biodiversity and the Law: Intellectual Property, Biotechnology and Traditional Knowledge*, London: Earthscan. See also Date, V. (1997), 'Global "Development" and Its Environmental Ramifications – The Interlinking of

of Law organised and edited a comprehensive collection on technology transfer.[155] The pair have suggested that the global system of intellectual property rights may have an adverse impact upon public global goods: 'First, TRIPS constrains [the ability of governments] from pursuing certain avenues for promoting imitation, innovation, and related social policies.'[156] Furthermore, 'Second, stronger private rights in information may raise roadblocks against deploying new technologies that could help improve the provision of environmental protection, health care, biological diversity, and basic scientific research.'[157] Maskus has also published extensively on technology transfer and climate change.[158] Stanford Law School Professor John Barton has considered the relationship between intellectual property, development, and climate change.[159]

Applying this range of methodologies, it is argued that there needs to be substantive reforms to intellectual property and climate change – in international negotiations; in national patent regimes; and in local innovations. This book maintains that intellectual property should not be ignored or neglected, marginalised or discounted, in multilateral debates over climate change – such as was the case in Copenhagen in 2009, and Cancún in 2010. It is essential that any future international agreement on climate change includes a comprehensive set of measures to address intellectual property and clean technologies. The history of patent law is bound

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Ecologically Sustainable Development and Intellectual Property Rights', *Golden Gate University Law Review*, **27**, 631–73.

155 Maskus, Keith and Jerome Reichman (2005), *International Public Goods and Transfer of Technology: Under a Globalized Intellectual Property Regime*, Cambridge: Cambridge University Press.

156 Ibid., 11.

157 Ibid.

158 Maskus, K. (2009), 'Differentiated Intellectual Property Regimes for Environmental Technologies', Organization for Economic Cooperation and Development, 6 October; and Maskus, K. and R. Okediji (2010), 'Intellectual Property Rights and International Technology Transfer to Address Climate Change: Risks, Opportunities and Policy Options', Intellectual Property and Sustainable Development Series, International Centre for Trade and Sustainable Development, Issue Paper No. 32, http://ictsd.org/i/news/biores/98251/.

159 Barton, John (2007), *Intellectual Property and Access to Clean Energy Technologies in Developing Countries: An Analysis of Solar Photovoltaic, Biofuel and Wind Technologies*, Geneva: International Center for Trade and Sustainable Development, http://www.trade-environment.org/page/ictsd/projects/BARTON_DEC_2007.pdf; and Barton, John (2008), *Mitigating Climate Change Through Technology Transfer: Addressing the Needs of Developing Countries*, Energy, Environment and Development Programme, Chatham House, http://www.chathamhouse.org.uk/files/12357_1008barton.pdf.

up with the development of what William Blake called the 'Dark Satanic Mills' of the industrial revolution.[160] Estelle Derclaye observes that patent regimes have, traditionally, provided incentives for the production of dirty, polluting technologies:

> Very few would also now deny that the cause of this greenhouse effect and the correlated climate change is man. What has not been much noted so far is that this extraordinary release of greenhouse gases in the earth's atmosphere may be due in major part to our patent laws. Indeed, the main goal of patent laws is to incentivise industrial and technological development, which in turn creates pollution including the release of greenhouse gases.[161]

Accordingly, this book calls for national patent laws to be reshaped to play a positive role in the protection of the environment, biodiversity, and the atmosphere. Patent offices and courts should take a differentiated approach to clean technologies under patent law. Governments should consider reforms in respect of technology transfer, patent pools, public sector licensing, patent subject matter exclusions, compulsory licensing, and Climate Innovation Centres. Finally, this book submits that there is a need to supplement the patent regime with additional mechanisms to support research and development, including government grants, modes of open innovation, and environmental prizes.

The first part of this book will consider the international framework in respect of intellectual property and climate change. Chapter 1 considers the series of discussions on intellectual property and climate change in the context of international environmental law. The *United Nations Framework Convention on Climate Change* 1992 emphasised that governments should 'promote and cooperate in the development, application and diffusion, including transfer, of technologies, practices and processes that control, reduce or prevent anthropogenic emissions of greenhouse gases not controlled by the *Montreal Protocol* in all relevant sectors, including the energy, transport, industry, agriculture, forestry and waste management sectors'.[162] The *Kyoto Protocol* 1997 suggested that parties should 'take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound

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[160] Dutton, Harold (1984), *The Patent System and Inventive Activity During the Industrial Revolution*, Manchester: Manchester University Press.

[161] Derclaye, E. (2009), 'Should Patent Law Help Cool the Planet? An Inquiry from the Point of View of Environmental Law: Part 1', *European Intellectual Property Review*, **31**(4), 168–84 at 168.

[162] *United Nations Framework Convention on Climate Change* 1992, opened for signature 9 May 1992, 1771 UNTS 107 (entered into force 21 March 1994).

technologies'.[163] The *Johannesburg Plan of Implementation* 2002 called upon national governments to 'take further action to mobilize the provision of financial resources, technology transfer, capacity-building and the diffusion of environmentally sound technologies'.[164] The *Bali Action Plan* 2007 emphasised the need for 'enhanced action on technology development and transfer to support action on mitigation and adaptation'.[165] The *Copenhagen Accord* 2009 did not contain specific text on intellectual property and climate change.[166] Nonetheless, it did envisage the creation of a Technology Mechanism, with a Technology Executive Committee and a network of Climate Innovation Centres. This model was elaborated in the *Cancún Agreements* 2010.[167]

Chapter 2 considers the relevance of the settings of the *TRIPS Agreement* 1994 to the debate over intellectual property and climate change.[168] At an international level, there has long been an interest in the dynamics of technology transfer under the *TRIPS Agreement* 1994 and the World Trade Organization. There has been an increasing focus on the transfer and dissemination of clean technologies to developing countries in order to achieve improvements in energy efficiency. Hutchinson has observed: 'The development and widespread dissemination of climate change technologies are a key component in the battle to

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[163] *Kyoto Protocol to the United Nations Framework Convention on Climate Change* 1997, opened for signature 16 March 1998, 2303 UNTS 148 (entered into force 16 February 2005) ('*Kyoto Protocol* 1997').

[164] *Johannesburg Plan of Implementation* 2002, Report of the World Summit on Sustainable Development, A/CONF 199/20.

[165] *Bali Action Plan 2007, Report of the Conference of the Parties on Its Thirteenth Session*, held in Bali from 3 to 15 December 2007, Addendum – Part Two: Action Taken by the Conference of the Parties at Its Thirteenth Session, UN Doc FCCC/CP/2007/6/Add.1 (14 March 2008) 3–7 (Decision 1/CP.13 – Bali Action Plan) ('*Bali Action Plan* 2007').

[166] The *Copenhagen Accord* 2009, UN Doc. FCCC/KP/CMP/2009/L.9 (18 December 2009).

[167] The *Cancún Agreements* 2010, *Outcome of the Work of the Ad Hoc Working Group on Long-Term Cooperative Action Under the Convention*, -/CP.16, http://unfccc.int/files/meetings/cop_16/application/pdf/cop16_lca.pdf, and *Outcome of the Work of the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol at its Fifteenth Session*, -/CMP.6 http://unfccc.int/files/meetings/cop_16/application/pdf/cop16_kp.pdf.

[168] *Marrakesh Agreement Establishing The World Trade Organization*, opened for signature 15 April 1994, 1867 UNTS 3, annex 1C (Agreement on Trade-Related Aspects of Intellectual Property Rights) (entered into force 1 January 1995) ('*TRIPS Agreement* 1994').

reduce global greenhouse gas emissions.'[169] There has been much debate about what, if any, flexibilities are available under the *TRIPS Agreement* 1994 – particularly with respect to patent subject matter exclusions; patent exceptions; compulsory licensing and crown use; technology transfer; and security exemptions. There has also been an intense interest in the minimum standards required in respect of intellectual property enforcement under the *TRIPS Agreement* 1994.

Chapter 3 considers the role of the World Intellectual Property Organization (WIPO) in the debate over intellectual property and clean technologies. The new director-general of WIPO, Francis Gurry, has promoted 'green innovation' as part of his agenda of tackling global issues.[170] He has stressed 'the contribution of a balanced intellectual property system to stimulating the creation, diffusion and application of clean technologies; to promoting green design, aimed at creating products that are eco-friendly from conception to disposal; to green branding, helping consumers make informed choices and giving companies a competitive edge'.[171] There has been an ongoing debate about patent harmonisation in WIPO. Developed countries and patent owners, such as General Electric Inc., have pushed for a *Substantive Patent Law Treaty*.[172] However, some developing countries have maintained that there should be scope for patent exclusions on environmental grounds under any such regime. As part of the *WIPO Development Agenda* 2007, WIPO has promised to explore 'intellectual property-related policies and initiatives necessary to promote the transfer and dissemination of technology, to the benefit of developing countries'.[173] While there has been a discussion about access to knowledge and access to essential medicines, there needs to be further debate about intellectual property, development, and energy poverty.

The second part of this book aims to provide a detailed account of patent law, policy and practice in relation to clean technologies. It will consider, in particular, the relevance of patent law to research, development, and

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169 Hutchinson, C. (2006), 'Does TRIPS Facilitate or Impede Climate Change Technology Transfer into Developing Countries?', *University of Ottawa Law and Technology Journal*, **3**(2), 517–37.

170 Gurry, F. (2009), 'World Intellectual Property Day – Promoting Green Innovation', Geneva: World Intellectual Property Organization, Press Release, 21 April, http://www.wipo.int/pressroom/en/articles/2009/article_0010.html.

171 Ibid.

172 World Intellectual Property Organization (2001), 'Agenda for Development of the International Patent System', A/36/14, 6 August.

173 *World Intellectual Property Organization Development Agenda: 45 Recommendations*, http://www.wipo.int/ip-development/en/agenda/recommendations.html#c ('*WIPO Development Agenda* 2007').

commercialisation of clean technologies. The research will comparatively examine intellectual property jurisprudence in relation to clean technologies in the United States, the European Union, and Australia.

Chapter 4 focuses upon the institutional practices of key patent offices, including the United States Patent and Trademark Office, the European Patent Office, the United Kingdom Intellectual Property Office, IP Australia, and the Intellectual Property Offices of the Republic of Korea, and Japan. It will consider whether the fast-tracking mechanisms introduced by the United States Patent and Trademark Office, IP Australia, and the United Kingdom Intellectual Property Office and others have been effective in encouraging research and development in respect of clean technologies. It will also explore the development of green databases, and the creation of new classifications for clean technologies. Looking at a variety of jurisdictions, this chapter will chart patent landscapes of key sectors – such as solar power, wind power, water power, geothermal energy, water filtration, energy efficiency inventions, green transportation, alternative fuels, and smart grids. The chapter will examine whether there is scope for further reforms to patent administration, in order to improve the quality and quantity of patent applications relating to clean technologies.

There is a long history of patent conflicts over energy-related technologies, dating back to the patent disputes between Joseph Swan and Edison over the electric light bulb in the nineteenth century. Chapter 5 observes that, with great public and private investment into clean technologies, companies are increasingly involved in litigation over clean technologies. Most prominent has been the patent infringement actions brought by Paice LLC against the Toyota over Toyota's hybrid cars using its patented hybrid electric vehicle drive train.[174] Faring poorly in the litigation, Toyota complained to the Supreme Court of the United States that 'Toyota's success in perfecting hybrid technology has made it the target of the patent litigation companies that stalk legitimate industry'.[175] The car manufacturer complained that it was the victim of patent trolls: 'Serious concerns have been voiced as to these companies and their practices, and apt parallels can be drawn between these modern "opportunistic licensors" and the "patent sharks" who disrupted agrarian commerce during the Gilded Age.'[176] Paice LLC responded: 'It is thus left here with

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[174] *Paice LLC* v. *Toyota Motor Corporation* 2004 WL 4908845; *Paice LLC* v. *Toyota Motor Corporation*, 2005 WL 6220101 (E.D.Tex. Sep 28, 2005); *Paice LLC* v. *Toyota Motor Corporation* 2006 WL 2385139 (E.D.Tex.); and *Paice LLC* v. *Toyota Motor Corporation* 504 F. 3d 1293 (2007).

[175] *Toyota Motor Corporation* v. *Paice LLC* 128 S.Ct. 2430 (Mem) U.S., 2008.

[176] Ibid.

name-calling – spending paragraphs wrongfully tagging Paice as a patent "shark," when such derogations are irrelevant to the issue on appeal, and it was Toyota that was caught in squaline posture feeding on Paice's technology.'[177] The Supreme Court of the United States declined to hear that matter. Paice LLC and Toyota have settled this dispute. This conflict has not been an isolated instance. In addition to this landmark conflict, there have been patent battles over solar photo-voltaic technologies; wind turbines; hydro and marine power; light emitting diodes technology; energy efficiency devices; and smart grids.

Chapter 6 considers the conflicted attitudes of the United States Government to patent law and compulsory licensing. Historically, the United States Government has been willing to engage in compulsory licensing to address competition problems – most notably in *United States* v. *General Electric Company*.[178] Moreover, there are compulsory licensing provisions in the *Clean Air Act* 1963 (US).[179] Nonetheless, in Congressional discussions and international negotiations, the United States Government has scorned compulsory licensing for political and ideological reasons. The United States Congress has included clauses on intellectual property and climate change in the *Foreign Relations Authorization Act, Fiscal Years 2010 and 2011* (US) HR 2410; the *American Clean Energy and Security Act* of 2009 (US) HR 2454; the *Foreign Operations, and Related Programs Appropriations Act* 2010 (US) HR 3081; the *Senate Resolution 379* 2009 (US); the *International Climate Change Investment Act* 2009 (US) (S-2835); and the *Clean Energy Jobs and American Power Act* 2010 (US) (S-1733). The Obama Administration – particularly the Secretary of Energy, Steven Chu – has been somewhat more pragmatic on questions of the management of intellectual property. It considers the bilateral collaboration and co-operation between the United States and China on matters of mutual concern, such as the United States–China Clean Energy Research Center. It also looks at proposals for research and development on clean technologies with India, and Australia.

The third part of this book explores alternative forms of incentives for research, development and deployment – such as environmental prizes, open innovation, patent pools, and global environmental funds.

Chapter 7 considers public sector licensing – a measure mooted to overcome barriers to technology transfer during the Copenhagen negotiations.

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[177] *Toyota Motor Corporation* v. *Paice LLC* 2008 WL 877884 (U.S.) (Appellate Petition, Motion and Filing).

[178] *United States* v. *General Electric Company* 115 F. Supp. 835 (DNJ, 1953).

[179] *Clean Air Act*, Pub. L. No. 88-206 77, Stat 401 (1963).

It charts the history of the National Renewable Energy Laboratory, first set up by the Carter Administration to focus on solar technologies, and later expanded to cover the full gamut of clean technologies. This model has been the template for a wide variety of public sector initiatives to incubate the development of clean technologies. The chapter examines the use of the *Bayh–Dole Act* 1980 (US) as a mechanism to encourage the transfer of technology from universities and public sector research institutions to the private sector.[180] It also considers the conflict over the ownership of public sector inventions, addressing the question of whether the duty to research involves a duty to invent. In particular, it contains a case study on the dispute between Galeen Suppes and the University of Missouri.[181] Finally, the chapter evaluates the model of Climate Innovation Centres, promoted by the United Kingdom Carbon Trust and India[182] and adopted as a compromise option as part of the minimalist *Copenhagen Accord* 2009, and the *Cancún Agreements* 2010.

Chapter 8 explores experimentation with alternative models of research and development – such as patent pools, the 'Eco-Patent Commons', and open innovation. There is a need to evaluate whether such alternative models of incentive for research and development are a useful supplement to the patent system. The World Business Council for Sustainable Development has been developing a patent pool, which it has labelled the Eco-Patent Commons.[183] Participants in the project include such companies as IBM, Sony, Bosch, DuPont and Xerox Corporation. The Eco-Patent Commons is intended to 'provide an avenue by which innovations and solutions may be easily shared to accelerate and facilitate implementations to protect the environment and perhaps lead to further

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[180] *University and Small Business Patent Procedures Act* 1980 (United States) (the '*Bayh-Dole Act*') 35 U.S.C. § 200-212 (1980).

[181] *The Curators of the University of Missouri* v. *Suppes, Sutterlin, Renewable Alternatives LLC, and Homeland Technologies LLC* (2009) 2:09-cv-0412-SOW; and *The Curators of the University of Missouri* v. *Suppes, Sutterlin, Renewable Alternatives LLC, and Homeland Technologies LLC* Case No. 09BA-CV02314 (2009), Circuit Court of Boone County, Missouri, http://aaup.missouri.edu/suppes/Suppes%20Counterclaim%206-15-09.pdf.

[182] Sagar, Ambuj and Bloomberg New Energy Finance (2010), *Climate Innovation Centres: A New Way To Foster Climate Technologies In The Developing World?*, Washington DC: The International Bank for Reconstruction and Development, and The World Bank, http://www.infodev.org/en/Article.645.html.

[183] World Business Council for Sustainable Development, *Eco-Patent Commons*, http://www.wbcsd.org/templates/TemplateWBCSD5/layout.asp?type=p&MenuId=MTQ3NQ&doOpen=1&ClickMenu=LeftMenu.

innovation'.[184] This chapter also examines and evaluates the adaptation of the Creative Commons licensing model to the field of scientific research in respect of clean technologies. The GreenXchange project, established by the Science Commons mission, is designed to foster innovation in sustainability through acting as an information and technology clearing house.[185] The final section of the chapter examines the adoption of open source strategies to address climate change and global warming, looking at Henry Chesbrough's model of Open Innovation; Cambia's Energy Open Source Project; and various projects of the European Business Council for Sustainable Development.[186]

Drawing upon the theoretical work of Joseph Stiglitz, Chapter 9 considers alternative models of innovation. It explores the use of environmental prizes to stimulate research and development in respect of renewable energy and climate change adaptation and mitigation. The chapter considers the application of philanthropic prizes to promote activism on environmental and climate issues, highlighting the award of the Nobel Prize to Al Gore and the Intergovernmental Panel on Climate Change. The chapter also considers the operation of government prizes, most notably, the United States Department of Energy's L-Prize to promote research into energy-efficienct lighting; and the H-Prize, which was created to promote research into hydrogen. Also worthy of note is the Saltire Prize which was created by the Scottish Government to encourage research into wave energy. Chapter 9 also surveys a range of commercial prizes designed to stimulate innovation in clean technologies. It particularly highlights the work of the X Prize Foundation; General Electric Inc's Ecomagination Challenge: Powering the Grid; and the Virgin Earth Challenge. The chapter concludes by flagging a new proposal. Thomas Pogge has promoted the establishment of an Ecological Impact Fund, which would reward technology developers relative to the impact of inventions upon the environment, biodiversity, and the climate.

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184 Ibid.

185 The GreenXchange, http://greenxchange.force.com/.

186 Chesbrough, Henry (2003), *Open Innovation: The New Imperative for Creating and Profiting from Technology,* Boston: Harvard Business School Press; Chesbrough, Henry (2006), *Open Business Models: How to Thrive in the New Innovation Landscape*, Boston: Harvard Business School Press; and Chesbrough, H. (2009), 'Can Open Innovation Help to Save the World?', FT Innovate 2009 Conference, 12 November, http://dw2blog.com/2009/11/12/can-open-innovation-help-to-save-the-world/.